Monday

SPDL20

RSNA Diagnosis Live™: Winter is Coming

Monday, Nov. 28 7:15AM - 8:15AM Room: E451B

CA GI HN MK NR

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

Participants
Adam E. Flanders, MD, Narberth, PA, (adam.flanders@jefferson.edu) (*Presenter*) Nothing to Disclose
Sandeep P. Deshmukh, MD, Philadelphia, PA, (sandeep.deshmukh@jefferson.edu) (*Presenter*) Nothing to Disclose
Christopher G. Roth, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance.This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

ABSTRACT

URL

SPSC20

Controversy Session: Controversies in Radiology Education-Have We Landed in the Magic Kingdom or the Wild Wild West?

Monday, Nov. 28 7:15AM - 8:15AM Room: E451A

ED

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 0

Participants
Lawrence P. Davis, MD, Glen Cove, NY (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the patient care and training aspects of 24/7 faculty presence. 2) Describe the constraints and opportunities for the fourth year of training. 3) Reiterate the issues related to the number of radiology training positions.

ABSTRACT

N/A

Sub-Events

SPSC20A Faculty 24/7 Presence-More Harmful or Helpful?

Participants
Theresa C. McLoud, MD, Boston, MA (*Presenter*) Nothing to Disclose
Mark E. Mullins, MD, PhD, Atlanta, GA, (memulli@emory.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the appropriate balance between residency supervision and development of increased responsibility and independence. 2) Describe opportunities to balance patient care and safety with resident educational requirements.

ABSTRACT

URL

SPSC20B Value in the New Residency Fourth Year-Golden Goose or Lame Duck?

Participants
N. Reed Dunnick, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Marta E. Heilbrun, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the flexibility available in the 4th year of residency training. 2) Appreciate the opportunities for specialized learning. 3) Consider the opportunity to blend the 4th year with planned fellowship training.

ABSTRACT

URL

SPSC20C Goldilocks and the Number of Residency Training Positions-Too Small or Just Right?

Participants
David C. Levin, MD, Philadelphia, PA, (david.levin@jefferson.edu) (*Presenter*) Consultant, HealthHelp, LLC; Board of Directors, Outpatient Imaging Affiliates, LLC
Vijay M. Rao, MD, Philadelphia, PA, (vijay.rao@jefferson.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the circumstances under which the number of radiology residents should be increased. 2) Understand the reasons why the number of residents being trained should remian the same as now.

ABSTRACT

n/a

URL

SPSH20

Hot Topic Session: MSK Quantitative Imaging Biomarkers: MRI and Beyond

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

MK BQ MR US

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

FDA Discussions may include off-label uses.

Participants

Sub-Events

SPSH20A MR Diffusion in the MSK System

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

LEARNING OBJECTIVES

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

SPSH20B Quantitative Techniques to Characterize MSK Tissue Structure and Function

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

LEARNING OBJECTIVES

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

ABSTRACT

URL

SPSH20C Quantitative Musculoskeletal Ultrasound Elastography: Shear Wave Speed Measurements

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

LEARNING OBJECTIVES

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

Active Handout:Kenneth S. Lee

http://abstract.rsna.org/uploads/2016/16002357/ACTIVE SPSH20C 2016 RSNA Quantitative US Imaging slide submission.pdf

SPSH21

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

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

GU HN NR OB CT MR US PD

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

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

LEARNING OBJECTIVES

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

URL

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

Sub-Events

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

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

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

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

Handout:Jacob Szejnfeld

http://abstract.rsna.org/uploads/2016/16045926/ZIKA J RSNA V17.pptx

SPSH21C Multidomality Prenatal Imaging Findings of Congenital Zika Infection

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

LEARNING OBJECTIVES

ABSTRACT

SPSH21D New Insights on Imaging and Pathological Correlations on Zika Infection

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

SPSH21E Controlling Zika Virus: Update on Prevention Strategies and Vaccination

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

SPSH21F Panel Discussion

Participants

RCA21

Prostate MRI (Hands-on)

Monday, Nov. 28 8:00AM - 10:00AM Room: S401AB

GU MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants

Jelle O. Barentsz, MD, PhD, Nijmegen, Netherlands (*Presenter*) Research Consultant, SPL Medical
Jurgen J. Futterer, MD, PhD, Nijmegen, Netherlands, (jurgen.futterer@radboudumc.nl) (*Presenter*) Research Grant, Medtronic, Inc; 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
Baris Turkbey, MD, Bethesda, MD (*Presenter*) Nothing to Disclose
Jeffrey C. Weinreb, MD, New Haven, CT, (jeffrey.weinreb@yale.edu) (*Presenter*) Nothing to Disclose
Antonio C. Westphalen, MD, Mill Valley, CA, (antonio.westphalen@ucsf.edu) (*Presenter*) Scientific Advisory Board, 3DBiopsy LLC ; Research Grant, Verily Life Sciences LLC
Rianne R. Engels, Cuijk, Netherlands (*Presenter*) Nothing to Disclose
Joyce G. Bomers, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Renske L. Van Delft, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Laura I. Stoilescu, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Daniel J. Margolis, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Patrik Zamecnik, MD, Heidelberg, Germany (*Presenter*) Officer, SPL Medical BV
Sadhna Verma, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

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 able to review up to 40 multi-parametric MRI cases with various prostatic pathology using a dedicted 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 periphral-transition- and central zone cancers, inflammation, BPH, and the most common pitfalls. Internationally renowned teachers will gude the participants during their PI-RADS v2 scoring. There will be 50 workstations available. Participants will be able to use their own laptops through a secure WiFi connection.

Active Handout:Renske Lian Van Delft

http://abstract.rsna.org/uploads/2016/16002000/RCA Coursebook Prostate hands on course.pdf

MSAS21

Global Health - Challenges and Lessons Learned (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Monday, Nov. 28 8:30AM - 10:00AM Room: S105AB

OT

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

Participants
Alexander Yule, DSc, Cardiff, United Kingdom (*Moderator*) Nothing to Disclose
Steven P. DeColle, Edmonton, AB (*Moderator*) Nothing to Disclose

Sub-Events

MSAS21A The Future of Tc-99m Supply

Participants
Francois Couillard, Ottawa, ON, (fcouillard@camrt.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the Tc-99m supply chain. 2) Assess the short and long-term disruption of supply risks. 3) Assess the potential of technological innovations and advances to create new sources of supply and mitigate risks.

ABSTRACT

With the closure of the Canadian NRU reactor in 2016, the world is losing one of the major producers of Mo-99 used in the production of Tc-99m. What will be the short and long-term consequences on the global supply chain? What innovative solutions are being explored? In this talk, François Couillard will rely on his past industry experience and current involvement in Canada's Multistakeholder Working Group on Radioisotopes to paint a picture of the situation and discuss the implications for nuclear medicine.

MSCM21

Case-based Review of Magnetic Resonance (An Interactive Session)

Monday, Nov. 28 8:30AM - 10:00AM Room: S100AB

MR

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

Participants
John R. Leyendecker, MD, Dallas, TX, (john.leyendecker@utsouthwestern.edu) (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Improve diagnostic confidence when interpreting MR examinations of the elbow and ankle. 2) Use MRI to problem solve benign and malignant lesions of the pancreas. 3) Describe MRI applications in the genitourinary system.

ABSTRACT

Sub-Events

MSCM21A MRI of the Ankle

Participants
Mini N. Pathria, MD, San Diego, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the anatomic organization and develop an organized approach to evaluation of ankle tendons. 2) Understand the variety of anatomic patterns of tendon failure. 3) Recognize secondary signs of tendon pathology such as tenosynovitis, reactive bone edema and malalignment.

MSCM21B MRI of the Elbow

Participants
Maha Torabi, MD, Winston Salem, NC, (mtorabi@wakejhealth.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the biomechanics, pathomechanics and mechanisms of elbow injury in the throwing athlete. 2) Describe common elbow arthroscopic interventions with MRI and arthroscopic correlation.

ABSTRACT

Handout:Maha Torabi

http://abstract.rsna.org/uploads/2016/16000966/Elbow MRI.pdf

MSCM21C MRI of the Pancreas

Participants
Frank H. Miller, MD, Chicago, IL, (fmiller@northwestern.edu) (*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 including autoimmune and groove pancreatitis. In addition, MRCP can be used to visualize the pancreatic and biliary ducts and evaluate pancreatic ductal anomalies including pancreas divisum and annular pancreas.This presentation reviews the use of MR to evaluate the pancreas, including recent advances, and discusses the normal appearance of the pancreas on different imaging sequences, as well as inflammatory diseases, congenital abnormalities, and neoplasms of the pancreas. It will discuss common imaging appearance of pancreatic lesions and their mimickers.

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

MSCM21D MRI of the GU System

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

LEARNING OBJECTIVES

1) Recognize the distinguishing MRI characteristics of a variety of pathologies of the genito-urinary system.

MSMC21

Cardiac CT Mentored Case Review: Part I (In Conjunction with the North American Society for Cardiovascular Imaging) (An Interactive Session)

Monday, Nov. 28 8:30AM - 10:00AM Room: S406A

CA CT

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

Participants
Jill E. Jacobs, MD, New York, NY (*Director*) Nothing to Disclose
Pamela K. Woodard, MD, Saint Louis, MO, (woodardp@wustl.edu) (*Moderator*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research agreement, Siemens AG; ; ; ; ;
Jill E. Jacobs, MD, New York, NY (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify cardiac and coronary artery anatomy. 2) Recognize cardiac disease processes, including coronary atherosclerosis, as diagnosed on CT. 3) Understand methods of cardiac CT and coronary CT angiography post-processing.

Sub-Events

MSMC21A Normal Coronary Anatomy

Participants
Prachi P. Agarwal, MD, Ann Arbor, MI, (prachia@med.umich.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize normal anatomy and common variants of the coronary arteries. 2) Review normal cardiac anatomy. 3) Describe the mimics and pitfalls in cardiac imaging that can simulate pathology.

ABSTRACT

Active Handout:Prachi P. Agarwal

http://abstract.rsna.org/uploads/2016/9001140/ACTIVE MSMC21Aanatomy_Agarwal.pdf

MSMC21B Anomalous Coronary Arteries

Participants
Cylen Javidan-Nejad, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Using Coronary Artery CT cases to review anomalous origins of the coronary arteries

MSMI21

Molecular Imaging Symposium: Basics of Molecular Imaging

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

BQ MI MR US

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

FDA Discussions may include off-label uses.

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

Sub-Events

MSMI21A MI Using Radioactive Tracers

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

LEARNING OBJECTIVES

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

ABSTRACT

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

MSMI21B Molecular MRI and MRS

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

LEARNING OBJECTIVES

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

ABSTRACT

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

MSMI21C Nanoparticles

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

LEARNING OBJECTIVES

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

ABSTRACT

NanoparticlesNanoscale materials can be employed to develop novel platforms for understanding, diagnosing, and treating diseases. Integrating nanomedicine with novel multi-modality imaging technologies spurs the development of new personalized diagnostic tests and theranostic (combined diagnostic and therapeutic) procedures. This presentation will provide an overview over the safety, diagnostic applications and therapeutic implications of clinically applicable ultrasmall superparamagnetic iron oxide nanoparticles (USPIO). USPIO which are currently used for clinical applications include ferumoxytol (Feraheme), an FDA-approved iron supplement, and ferumoxtran-10 (Combidex/Sinerem), which is currently undergoing renewed clinical trials in Europe. Safety considerations for these agents will be discussed. Since USPIO are not associated with any risk of nephrogenic sclerosis, they can be used as alternative contrast agents to gadolinium chelates in patients with renal insufficiency or in patients in whom creatinine lab values are not available. Both ferumoxytol and ferumoxtran-10 provide long lasting blood pool enhancement, which can be used

for MR angiographies and tissue perfusion studies. Subsequently, USPIO are slowly phagocytosed by macrophages in the reticuloendothelial system (RES), which can be used to improve MRI detection of tumors in liver, spleen, lymph nodes and bone marrow. A slow phagocytosis by tumor associated macrophages (TAM) in the tumor microenvironment can be used to grade tumor-associated inflammation and monitor the efficacy of new cancer immunotherapies. This opens opportunities for new discoveries in the area of cancer immunology and immunotherapy. TAM imaging concepts could represent a significant breakthrough for clinicians as a new means for risk stratification and as a new gold-standard imaging test for tracking treatment response in TAM-directed immunotherapy trials, which are currently entering clinical applications.

MSMI21D Contrast Ultrasound

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

LEARNING OBJECTIVES

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

ABSTRACT

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

MSMI21E Quantitative Imaging Biomarkers

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

LEARNING OBJECTIVES

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

ABSTRACT

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

Honored Educators

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Richard L. Wahl, MD - 2013 Honored Educator

MSRO21

BOOST: Gastrointestinal-Oncology Anatomy (An Interactive Session)

Monday, Nov. 28 8:30AM - 10:00AM Room: S103AB

GI RO

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

Participants

Mukesh G. Harisinghani, MD, Boston, MA (*Presenter*) Nothing to Disclose
Theodore S. Hong, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Achieve a basic understanding of the anatomy pertinent to the pancreatico-biliary region and imaging appearance of pancreaticobiliary tumors. 2)Understand strengths and limitations of imaging techniques, including MRI, PET-CT and CT, as they are used in delineating primary tumor and staging involved regional nodes. 3) Identify reasons for local recurrence and recognize the imaging appearances of these recurrences. 4) Improve radiation therapy delivery through understanding the contouring recommendations for the gross tumor volume (GTV) and clinical target volumes (CTV) for anorectal tumors, both in the locally advanced and postoperative setting.

ABSTRACT

In this course cross sectional imaging will be used to contour normal pancreatico-biliary anatomy as well as tumors involving this anatomical region. Also patterns of spread of pathological lymph nodes will be shown, and corss sectional imaging will be used to contour the regional nodal lesions. Cases will be
presented and the participants will be stimulated to do the contouring themselves, and will have feed-back on their results

MSRO24

BOOST: CNS-Oncologic Anatomy and Contouring Review: Emphasis on Molecular Markers and Role of MR/PET Imaging (An Interactive Session)

Monday, Nov. 28 8:30AM - 10:00AM Room: S103CD

NR BQ MI MR NM RO

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

Participants
Rajan Jain, MD, Hartsdale, NY (*Presenter*) Consultant, Cancer Panels; Royalties, Thieme Medical Publishers, Inc
Michael D. Chan, MD, Winston-Salem, NC (*Presenter*) Advisory Board, NovoCure Ltd
Christina I. Tsien, MD, Saint Louis, MO (*Presenter*) Speaker, Merck & Co, Inc

LEARNING OBJECTIVES

1) Describe how to differentiate gliomas from lymphoma, metastases as well as non-neoplastic etiologies such as demyelinating lesions: Role of functional imaging modalities. 2) Describe imaging characteristics of gliomas based on genomic differences: Imaging phenotype genotype correlation. 3) Advanced imaging techniques as a surveillance tool in post-therapy gliomas with emphasis on genomic markers.

ABSTRACT

Recent advances in glioma genomics have significantly changed our understanding of tumor biology and hence, affected how these patients are treated. Similarly, integrating imaging data with genomic markers has also helped create better prognostic and predictive biomarkers which offer promising future for personalized medicine. This session will highlight a multi-disciplinary approach with the focus on advanced imaging and genomics markers before and after therapy in gliomas.

RC201

Smoking Related Lung Disease: Radiologic-Pathologic Correlation

Monday, Nov. 28 8:30AM - 10:00AM Room: E353C

CH CT

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

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

LEARNING OBJECTIVES

1) Describe the range of lung injury resulting from the inhalation of cigarette smoke. 2) Explain the general mechanisms of cigarette smoke injury. 3) List the currently accepted diagnostic categories. 4) Identify the key imaging features of smoking related lung disease.

ABSTRACT

Symptomatic cigarette smokers are a common source of referral for diagnostic imaging. Radiologists are regularly confronted with an array of findings on plain radiography and computed tomography that mirror varying combinations of emphysema, airway inflammation, airway fibrosis and the changes of pulmonary Langerhans' cell histiocytosis (PLCH). In addition, there is growing acceptance of a link between cigarette smoke and alveolar wall fibrosis. The radiologist is confronted with an extensive list of smoking-related diagnostic categories including: emphysema, obstructive bronchitis, respiratory bronchiolitis-interstitial lung disease (RB-ILD), desquamative interstitial pneumonia (DIP), PLCH and acute eosinophilic pneumonia. These injuries are best understood through correlation of the imaging with pathology and physiology.

Active Handout:Jeffrey R. Galvin

http://abstract.rsna.org/uploads/2016/15001895/SmokingRelatedDLD Fibrosis handout 2016 compressed.pdf

Sub-Events

RC201A Introduction

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

LEARNING OBJECTIVES

1) Describe the range of lung injury resulting from the inhalation of cigarette smoke. 2) Explain the general mechanisms of cigarette smoke injury. 3) List the currently accepted diagnostic categories.

ABSTRACT

Symptomatic cigarette smokers are a common source of referral for diagnostic imaging. Radiologists are regularly confronted with an array of findings on plain radiography and computed tomography that mirror varying combinations of emphysema, airway inflammation, airway fibrosis and the changes of pulmonary Langerhans' cell histiocytosis (PLCH). In addition, there is growing acceptance of a link between cigarette smoke and alveolar wall fibrosis. The radiologist is confronted with an extensive list of smoking-related diagnostic categories including: emphysema, obstructive bronchitis, respiratory bronchiolitis-interstitial lung disease (RB-ILD), desquamative interstitial pneumonia (DIP), PLCH and acute eosinophilic pneumonia. These injuries are best understood through correlation of the imaging with pathology and physiology.

RC201B CT Definable Subtypes of COPD

Participants
Alexander A. Bankier, MD, PhD, Boston, MA (*Presenter*) Author with royalties, Reed Elsevier Consultant, Olympus Corporation

LEARNING OBJECTIVES

1) Describe the current Fleischner classification of chronic obstructive pulmonary disease (COPD). 2) Identify the different categories of emphysema and associated abnormalities on computed tomography. 3) Explain the relationship between image derived assessment of COPD and clinical assessment including pulmonary function.

ABSTRACT

Symptomatic cigarette smokers are a common source of referral for diagnostic imaging. Radiologists are regularly confronted with an array of findings on plain radiography and computed tomography that mirror varying combinations of emphysema, airway inflammation, airway fibrosis and the changes of pulmonary Langerhans' cell histiocytosis (PLCH). In addition, there is growing acceptance of a link between cigarette smoke and alveolar wall fibrosis. The radiologist is confronted with an extensive list of smoking-related diagnostic categories including: emphysema, obstructive bronchitis, respiratory bronchiolitis-interstitial lung disease (RB-ILD), desquamative interstitial pneumonia (DIP), PLCH and acute eosinophilic pneumonia. These injuries are best understood through correlation of the imaging with pathology and physiology.

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Alexander A. Bankier, MD, PhD - 2013 Honored Educator
Alexander A. Bankier, MD, PhD - 2014 Honored Educator
Alexander A. Bankier, MD, PhD - 2015 Honored Educator

RC201C Inflammatory Lung Disease in Smokers

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

LEARNING OBJECTIVES

1) Describe the categories of cigarette smoke related lung inflammation. 2) Classify the smoking-related inflammatory disorders including: respiratory bronchiolitis, desquamative interstitial pneumonia, pulmonary Langerhans cell histiocytosis and acute eosinophilcpneumonia. 3) Identify the key imaging features of smoking-related inflammatory disease on imaging. 4) Understand how pathologic changes mirror findings on imaging.

ABSTRACT

Smoking Related Lung Disease: Radiologic-Pathologic CorrelationSymptomatic cigarette smokers are a common source of referral for diagnostic imaging. Radiologists are regularly confronted with an array of findings on plain radiography and computed tomography that mirror varying combinations of emphysema, airway inflammation, airway fibrosis and the changes of pulmonary Langerhans' cell histiocytosis (PLCH). In addition, there is growing acceptance of a link between cigarette smoke and alveolar wall fibrosis. The radiologist is confronted with an extensive list of smoking-related diagnostic categories including: emphysema, obstructive bronchitis, respiratory bronchiolitis-interstitial lung disease (RB-ILD), desquamative interstitial pneumonia (DIP), PLCH and acute eosinophilic pneumonia. These injuries are best understood through correlation of the imaging with pathology and physiology.

RC201D Fibrotic Lung Disease in Smokers

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

LEARNING OBJECTIVES

1) Describe the categories of cigarette smoke related lung fibrosis. 2) Identify the key imaging features that indicate the presence of lung fibrosis. 3) Explain the importance of imaging in the interpretation of pulmonary functions.

ABSTRACT

Symptomatic cigarette smokers are a common source of referral for diagnostic imaging. Radiologists are regularly confronted with an array of findings on plain radiography and computed tomography that mirror varying combinations of emphysema, airway inflammation, airway fibrosis and the changes of pulmonary Langerhans' cell histiocytosis (PLCH). In addition, there is growing acceptance of a link between cigarette smoke and alveolar wall fibrosis. The radiologist is confronted with an extensive list of smoking-related diagnostic categories including: emphysema, obstructive bronchitis, respiratory bronchiolitis-interstitial lung disease (RB-ILD), desquamative interstitial pneumonia (DIP), PLCH and acute eosinophilic pneumonia. These injuries are best understood through correlation of the imaging with pathology and physiology.

RC202

Examinations in MOC: Why, How, and Future Considerations

Monday, Nov. 28 8:30AM - 10:00AM Room: S403A

ED

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants
Valerie P. Jackson, MD, Tucson, AZ (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the rationale for cognitive expertise assessment in MOC. 2) Discuss how MOC exams are developed and scored. 3) Describe possible improvement in MOC examinations in the future.

Sub-Events

RC202A Introduction

Participants
Lisa A. Kachnic, MD, Nashville, TN (*Presenter*) Speaker, Physician's Education Resource, LLC; Royalties, UpToDate, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

RC202B Why We Examine

Participants
Brent J. Wagner, MD, Reading, PA, (Brent.Wagner@readinghealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC202C How We Develop, Validate, and Score the Examination

Participants
Valerie P. Jackson, MD, Tucson, AZ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

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Valerie P. Jackson, MD - 2014 Honored Educator

RC202D What We May Be Doing in the Future

Participants
Vincent P. Mathews, MD, Elm Grove, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC203

Imaging of Cardiac Valves

Monday, Nov. 28 8:30AM - 10:00AM Room: N229

CA CT IR MR

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

Participants
Albert De Roos, MD, Leiden, Netherlands (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC203A CT Imaging of Native Valves

Participants
Fabian Plank, Innsbruck, Austria (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the full spectrum of CT imaging findings in native valvular disease (from stenosis, regurgitation to infective endocarditis). 2) Understand technical basics and state-of the art imaging of heart valves by cardiac CT. 3) Discuss when and why use cardiac CT for diagnosis of valvular disease and patient management.

ABSTRACT

While echocardiography is the primary screening modality for valvular disease, it has some inherent limitations. Cardiac CT provides incremental value in the assessment of native valvular disease and allows for 3D - and 4D-imaging of valvular function. The specific settings in clinical practice ("when-and-why") using cardiac CT, patient management and multimodality imaging (including PET/CT) will be discussed.Topics of this course are: 1) the assessment of native valvular disease (stenosis, regurgitation and prolapse) and congenital abnormalities by cardiac CT 2) cardiac CT in infective endocarditis 3) CT for differential diagnosis/characterization of valvular masses.

RC203B MRI of Native Valves

Participants
Gautham P. Reddy, MD, Seattle, WA (*Presenter*) Nothing to Disclose

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Gautham P. Reddy, MD - 2014 Honored Educator

RC203C The Role of Imaging Prior to TAVR

Participants
Jonathon A. Leipsic, MD, Vancouver, BC, (jleipsic@providencehealth.bc.ca) (*Presenter*) Speakers Bureau, General Electric Company; Speakers Bureau, Edwards Lifesciences Corporation; Consultant, Heartflow, Inc; Consultant, Circle Cardiovascular Imaging Inc; Consultant, Edwards Lifesciences Corporation; Consultant, Neovasc Inc; Consultant, Samsung Electronics Co, Ltd; Consultant, Koninklijke Philips NV; Consultant, Arineta Ltd; Consultant, Pi-Cardia Ltd;

LEARNING OBJECTIVES

1) Understand the role of pre-procedural imaging and in particular MDCT in TAVR planning. 2) Discuss new data highlighting novel imaging parameters that help improve clinical outcomes. 3) Discuss the role of MDCT sizing for next generation TAVR devices.

ABSTRACT

NA

Honored Educators

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Jonathon A. Leipsic, MD - 2015 Honored Educator

RC203D Mitral Valve Interventions

Participants

Philipp Blanke, MD, Freiburg, Germany, (phil.blanke@gmail.com) (*Presenter*) Consultant, Edwards Lifesciences Corporation; Consultant, Neovasc Inc ; Consultant, Tendyne Holdings, Inc; Consultant, Circle Cardiovascular Imaging Inc

RC204

Musculoskeletal Series: MRI of Lower Extremity Sports Injuries

Monday, Nov. 28 8:30AM - 12:00PM Room: E451B

MK MR

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

FDA Discussions may include off-label uses.

Participants
Lynne S. Steinbach, MD, San Francisco, CA, (lynne.steinbach@ucsf.edu) (*Moderator*) Nothing to Disclose
Soterios Gyftopoulos, MD, New York, NY, (Soterios.Gyftopoulos@nyumc.org) (*Moderator*) Nothing to Disclose
Stacy E. Smith, MD, Weston, MA (*Moderator*) Nothing to Disclose
Marcelo R. Abreu, MD, Porto Alegre, Brazil (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC204-01 Preoperative Evaluation of Knee

Monday, Nov. 28 8:30AM - 8:50AM Room: E451B

Participants
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom, (andrewgrainger@nhs.net) (*Presenter*) Speaker, General Electric Company; Equipment support, Siemens AG; Consultant, Medivir AB; Medical Advisor, Medivir AB

Active Handout:Andrew J. Grainger

http://abstract.rsna.org/uploads/2016/16000526/ACTIVE RC20401 Grainger RSNA Knee Notes.pdf

LEARNING OBJECTIVES

1) Understand the main indications for surgery following sports injuries in the knee. 2) Learn MRI features of meniscal injury that will affect surgical decisions rand management. 3) Learn MRI features of ligamentous injury theat will affect surgical decisions rand management. 4) Learn MRI features of chondral injury theat will affect surgical decisions rand management. 5) Understand MRI findings in patella instability that will influence surgical management.

RC204-02 Meniscus-Chondral Relationship in Cadaveric Knees: A Surrogate for Meniscal Mechanical Axis?

Monday, Nov. 28 8:50AM - 9:00AM Room: E451B

Awards
Trainee Research Prize - Resident

Participants
Tineke De Coninck, MD, Ghent, Belgium (*Abstract Co-Author*) Nothing to Disclose
Alessandro Vidoni, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Won C. Bae, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Sheronda Statum, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Reni Biswas, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Christine B. Chung, MD, San Diego, CA (*Presenter*) Nothing to Disclose

PURPOSE

To describe the relationship of meniscal integrity with cartilage morphology and biochemistry in 7 cadaveric knees.

METHOD AND MATERIALS

7 fresh-frozen human cadaveric knees (mean age at death = 78 years) were screened for osteoarthritis with CT, and prospectively investigated (IRB exempt study) with magnetic resonance imaging (MRI). The meniscus (WORMS grading) and cartilage (International Cartilage Repair Society) were morphologically graded on conventional MR images. Ultrashort echo time (UTE) and standard quantitative MRI (qMRI) sequences (T2*, T2) were performed to quantitatively evaluate the meniscus and cartilage biochemical status (ICRS grade 2 or lower). UTE T2* and T2 measurements were acquired using constant TR and variable TE method with mono-exponential decay curve fitting. Formal statistical analysis was not performed due to small sample size.

RESULTS

Three cartilage - meniscus relationships were identified. Group 1: normal menisci (n= 3) with normal cartilage (morphologic / qMRI) (mean T2* meniscus = 7,44 ms; mean T2 cartilage = 38 ms), Group 2: posterior horn meniscal tear with altered cartilage morphology (n= 5) and / or altered qMRI (n= 3) in subjacent meniscal covered femorotibial surfaces (mean T2* meniscus = 14,10 ms; mean T2 cartilage = 46 ms), Group 3: meniscal degeneration with altered chondral morphology / qMRI (n= 4) occuring in central, meniscal uncovered surfaces of the same compartment (mean T2* meniscus = 12,23 ms; all cartilage scores ICRS 3 or 4 so no qMRI values).

CONCLUSION

This study demonstrated the correlation between meniscal and cartilage integrity. The type of meniscal pathology was related to the degree and location of mechanical axis alteration (meniscal tear subjacent cartilage / meniscal degeneration central cartilage) expressed by loss of cartilage integrity. Cartilage evaluation may serve as a potential surrogate for determination of intact

mechanical axis of the meniscus. T2* data correlates with severity of meniscal pathology.

CLINICAL RELEVANCE/APPLICATION

Quantitative MRI of femorotibial cartilage has potential to serve as a surrogate to assess meniscus mechanical axis.

RC204-03 The Healing Process of Anterior Cruciate Ligament (ACL) Graft, as Evaluated by Longitudional PET-MRI

Monday, Nov. 28 9:00AM - 9:10AM Room: E451B

Participants
Mingqian Huang, MD, Syosset, NY (*Presenter*) Nothing to Disclose
Michael J. Salerno, BS,MBA, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Erik Lawrence, BS, East Setauket, NY (*Abstract Co-Author*) Nothing to Disclose
Seth Korbin, MD, Setauket- East Setauket, NY (*Abstract Co-Author*) Nothing to Disclose
Mark E. Schweitzer, MD, Stony Brook, NY (*Abstract Co-Author*) Consultant, MMI Munich Medical International GmbH Data Safety Monitoring Board, Histogenics Corporation
James M. Paci, MD, Setauket- East Setauket, NY (*Abstract Co-Author*) Nothing to Disclose
Paul Vaska, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

ACL graft placement is among the most common orthopedic procedures. The biointegration of the graft has been shown in animal models to consist of revascularization, cell repopulation and metaplasia of tendon to ligament. We sought to use longitudinal PET MRI to better understand this process.

METHOD AND MATERIALS

11 patients (mean age: 36y; range: 19-55y SD 11.8 y) who underwent autograft of semitendinosus ACL reconstruction were recruited in this ongoing IRB-approved study. Simultaneous 18F-FDG PET (5 mCi IV) and MRI of both knees were obtained at 3 months (11 scans), 6 months (5 scans) and 12 months (1 scan) post operatively using Siemens mMR tomograph. First, whole-knee ROIs were placed on both knees to characterize changes at the organ scale. Then, for each tunnel (in femur & tibia), MRI images were resliced using PMOD to align the tunnels perpendicular to the image plane and circular ROIs were manually drawn on each plane with diameter equal to the tunnel diameter. The same reslicing was applied to associated PET images. Average PET uptake was normalized to measurements from the posterior cruciate ligament of same knee. Sequential knee MRI images were reviewed by musculoskeletal fellowship trained radiologist for morphological changes.

RESULTS

Our study demonstrated a higher PET uptake in postoperative knee compared to contralateral knee and the difference decreased over time – at 3 months 47% higher (8% SD) and at 6 months 22% higher (12% SD). Within the femoral & tibial tunnels, activity generally had a focal, rather than uniform distribution. Average activity in the tunnels exhibited a decreasing trend from 3 to 6 months (average -12%, p=0.11, including a decrease in 4 out of 5 subjects). The subject who had 3, 6 and 12 months postoperative scans also demonstrated decreased activity (-22%) from 6 to 12 months. No focal graft related complication was seen on MR portion of the study.

CONCLUSION

Longitudinal simultaneous PET MRI of knee in postoperative ACL graft can demonstrate both morphologic as well as physiologic data about the healing process.

CLINICAL RELEVANCE/APPLICATION

Simultaneous PET MR imaging of the knee may provide a better understanding of ACL graft integration and thus improve management of postoperative recovery.

RC204-04 Postoperative Evaluation of Knee: ACL

Monday, Nov. 28 9:10AM - 9:30AM Room: E451B

Participants
Lynne S. Steinbach, MD, San Francisco, CA, (lynne.steinbach@ucsf.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1. Understand the MR appearance of ACL reconstruction2. Review most common surgical techniques for ACL reconstruction3. Recognize various complications of ACL reconstruction

ABSTRACT

Normal ACL grafts are straight, of uniform caliber, and low signal intensity. The hamstring grafts may have some striation. Approximately 3-12 months following surgery the graft may undergo ligamentization which represents cellular remodeling and revascularization. On MRI, the graft may show intermediate signal intensity on all imaging sequences. This should not be misinterpreted for an abnormality. By 12-18 months, most grafts again demonstrate low signal intensity, although some normal grafts can demonstrate intermediate to high signal intensity. Those who have had patellar tendon grafts demonstrate a defect in the middle third of the inferior patella and the patellar tendon. The normal postoperative patellar tendon thickens and is of uniform low signal intensity. This should not be mistaken for tendinosis. Except for the rare finding of scarring, it is difficult to identify the harvest site of hamstring grafts. Tunnels for the ACL graft should be positioned in a certain manner to restore knee homeostasis and provide functional stability. On coronal images, the femoral tunnel extends from the lateral femoral metadiaphysis to the roof of the intercondylar notch. In the right knee it should enter the tunnel at approximately 10-11 o'clock position and in the left knee it should enter at the 1-2 o'clock position. The lateral edge of the tibial tunnel should be parallel to the lateral tibial spine and the graft should be angulated 60-65 degrees to the joint line 10. On sagittal images the femoral tunnel should enter the intercondylar notch at the junction of the posterior femoral cortex with the intercondylar notch approximally 1-2 mm from the cortical rim. The tibial tunnel should enter the tibia parallel and posterior to a line drawn along the roof of the intercondylar notch (Blumensaat's line)10 . Anterior translation of the tibia may persist following successful ACL reconstruction. Complications of ACL graft include

improper positioning of the tibial and femoral tunnels, graft impingement, graft tear, cyclops lesions, arthrofibrosis, mucoid degeneration in the graft and tunnels and hardware failure.

LEARNING OBJECTIVES

1) Review types of procedures commonly used following ACL injury. 2) Become familiar with the normal appearance of the ACL graft of MRI Identify complications of ACL grafting as seen on MRI.

RC204-05 Postoperative Imaging after Subchondroplasty in the Knee

Monday, Nov. 28 9:30AM - 9:40AM Room: E451B

Participants
Christoph A. Agten, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Daniel J. Kaplan, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Laith Jazrawi, MD, New York, NY (*Abstract Co-Author*) Consultant, Ferring Group Institutional Support, Arthrex, Inc Institutional Support, Johnson & Johnson Royalties, Wolters Kluwer nv Intellectual Property, Wolters Kluwer nv
Christopher J. Burke, MBChB, New York, NY (*Presenter*) Nothing to Disclose

PURPOSE

Subchondroplasty is an increasingly used minimally-invasive procedure to treat painful bone marrow edema in the knee by injecting synthetic calcium phosphate into the lesion. The purpose of this study was to describe the postoperative imaging findings after subchondroplasty in the knee.

METHOD AND MATERIALS

The study was IRB-approved and informed consent was obtained from all participants. Nine patients (4 female, 5 male, mean age 56±10 years) undergoing subchondroplasty were included. Bone marrow edemas on preoperative MRI were assessed regarding etiology and location. On postoperative imaging (radiographs, computed tomography, MRI – depending on availability) we assessed visibility of the injected calcium phosphate (yes/no), matching of the calcium phosphate deposits with the bone marrow edema location on preoperative MRI (yes, partially, no), and leakage of injected calcium phosphate into the soft tissues (yes/no). Clinical outcome was assessed by comparing pre- and postoperative International Knee Documentation Committee (IKCD) scores (0-100, higher scores=better outcome).

RESULTS

Bone marrow edema were related to osteoarthritis (n=5) and insufficiency fractures (n=4) and were located in the medial tibia plateau (n=5), medial femoral condyle (n=3), and lateral femoral condyle (n=1). Postoperative imaging was only available in 5 patients. The injected calcium phosphate was depicted on all postoperative radiographs. The site of the injected calcium phosphate matched with preoperative MRI bone marrow edema in 4/5 patients, and matched only partially in one patient. Leakage in the soft tissues was noted in 3/5 patients (along the needle approach). The median improvement in IKCD scores 1 year after subchondroplasty was 20.7 points (range -1.1 to 65.6).

CONCLUSION

Radiologists should be familiar with the typical postoperative imaging appearance after subchondroplasty. On postoperative imaging, soft tissue contamination with injected calcium phosphate can be observed and should not be mistaken as trauma-related or heterotopic ossification.

CLINICAL RELEVANCE/APPLICATION

The radiologist should be familiar with the anticipated postoperative imaging appearances following subchondroplasty and the potential complications, to ensure accurate imaging interpretation.

RC204-06 Upsloping Lateral Sourcil: A Novel Radiographic Finding in Clinically Unstable Hips

Monday, Nov. 28 9:40AM - 9:50AM Room: E451B

Awards
Student Travel Stipend Award

Participants
Thomas Wong, BA, Aurora, CO (*Presenter*) Nothing to Disclose
Mary Kristen Jesse, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Omer Mei-Dan, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

While radiographic findings of frank hip dysplasia are well defined, there is a lack of diagnostic criteria for patients with radiographically "normal" hips who have borderline morphologic deficit and clinical instability. In this study, we evaluate the upsloping lateral sourcil (ULS) as a novel radiographic finding in the evaluation of these patients.

METHOD AND MATERIALS

316 patient charts were reviewed for: AP-pelvis radiographs with confirmed standard quality parameters, lateral center edge (LCE) angles, the presence of upsloping lateral sourcils, and clinical instability as elucidated from notes by a hip preservation surgeon. Chi-square statistical analysis was used to evaluate the association of the ULS with clinical hip instability. Patients with gross dysplastic deformity, marked inclination of the acetabular roof, or femoral head subluxation were removed from analysis.

RESULTS

Our review consisted of 104 males (32.9%) and 212 females (67.1%), with a mean age of 34y. The prevalence of the ULS correspondingly increased with the degree of dysplasia and was found in 65.2% of dysplastic hips (LCE<20°), 29.6% of "borderline" hips (LCE 20°-25°), 14.9% of normal hips (LCE 25°-40°) and 0% of pincer hips (LCE >40°). Of the hips displaying ULS, 77.9% had clinical instability (p-value = 0.0258). The ULS radiographic finding demonstrated 89.0% specificity for clinical instability.

CONCLUSION

Advancements in hip preservation surgery garners substantial attention towards accurate diagnosis of borderline hip dysplasia and clinical hip instability. The ULS is a novel radiographic finding that may be useful as a secondary identifier of borderline hip dysplasia and hip instability. Incorporation of this finding into the routine assessment of the painful hip will allow for an earlier and more accurate identification of at-risk patients and help to guide clinical referral and treatment.

CLINICAL RELEVANCE/APPLICATION

The upsloping lateral sourcil is a novel radiographic characteristic that may help to identify clinical instability in borderline patients who demonstrate "normal" morphology.

RC204-07 Preoperative Evaluation of Hip

Monday, Nov. 28 10:00AM - 10:20AM Room: E451B

Participants
Donna G. Blankenbaker, MD, Madison, WI, (dblankenbaker@uwhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Apply the most appropriate imaging technique in the assessment of the painful hip. 2) Identify and examine the cause for the painful hip. 3) Develop a checklist in the imaging assessment of the hip.

ABSTRACT

RC204-08 More than Half of the Patients Eligible for Joint Preserving Surgery of the Hip Present with Abnormal Femoral Torsion

Monday, Nov. 28 10:20AM - 10:30AM Room: E451B

Participants
Till Lerch, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Florian Schmaranzer, Bern, Switzerland (*Presenter*) Nothing to Disclose
Inga Todorski, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Simon D. Steppacher, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Stefan Werlen, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Klaus A. Siebenrock, MD, PhD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Moritz Tannast, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Torsional deformities are increasingly recognized as an additional factor in the setting of femoroacetabular impingement (FAI). Decreased femoral torsion can worsen an anterior FAI conflict while an increased torsion can be beneficial with the same configuration. It is unknown how often torsional deformities are present in young patients presenting with groin pain that are eligible for joint preserving surgery. We questioned what is the prevalence of an abnormal femoral torsion in hips with FAI or hip dysplasia and which hip disorders are associated with an abnormal torsion?

METHOD AND MATERIALS

An IRB-approved retrospective study of 463 consecutive symptomatic FAI patients (538 hips) and a MRI or CT scan on which femoral torsion could be measured was performed ('study group'). Out of 915 MRI we excluded 377 hips. All patients had an AP pelvic view. Coxometric parameters were assessed with a previously validated software. The study group was divided into 10 groups: Dysplasia (< 22° LCE), retroversion, anteverted hips, overcoverage (LCE angle 36-39°), severe overcoverage (LCE>39°), cam (>50° alpha angle), mixed FAI, varus- , valgus- and Perthes-hips. The 'control group' of normal hips consisted of 35 asymptomatic patients (35 hips) without radiographic signs of osteoarthritis. Femoral torsion was measured on axial MRI and CT scans. Normal femoral torsion was defined according to Tönnis et al. (10-25°) while abnormal and severely abnormal torsion was defined as <10° and >25° respectively <0° and >35°. ANOVA analysis was performed for statistical analysis.

RESULTS

52% of the patients presented with abnormal values for femoral torsion. Severely abnormal torsion was measured in 17% of all 538 hips eligible for joint preserving surgery. Abnormal femoral torsion was present in 90% of Perthes hips, in 63% of dysplastic hips, 58% of hips with overcoverage and in 75% of valgus hips.
Significant differences ($p<0.001$) in torsion between normal hips (mean 17°) and hips with dysplasia (26°), valgus hips (27°) and Perthes hips (32°) could be found.

CONCLUSION

More than half of the patients which are eligible for joint preserving surgery of the hip present with abnormal femoral torsion.

CLINICAL RELEVANCE/APPLICATION

Though the exact contribution of altered femoral torsion to patients symptoms and outcome are currently unknown, femoral torsion should be measured in patients eligible for hip-preserving surgery.

RC204-09 Utility of 3D Print Models for Pre-operative Planning in Femoroacetabular Impingement

Monday, Nov. 28 10:30AM - 10:40AM Room: E451B

Participants
Tony T. Wong, MD, New York, NY (*Presenter*) Nothing to Disclose
Thomas S. Lynch, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Charles A. Popkin, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jonathan K. Kazam, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To establish 3D print models as a useful tool in pre-operative planning for FAI surgery.

METHOD AND MATERIALS

This is a retrospective review with IRB approval. The electronic medical record was queried for patients with a clinical diagnosis of FAI that had CT, MRI, and radiographs available for review from 2013-2015. This yielded a study group of 10 consecutive patients. 3D print models for the femora and acetabuli of each patient were created.The clinical information and imaging for each patient were reviewed independently by two orthopedic surgeons. They anticipated the bone resection required on the femur and acetabulum as per routine pre-surgical planning. They were then shown the 3D models and decided whether the extent of this anticipated resection changed. On the femoral side, the assessment was made in regards to direction (superior, inferior, medial, and lateral femoral neck) and depth. On the acetabular side, the assessment was made in regards to direction (anterior and posterior rim), depth, and involvement of the anterior inferior iliac spine (AIIS).

RESULTS

On a per patient basis, the 3D models changed the amount of bone resection for at least one reader in 9/10 (90%) femoral cases and 10/10 (100%) acetabular cases. The proportions of anticipated femoral resection change by position were (95% CI): 25% (9.4%-52%) superior, 20% (6.1%-49%) inferior, 25% (9.4%-52%) medial, 55% (29%-79%) lateral, and 55% (29%-79%) depth. Cohen's kappa was: 0.348 (p = 0.26) superior-inferior, 0.737 (p = 0.016) medial-lateral, and 0.600 (p = 0.058) depth. The proportions of anticipated acetabular resection change by position were (95% CI): 75% (56%-88%) anterior, 40% (19%-65%) posterior, 60% (40%-77%) depth, and 35% (18%-57%) AIIS. Cohen's kappa was: -0.176 (p = 0.49) anterior-posterior, 0.091 (p = 0.49), depth, and 0.000 (p = 1.0) AIIS. Proportion of position changes in:Cam lesion > 60 deg vs. < 60 deg: 55% vs. 20% (p = 0.00030)Neg. crossover vs. pos. crossover: 79% vs. 44% (p=0.0075)

CONCLUSION

Our results show that 3D print models can change the anticipated degree of required femoroplasty and acetabuloplasty in FAI surgery. They may be particularly useful for cases with larger cam lesions and no crossover sign. Inter-rater agreements ranged from fair to good in the femur and poor in the acetabulum.

CLINICAL RELEVANCE/APPLICATION

3D models can alter the surgical plan in patients with FAI.

RC204-10 Postoperative Evaluation of Hip

Monday, Nov. 28 10:40AM - 11:00AM Room: E451B

Participants
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Know the relevant surgical procedures to treat the hip joint. 2) Identify the most relevent conditions after surgery of the hip joint. 3) Apply the most appropriate exam for the postopertive patient.

RC204-11 Preoperative Evaluation of Ankle

Monday, Nov. 28 11:00AM - 11:20AM Room: E451B

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

LEARNING OBJECTIVES

1) Apply the most appropriate MR imaging technique in the assessment of the painful ankle. 2) Learn MRI imaging features of tendons, ligaments, bone and soft tissue that will affect surgical versus conservative treatment 3). Review pertinent anatomy of the ankle by MRI criteria

ABSTRACT

RC204-12 Accessory Anterolateral Talar Facet Associated with Tarsal Coalition: Prevalence and Cross-sectional Characterization

Monday, Nov. 28 11:20AM - 11:30AM Room: E451B

Awards
Student Travel Stipend Award

Participants
Eman Alqahtani, MD, MPH, La jolla, CA (*Presenter*) Nothing to Disclose
Evelyne Fliszar, MD, Mount Royal, QC (*Abstract Co-Author*) Nothing to Disclose
Donald L. Resnick, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Brady K. Huang, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The accessory anterolateral talar facet (AALTF) is a developmental entity recently described as a potential cause for rigid painful flat foot. We hypothesize that there is an association between AALTF and other flat foot etiologies such as tarsal coalitions.

METHOD AND MATERIALS

We investigated the presence of AALTF on all CT and MRI of patients with possible tarsal coalition or sinus tarsi syndrome (01/01/2010-12/31/2016). Exclusion criteria included acute ankle trauma, recent ankle surgery, motion or metal artifacts. We evaluated the AALTF length and height, and the lateral talocalcaneal structures and sinus tarsi for edema and osseous changes.

The presence of tarsal coalitions such as calcaneonavicular (CNC), intra- articular middle facet talocalcaneal (MFTCC), posterior facet talocalcaneal (PFTCC), extra-articular posteromedial talocalcaneal (EATCC) and other rare coalitions were also evaluated.

RESULTS

187 patients were included in this study (age range 14-91 years; mean ± SD age; 50 ± 17 years), 47.1% males and 52.9% females. Overall AALTF prevalence was 31.55% (59/187), 41.91% in men, and 23.23% in women. AALTF average length was 4.5±1.1mm, and average height was 8.9±3.4mm. AALTF was found to be significantly associated with lateral talocalcaneal osseous changes such as cortical thickening and cystic changes (34/59 and 24/59 respectively, P< 0.01).At least one type of collation was identified in 37.43% of study population (70/187). The most common type was CNC (52.86%) followed by EATCC (35.71%). Intra-articular MFTCC (12.86%,) was found to be more common than PFTCC (5.71%). Other rare coalitions were present in less than 3%. There was a significant association between AALTF and the presence of EATCC (19/59, P < 0.01) and MFTCC (7/59, P < 0.05). No association was found with CNC, PFTCC or other rare coalitions. AALTF was also found to be significantly associated with sinus tarsi edema on MRI (45 of 59, P< 0.05).

CONCLUSION

AALTF is common and significantly associated with tarsal coalitions, specifically EATCC and MFTCC. When a coalition is identified, special attention should be made to evaluate for other associated pathologies. Failure to recognize an AALTF may result in persistent symptoms if only the coalition is treated.

CLINICAL RELEVANCE/APPLICATION

Imaging interpreter must be aware of possible association between AALTF and tarsal coalition to aid appropriate clinical and surgical decisions.

RC204-13 Metal Artifact Reduction Sequence MRI of Total Ankle Arthroplasty Implants: Compressed Sensing Accelerated SEMAC MRI versus Conventional High-Bandwidth MRI

Monday, Nov. 28 11:30AM - 11:40AM Room: E451B

Participants
Jan Fritz, MD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG
Lucas Fonseca, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Mathias Nittka, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Wesley Gilson, PhD, Baltimore, MD (*Abstract Co-Author*) Employee, Siemens AG
Lew Schon, MD, Baltimore, MD (*Abstract Co-Author*) Royalties, DJO, LLC Royalties, Arthrex, Inc Royalties, DARCO International, Inc Royalties, Gerson Lehrman Group, Inc Royalties, Zimmer Biomet Holdings, Inc, Inc Royalties, Reed Elsevier Speakers Bureau, Tornier, Inc Speakers Bureau, Zimmer Biomet Holdings, IncSpeakers Bureau, BioMimetic Therapeutics, Inc Consultant, Zimmer Biomet Holdings, Inc Consultant, BioMimetic Therapeutics, Inc Consultant, Guidepoint Global, LLC Consultant, Gerson Lehrman Group, Inc Consultant, Tornier, Inc Consultant, Wright Medical Technology, Inc Consultant, Royer Medical, Inc Consultant, Carestream Health, Inc Stockholder, Tornier, Inc Stockholder, Royer Medical, Inc Stockholder, Bioactive Surgical, Inc Stockholder, HealthpointCapital Research support, Royer Medical, Inc Research support, Zimmer Biomet Holdings, IncResearch support, Tornier, Inc Research support, Arthrex, Inc Research support, SpineSmith LP Research support, BioMimetic Therapeutics, Inc Support, Bioactive Surgical, Inc Support, Educational Concepts in Medicine, LLC Support, Smith & Nephew plc Support, OrthoHelix Surgical Designs, Inc Support, Chesapeake Surgical Biocomposites Support, Olympus Corporation Support, Omega Surgical Instruments Ltd
Cesar de Cesar Netto, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Metal artifact reduction sequence (MARS) MRI is helpful for the assessment of pain and dysfunction following arthroplasty. Conventional SEMAC MRI affords powerful metal suppression, but is time consuming. Compressed sensing (CS) accelerated data sampling based on k-space sparsity, however, affords the time-neural use of SEMAC when compared to high-bandwidth (high-BW) MRI. Thus, we prospectively compared an 8-fold accelerated CS-SEMAC sequence prototype with high-BW MRI in patients with total ankle arthroplasty implants (TAA).

METHOD AND MATERIALS

Following IRB approval and written informed consent, 20 asymptomatic volunteers and 10 symptomatic patients [18 women, 12 men; age, 62 (41-81) years] with TAA underwent CS-SEMAC (30 min) with 19 encoding steps and high-BW (30 min) MARS MRI at 1.5 Tesla. For each technique, intermediate-weighted and fat-suppressed axial, sagittal and coronal MR images were obtained. Three experienced physicians evaluated image quality, metal suppression, bone-implant interfaces, synovium, tendons, ligaments, bone and joints. Kruskall-Wallis and intraclass correlation coefficient (ICC) were applied. Bonferroni-corrected p-values ≤ 0.01 were considered significant.

RESULTS

There was good agreement between observers (ICC=0.79; 95% CI, 0.78-0.80). Metal artifact reduction was significantly better (p<0.01) on CS-SEMAC images (very good) than on high-BW images (poor-to-adequate). Tissue contrast, fat suppression, and fluid brightness were statistically similar, whereas image sharpness was higher on high-BW MR images (p<0.01). At implant levels, tendons, ligaments and synovium were significantly better seen (p<0.01) on CS-SEMAC images than on high-BW images. Abnormal findings included fractures (n=2), tendon tears (n=2), osteolysis (n=3), medial tibiotalar overload (n=3), synovial fibrosis (n=2), non-specific synovitis (n=2), and subtalar and midfoot arthrosis (n=2), which were equally well or better seen on CS-SEMAC MR images (p<0.01).

CONCLUSION

Time-equivialent CS-SEMAC MRI outperforms high-BW MRI in the degree of metal artifact reduction as well as visibility and diagnosis of abnormalities along the bone implant interfaces and at level of the tibiotalar joint line.

CLINICAL RELEVANCE/APPLICATION

Sparsity-driven, compressed sensing accleration affords the time-neural use of SEMAC MRI and higher image and diagnostic quality than traditional high-BW MRI for the diagnosis of periprosthetic abnormalities in patients with TAA.

RC204-14 Postoperative Evaluation of Ankle

Monday, Nov. 28 11:40AM - 12:00PM Room: E451B

Participants
Hilary R. Umans, MD, Ardsley, NY (*Presenter*) Nothing to Disclose

Active Handout:Hilary Ruth Umans

http://abstract.rsna.org/uploads/2016/16000531/ACTIVE RC204-14 RSNA Post-Op Ankle MRI Handout.pdf

LEARNING OBJECTIVES

1) Review MRI technical considerations in imaging the post-operative ankle. 2) Review normal and abnormal post-operative MR appearance of various procedures, including lateral collateral ligament reconstruction, tendon transfers and tenodesis and treatment of osseous/osteocartilaginous pathology.

ABSTRACT

RC205

Neuroradiology Series: Stroke

Monday, Nov. 28 8:30AM - 12:00PM Room: N227B

NR ER

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

FDA Discussions may include off-label uses.

Participants

Ajay Gupta, MD, New York, NY (*Moderator*) Consultant, Biomedical Systems;
Howard A. Rowley, MD, Madison, WI, (hrowley@uwhealth.org) (*Moderator*) Research Consultant, Bracco Group Research Consultant, Guerbet SA Research Consultant, General Electric Company Consultant, F. Hoffmann-La Roche Ltd Consultant, W.L. Gore & Associates, Inc Consultant, Lundbeck Group

Sub-Events

RC205-01 Stroke Systems of Care and Implications for the Radiologist

Monday, Nov. 28 8:30AM - 9:00AM Room: N227B

Participants
Edward C. Jauch, MD, MS, Charleston, SC (*Presenter*) Research Support, F. Hoffmann-La Roche Ltd; Research Support, Ischemia Technologies; Research Support, Medtronic plc; Research Support, Stryker Corporation; Research Support, Penumbra, Inc; Research Support, NoNO, Inc; Research Support, ZZ Biotech, LLC; ;

RC205-02 Prediction of Treatment Response to IV Thrombolysis in Acute Ischemic Stroke Patients using CT Perfusion-Based Wavelet-Transformed Angiography

Monday, Nov. 28 9:00AM - 9:10AM Room: N227B

Participants
Wolfgang G. Kunz, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Fabritius, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Lukas Havla, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Birgit B. Ertl-Wagner, MD, Munich, Germany (*Abstract Co-Author*) Board Member, Koninklijke Philips NV; Board Member, Bracco Group; Board Member, Springer Science+Business Media; Consultant, MMI Munich Medical International GmbH; Consultant, Koninklijke Philips NV; Consultant, Springer Science+Business Media; Consultant, Thieme Medical Publishers, Inc; Consultant, Bracco Group; Institutional Research Grant, Eli Lilly and Company; Institutional Research Grant, F. Hoffmann-La Roche Ltd; Institutional Research Grant, Guerbet SA; Institutional Research Grant, Merck KGaA; Institutional Research Grant, Bayer AG; Institutional Research Grant, Novartis AG; Speaker, Siemens AG; Author, Springer Science+Business Media; Author, Thieme Medical Publishers, Inc; Author, Bracco Group; Royalties, Springer Science+Business Media; Royalties, Thieme Medical Publishers, Inc; Stockholder, Siemens AG; Travel support, Siemens AG;
Wieland H. Sommer, MD, Munich, Germany (*Abstract Co-Author*) Founder, QMedify GmbH
Kolja M. Thierfelder, MD,MSc, Munich, Germany (*Presenter*) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the predictive value of vessel occlusions that were only detected using CT perfusion-based wavelet-transformed angiography (waveletCTA) on morphologically determined response to IV thrombolysis.

METHOD AND MATERIALS

In this IRB-approved study, patients out of a retrospective cohort of 929 consecutive subjects who had undergone multiparametric CT including whole-brain CT perfusion due to suspected ischemic stroke were included. Inclusion criteria were: (1) significant cerebral blood flow (CBF) deficit, (2) no evidence of single phase CTA (spCTA) occlusion, and (3) acute ischemic non-watershed infarction as confirmed by follow-up imaging. waveletCTA defines angiographic signal by best fitting of time-attenuation curves to a generic contrast bolus curve in each voxel as described before. Two blinded and experienced readers analyzed the waveletCTA images with respect to presence and location of vessel occlusions. Morphologic outcome was defined as relative final infarction volume using the ratio (final infarction volume) / (CBF deficit volume), of which smaller values were considered favorable. Multivariate linear regression analyses were performed to identify independent associations.

RESULTS

Seventy-six patients (mean age 71.6 years, SD 12.7) fulfilled the inclusion criteria. Among all 76 patients with unremarkable spCTA, 39 (51.3%) patients showed an occlusion on waveletCTA (vascular territories: MCA 34, PCA 2, ACA 1, SCA 2). Patient subgroups receiving IV thrombolysis (IVT) (N=39) or supportive care (SC) (N=37) showed no statistically significant difference in age, sex, time from symptom onset, early infarction signs, CTP mismatch, waveletCTA-detected occlusions or NIHSS on admission (all $p>0.05$). In patients treated with IVT, linear regression analysis showed that the presence of a waveletCTA-detected occlusion was an independent predictor of a favorable morphologic outcome (beta=-0.524; $p=0.015$), while it failed to predict morphologic outcome in patients receiving SC (beta=0.046; $p=0.812$).

CONCLUSION

The presence of an spCTA occult vessel occlusion detected using waveletCTA is an independent predictor of a favorable response to IVT in terms of a smaller relative final infarction volume.

CLINICAL RELEVANCE/APPLICATION

waveletCTA has the potential to contribute to decision making in acute stroke as occlusions that are detected with this technique

(but not on spCTA) seem to predict a more favorable response to IVT.

RC205-03 Cost-Utility Analysis of MR Selection with DWI for Thrombectomy in Proximal Large Vessel Occlusion Stroke

Monday, Nov. 28 9:10AM - 9:20AM Room: N227B

Awards
Student Travel Stipend Award

Participants
Brian C. Cristiano, MD, Loma Linda, CA (*Presenter*) Nothing to Disclose
Rajeev Nowrangi, MD,MPH, Loma Linda, CA (*Abstract Co-Author*) Nothing to Disclose
Udo Oyoyo, Loma Linda, CA (*Abstract Co-Author*) Nothing to Disclose
Matthew D. Pond, MD, Loma Linda, CA (*Abstract Co-Author*) Nothing to Disclose
Somnath Basu, MD, Toluca Lake, CA (*Abstract Co-Author*) Nothing to Disclose
J. Paul Jacobson, MD, Loma Linda, CA (*Abstract Co-Author*) Shareholder, Genelux Corporation

PURPOSE

Mechanical thrombectomy improves outcomes for patients with proximal large vessel occlusion (LVO) stroke. Treatment selection strategies however remain poorly defined. At our institution we have observed favorable results among patients with small presenting DWI core volume regardless of time from onset. Here we leveraged data from an institutional stroke database to model the cost and effectiveness of a time-independent, MR-driven treatment selection strategy compared with the present standard of care, which emphasizes time from onset and excludes late candidates.

METHOD AND MATERIALS

A decision-analysis model was constructed using outcomes, probabilities and cost data from published sources and an institutional stroke database. Willingness to pay (WTP) was set at $50k/QALY. Two selection strategies were modeled: (1) treat all early LVO patients if reasonable to achieve access within 6 hours of onset (standard of care), (2) treat all LVO patients with small presentation core infarct (≤50 mL diffusion restriction on MRI), regardless of time from onset. Probabilistic and one-way sensitivity analyses were performed.

RESULTS

Using a US cost structure, MR screening dominates the standard-of-care, with improved QALYs (0.42 v. 0.40) and reduced costs ($33,800 v. $35,410). In a probabilistic sensitivity analysis, MR screening was more cost-effective in 99% of simulations. In a separate Monte Carlo simulation using a UK cost environment, MR screening was more cost-effective 89% of the time.

CONCLUSION

A time-independent, MR-driven treatment selection strategy is more cost effective than the current standard of care, which emphasizes time from symptom onset as the major criterion for selection.

CLINICAL RELEVANCE/APPLICATION

Improved outcomes and reduced costs may be achievable in proximal LVO stroke by selecting patients for thrombectomy based on presenting DWI infarct volume rather than time from onset.

RC205-04 Machine Learning in the Detection of Brain Infarct on Computed Tomography

Monday, Nov. 28 9:20AM - 9:30AM Room: N227B

Awards
Student Travel Stipend Award

Participants
Ashley Knight-Greenfield, MD, New York, NY (*Presenter*) Nothing to Disclose
Lohendran Baskaran, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Praneil Patel, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Tong Zhang, Piscataway, NJ (*Abstract Co-Author*) Nothing to Disclose
Peng Sun, Piscataway, NJ (*Abstract Co-Author*) Nothing to Disclose
Qi Chang, Piscataway, NJ (*Abstract Co-Author*) Nothing to Disclose
Hooman Kamel, MD, New York, NY (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd
Ajay Gupta, MD, New York, NY (*Abstract Co-Author*) Consultant, Biomedical Systems;
James K. Min, MD, New York, NY (*Abstract Co-Author*) Speakers Bureau, General Electric Company Advisory Board, General Electric Company Stockholder, General Electric Company Consultant, Koninklijke Philips NV

PURPOSE

To utilize a deep learning technique in which a computer is trained and tested in the detection of infarct on computed tomography (CT).

METHOD AND MATERIALS

56 head CT scans from an IRB-approved institutional stroke database were selected at random and uploaded to an annotation system. A total of 1482 axial CT slices were annotated by a single radiologist. Brain centerline was drawn, and brain area and infarct area were manually traced on CT slices. Categories of annotation included presence of infarct, chronicity of infarct, type of infarct (ischemic/hemorrhagic), and sidedness of infarct. CT slices from 47 scans were utilized as a training set, while slices from 9 scans were used as a test set. In order to train the computer, 60 x 60 pixel sections, or patches, were utilized with a 10 pixel stride for a total of 1.8 million training patches and 360,000 test patches. Patches were input into a max-pooling convolutional neural network, a type of deep learning architecture, for the purposes of training and testing the computer. Sensitivity, specificity, and receiver operating characteristic (ROC) analysis for pixel accuracy was performed on the test set. Heat maps were generated by the computer denoting possibility of infarct.

RESULTS

387 (31%) slices were positive for infarct in the training set, 223 (58%) of which were acute, while 76 (30%) slices were positive in the test set, 35 (46%) of which were acute. Increased accuracy for infarct detection by the computer was observed on sequential testing cycles. Sensitivity for infarct detection in the test set was 76.6%, with specificity of 90.25%. ROC analysis revealed area under the curve of 0.93.

CONCLUSION

We demonstrated that a deep learning technique can be used as a tool to train computers in infarct detection, with ultimate self-learning capability. With future optimization of this learning process, we hope to develop a highly accurate assistive tool for radiologists in the detection of infarct.

CLINICAL RELEVANCE/APPLICATION

Early stages of brain infarction can oftentimes be difficult to detect with computed tomography, and thus an assistive tool, such as a computer, would be of use to radiologists.

RC205-05 A Simplified Alberta Stroke Program Early CT Score (sASPECTS) for Prognostication and Treatment Triage of Anterior Circulation Acute Ischemic Stroke

Monday, Nov. 28 9:30AM - 9:40AM Room: N227B

Participants
Seyedmehdi Payabvash, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Siamak Noorbaloochi, Minneapolis, MN (*Abstract Co-Author*) Nothing to Disclose
Adnan I. Qureshi, MD, Minneapolis, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop a predictive tool based on the topology of early ischemic changes on the admission noncontrast CT scan of anterior circulation ischemic stroke.

METHOD AND MATERIALS

The study cohort was derived from the ALIAS (Albumin in Acute Stroke) multicenter trials. Patients with admission noncontrast CT scan and anterior circulation stroke were included. Two expert readers graded ischemic change on admission CT scan using the Alberta Stroke Program Early CT Score (ASPECTS). A stepwise penalized logistic regression determined those components of the ASPECTS on admission scans that were independent predictors of favorable outcome – defined by 3-month modified Rankin Scale (mRs) score ≤2. Follow-up 24-hour CT/MRI scans were reviewed for evidence of intracranial hemorrhage (ICH).

RESULTS

A total of 1115 patients were included. The ischemic changes of the caudate, lentiform nucleus, insula, and M5 components of ASPECTS on admission CT scan were independent predictors of favorable outcome based on stepwise penalized logistic regression. A 0-to-4 point simplified ASPECTS (sASPECTS) was developed including these components. There was no significant difference between the ASPECTS and sASPECTS in prediction of clinical outcome (p=0.738). Among patients with sASPECTS≥1, the rate of favorable outcome was higher in patients with IV thrombolytic therapy (501/837, 59.9%) versus those without treatment (91/183, 49.7%, p=0.013); whereas, among patients with sASPECTS of 0, IV thrombolysis was not associated with improved clinical outcome. Moreover, patients with sASPECTS of 0 were more likely to develop symptomatic ICH (odds ratio=2.62, 95% confidence interval: 1.49–4.62), compared to those with sASPECTS≥1 (p=0.004).

CONCLUSION

In anterior circulation stroke patients, topographic assessment of acute ischemic changes in the caudate, lentiform nucleus, insula, and M5 (as part of sASPECTS) can predict clinical outcome as accurately as the ASPECTS. Moreover, sASPECTS may identify those patients with favorable outcome associated with thrombolytic therapy, and those who are at risk of developing symptomatic ICH.

CLINICAL RELEVANCE/APPLICATION

A semi-quantitative assessment of central MCA territory early ischemic changes can assist stroke treatment triage by identifying patients who may benefit from IV tPA therapy and those at risk of developing symptomatic ICH.

RC205-06 One Year Out from the 2015 Trials- Where does Endovascular Treatment Stand?

Monday, Nov. 28 9:40AM - 10:10AM Room: N227B

Participants
Philip M. Meyers, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will appreciate the significance of recent endovascular stroke trials demonstrating safety and efficacy of mechanical thromboectomy for treatment of acute large artery ischemic stroke. 2) The participant will understand the context in which additional NIH stroke trials address outstanding questions about endovascular treatment of acute ischemic stroke in a broader patient population.

ABSTRACT

Stroke remains a leading cause of adult death and disability throughout the world. During the last two years, a series of randomized, controlled trials comparing mechanical thrombo-embolectomy plus medical therapy to medical therapy alone have demonstrated superior clinical outcomes with rapid revascularization using catheter-based techniques. In carefully selected patients, the odds of recovery are better. These studies show benefit most often when treatment is performed as quickly as possible and within 6 hours of stroke onset. For a variety of reasons, many stroke victims – perhaps even a majority – present outside of the conventional time window. With imaging to assess directly or indirectly for cerebral viability, identification of additional treatment candidates is possible. This is an important goal of the next set of ischemic stroke trials.

LEARNING OBJECTIVES

1) The participant will appreciate the significance of recent endovascular stroke trials demonstrating safety and efficacy of mechanical thromboectomy for treatment of acute large artery ischemic stroke. 2) The participant will understand the context in which additional NIH stroke trials address outstanding questions about endovascular treatment of acute ischemic stroke in a broader patient population.

ABSTRACT

Stroke remains a leading cause of adult death and disability throughout the world. During the last two years, a series of randomized, controlled trials comparing mechanical thrombo-embolectomy plus medical therapy to medical therapy alone have demonstrated superior clinical outcomes with rapid revascularization using catheter-based techniques. In carefully selected patients, the odds of recovery are relatively good. These studies show benefit most often when treatment is performed as quickly as possible and within 6 hours of stroke onset. For a variety of reasons, many stroke victims – perhaps even a majority – present outside of the conventional time window. With imaging to assess directly or indirectly for cerebral viability, identification of additional treatment candidates is possible. This is an important goal of the next set of ischemic stroke trials.

RC205-07 Excluded Patients from the 2015 Trials: The Silent Majority

Monday, Nov. 28 10:20AM - 10:50AM Room: N227B

Participants
Achala S. Vagal, MD, Cincinnati, OH, (achala.vagal@uchealth.com) (*Presenter*) Research Grant, F. Hoffmann-La Roche AG

LEARNING OBJECTIVES

1) Recognize the imaging features of patients who were included in the 2015 endovascular trial. 2) Discuss which groups of patients were excluded from the 2015 trials. 3) Discuss the current evidence and future research directions in these excluded subgroups.

ABSTRACT

RC205-08 Acute Reperfusion without Recanalization: Assesment of Collaterals Using Perfusion-Weight MRI

Monday, Nov. 28 10:50AM - 11:00AM Room: N227B

Participants
Leila Chamard, BRON, France (*Presenter*) Nothing to Disclose
Nikolaos Makris, BRON, France (*Abstract Co-Author*) Nothing to Disclose
Tae-Hee Cho, MD, Bron, France (*Abstract Co-Author*) Nothing to Disclose
Marc Hermier, MD, PhD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Roxana R. Ameli, Bron, France (*Abstract Co-Author*) Nothing to Disclose
Guy Louis-Tisserand, MD, Bron Cedex, France (*Abstract Co-Author*) Nothing to Disclose
Norbert Nighoghossian, MD, PHD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Yves Berthezene, MD, PhD, Bron, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Acute reperfusion despite persistent vessel occlusion can occur in about 30% of patients. Retrograde reperfusion through leptomeningeal collaterals may explain this phenomenom. The present study evaluated relationship between colaterals and reperfusion and clinical outcome in acute stroke.

METHOD AND MATERIALS

From a multicenter prospective database (I-KNOW), 46 patients with MR-angiography-visible occlusion and in whom both reperfusion and recanalization were assessed within 6 hours of symptoms onset where identified. Maps of collateral flow at arterial, capillary and late veinous phases were automatically generated from dynamic susceptibility-contrast perfusion images through inter-frame registration, baseline signal substraction and temporal summation, and graded according to the American Society of Interventional and Therapeutic Neuroradiology system. Flow direction (anterograde vs retrograde) was visually assessed from the dynamic images. The acute evolution of collateral grades was evaluated against the reperfusion and recanalization status.

RESULTS

Acute reperfusion was associated with better collateral grades at baseline (OR: 36.02; 95% CI: 8.5-207.7; p<0.001). Among patients without recanalization, collateral grades significantly improved between admission and acute follow-up in reperfused patients (OR: 4.57; 95% CI: 1.1-22.7; p=0.048), but not in those without reperfusion (OR: 1.34; 95% CI: 0.4-4.5; p=0.623). Acute reperfusion was associated with favourable clinical outcome, regardless of flow direction.

CONCLUSION

Acute reperfusion without recanalization is related to a significant improvement of retrograde collateral flow.

CLINICAL RELEVANCE/APPLICATION

Collateral status is usefull for management in patient with acute stroke

RC205-10 MR Perfusion to Determine the Status of Collaterals in Patients with Acute Ischemic Stroke: Look Beyond Perfusion Time-Maps

Monday, Nov. 28 11:10AM - 11:20AM Room: N227B

Participants
Kambiz Nael, MD, New York, NY (*Presenter*) Research Consultant, Olea Medical
James R. Knitter, BS, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Amish H. Doshi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
J. Mocco, MD, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
Reade Deleacy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Joshua Bederson, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Thomas P. Naidich, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MR perfusion time-maps show delayed perfusion but are unable to differentiate antegrade from collateral flow if used alone. Using a multiparametric approach, we aimed to identify perfusion parameter/s that can represent the extent of collaterals in comparison to angiographic findings in patients with acute ischemic stroke (AIS).

METHOD AND MATERIALS

AIS patients with anterior circulation proximal occlusion who had baseline MR perfusion and cerebral angiography were evaluated. MR perfusion data were processed using Bayesian method to generate arterial tissue delay (ATD) maps at thresholds of 2, 6 seconds. The volume of delayed perfusion (Vol-ATD2sec), critical hypoperfusion (Vol-ATD6sec), and hypoperfusion (Vol-ATD 2sec-6sec) in addition to corresponding values of rCBV and rCBF were calculated using volume-of-interest (VOI) analysis. Collateral status was dichotomized to poor (ASITN/SIR 0-2) or good (ASITN/SIR 3–4) using baseline cerebral angiography. Statistical analysis was performed using multivariate logistic regression and receiver operating characteristic (ROC) analysis.

RESULTS

In 37 patients included, 20 (54%) had good collaterals using cerebral angiography. After controlling for age, baseline NIHSS and infarct volume, multivariate logistic regression analysis identified rCBV (p=0.001) and hypoperfused volume (Vol-ATD 2sec-6sec) (p=0.01), but not rCBF (p=0.08), Vol-ATD 2sec (p=0.3) or Vol-ATD 6sec (p=0.07), as independent predictors of good collaterals. For rCBV, ROC analysis showed the greatest AUC (0.89) at the threshold > 2.1 with sensitivity/specificity of 85%/90%. For Vol-ATD 2sec-6sec, ROC analysis showed the greatest AUC (0.78) at a threshold > 51 ml with sensitivity/specificity of 70%/82%. Hypoperfused tissue volume (Vol-ATD 2sec-6sec) multiplied by its rCBV, termed hypoperfused tissue collateral index, remained an independent predictor of good collaterals, with improved diagnostic accuracy over each measure alone (AUC: 0.96 at a threshold > 90, sensitivity/specificity of 91%/100%).

CONCLUSION

Hypoperfused tissue collateral index defined as hypoperfused volume (Vol-ATD 2sec-6sec) x rCBV is a new perfusion index with diagnostic accuracy of 96% compared to angiographic findings to predict status of collaterals.

CLINICAL RELEVANCE/APPLICATION

In patients with AIS, evaluation of collateral flow using baseline imaging can have therapeutic and prognostic implications.

RC205-12 Don't Fall for These Stroke Mimics

Monday, Nov. 28 11:30AM - 12:00PM Room: N227B

Participants
Pamela W. Schaefer, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the key neuroimaging characteristics of acute ischemic stroke and common stroke mimics. 2) Use pertinent imaging features and key clinical factors to differentiate acute ischemic stroke from stroke mimics. 3) Discuss the utility of various imaging techniques to distinguish stroke mimics from acute ischemic stroke.

ABSTRACT

This talk will discuss the key imaging features of common stroke mimics and how to distinguish them from acute ischemic stroke. Entities resembling acute ischemic stroke due to restricted diffusion - such as seizures, tranisent global amnesia, hypoglyycemia, central pontine myelinolysis and other metaqboilc disorders, methotrexate and other drug toxicities, diffuse axonal injury, some metastases, fat emboli, demyelinative lesions, some products of hemorrhage, and some infections - will be discussed. Entities resembling subacute stroke with vasogenic edema and elevated diffusion - such as venous thrombosis, hyperperfusion syndrome, and PRES - will be presented. Entities with gyrifrom enhancement resembling subacute stroke - such as some neoplasms, infectious processes and inflammatory processes - will be discussed.

RC206

Pharynx, Larynx, and Oral Cavity

Monday, Nov. 28 8:30AM - 10:00AM Room: E450B

HN NR

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

Participants

Sub-Events

RC206A Imaging the Nasopharynx

Participants
Nancy J. Fischbein, MD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the normal anatomy of the nasopharynx. 2) Illustrate the appearance and patterns of spread of nasopharyngeal carcinoma. 3) Describe additional pathologies of the nasopharynx, along with imaging pearls and pitfalls.

RC206B Imaging of the Oropharynx and Oral Cavity

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

LEARNING OBJECTIVES

1) Understand the anatomic subsites of the oral cavity and oropharynx, and the common tumor histologies arising there. 2) Present the imaging appearance, spread patterns, and imaging stgrategies in terms of modality. 3) Review the role of radiology in staging malignancy of the oropharynx and oral cavity.

ABSTRACT

RC206C Imaging the Larynx and Hypopharynx

Participants
Kristine M. Mosier, DMD, PhD, Indianapolis, IN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define key anatomy of the larynx and hypopharynx. 2) Understand the influence of anatomy on pathways of tumor spread. 3) Identify radiographic features of the patterns of tumor involvement of the larynx and hypopharynx.

ABSTRACT

The focus of this presentation is to highlight the anatomy of the larynx and pharynx with particular emphasis on the laryngeal cartilage framework, membranes and laryngeal spaces. A clear knowledge of these anatomic relationships is essential to understanding the pathways of tumor spread within the laryngopharynx. Recognizing patterns of spread allows the radiologist to influence treatment decisions especially in regards to the extent of surgery and also in post treatment monitoring for recurrent disease. Certain benign conditions that affect the larynx will also be discussed.

RC207

Controversies in Intravenous Contrast Media 2016: Getting Your Questions Answered

Monday, Nov. 28 8:30AM - 10:00AM Room: E450A

GU SQ

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

FDA Discussions may include off-label uses.

Participants
Richard H. Cohan, MD, Ann Arbor, MI (*Coordinator*) Nothing to Disclose
Matthew S. Davenport, MD, Cincinnati, OH, (matdaven@med.umich.edu) (*Presenter*) Royalties, Wolters Kluwer nv; ;
Robert J. McDonald, MD, PhD, Rochester, MN, (mcdonald.robert@mayo.edu) (*Presenter*) Nothing to Disclose
Alexander Radbruch, MD, Heidelberg, Germany, (a.radbruch@dkfz.de) (*Presenter*) Consultant, Guerbet SA; Consultant, Bayer AG; Support, Guerbet SA; Support, Bayer AG; Advisory Board, Guerbet SA; Advisory Board, Bayer AG; Advisory Board, Bracco Group; Advisory Board, AbbVie Inc; Speaker, Guerbet SA; Speaker, Bayer AG; Speaker, Siemens AG; Speaker, prIME Oncology; Advisory Board, General Electric Company; ;
Jay K. Pahade, MD, New Haven, CT (*Presenter*) Consultant, Precision Imaging Metrics, LLC

LEARNING OBJECTIVES

1) To review current management recommendations regarding contrast material administration, including a) what to do in patients who have had allergic-like reactions and who require reinjection, b) current thoughts concerning the risks of contrast induced nephrotoxicity, c) recent observations of long-term gadolinium retention in the body, and d) how to minimize the likelihood of errors in management of contrast reactions.

ABSTRACT

Premedication: Is it worthwhile? (Matthew Davenport - University of Michigan) Objectives: During this talk, the attendee will learn the common indications for premedication and premedication regimens; the degree to which premedication reduces the incidence of subsequent reactions, the likelihood of breakthrough reactions, and the costs of premedication. CIN: Does it exist? If not, why are we trying so hard to prevent it (Robert McDonald - Mayo Clinic) Objectives: During this talk, the literature calling into question the existence of CIN will be reviewed and the necessity of prophylaxis in patients who are more likely to develop acute kidney injury will be discussed. Gadolinium Deposition in the Brain: What does this mean and what should we do about it ? (Alexander Radbruch - University of Heidelberg, Germany). Objectives: During this talk, the recent literature demonstrating gadolinium retention in the body, including the brain will be reviewed. The potential clinical implications of such retention will be discussed, along with a description of future research that needs to be performed in this area. Treating Contrast Reactions: How can we minimize errors? (Jay Pahade - Yale University) Objectives: During this talk, the indications for epinephrine administration, appropriate dose and route of epinephrine administration; common treatment errors that are made and common problems with current treatment training will be discussed. Possible solutions for reducing treatment errors will be discussed.

RC208

Emergency Radiology Series: Current Imaging of the Acute Abdomen

Monday, Nov. 28 8:30AM - 12:00PM Room: S102AB

GI CT MR ER

AMA PRA Category 1 Credits ™: 3.50
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Michael N. Patlas, MD, FRCPC, Hamilton, ON, (patlas@hhsc.ca) (*Moderator*) Nothing to Disclose
Zachary S. Delproposto, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss common and uncommon causes of acute abdomen relevant to emergency imagers.

ABSTRACT

Sub-Events

RC208-01 CT of Gastroduodenal Ulcers and Related Disorders

Monday, Nov. 28 8:30AM - 9:00AM Room: S102AB

Participants
Perry J. Pickhardt, MD, Madison, WI, (ppickhardt2@uwhealth.org) (*Presenter*) Co-founder, VirtuoCTC, LLC; Stockholder, Cellectar Biosciences, Inc; Stockholder, SHINE Medical Technologies, Inc; Research Grant, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Comprehend the underestimated role of CT in diagnosing gastroduodenal ulcer disase. 2) Analyze the CT findings of gastroduodenal ulcers, related conditions, and differential diagnosis. 3) Apply these CT features into daily clinical practice to affect patient outcomes.

ABSTRACT

Honored Educators

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

Perry J. Pickhardt, MD - 2014 Honored Educator

RC208-02 Diagnosing Gastric Band Slippage in the Emergency Department: Performance of 4 Imaging Signs on Both Radiography and Computed Tomography

Monday, Nov. 28 9:00AM - 9:10AM Room: S102AB

Participants
Michael S. Furman, MD, Providence, RI (*Presenter*) Nothing to Disclose
David W. Swenson, MD, Brooklyn, CT (*Abstract Co-Author*) Nothing to Disclose
Kevin J. Chang, MD, Sharon, MA (*Abstract Co-Author*) Nothing to Disclose
David J. Grand, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Albert A. Scappaticci, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Grayson L. Baird, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Anna Ellermeier, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Gastric band slippage occurs in up to 30% of gastric band patients. We previously reported the performance of 4 signs (2 old, and 2 new) of slippage on barium swallow exams. This study now evaluates the applicability of these signs to plain radiographs and CT studies performed in the emergency department.

METHOD AND MATERIALS

We identified 45 gastric band patients who underwent radiography and/or CT in the emergency department from 1/1/2008 – 12/31/2014. Of these patients, 13 were surgically diagnosed with band slippage, while 32 were discharged and returned to standard clinical follow-up without evidence of slippage. Three board-certified radiologists retrospectively reviewed all imaging studies while blinded to patient symptoms and clinical outcomes. The following signs were assessed: (1) abnormally increased phi angle (>58º), (2) inferior displacement of the superolateral gastric band margin from the diaphragm by >2.4 cm, (3) presence of an "O Sign", and (4) presence of an air-fluid level above the gastric band. Sensitivity, specificity, and interobserver agreement (Cohen's Kappa statistic) were calculated for each sign.

RESULTS

For a phi angle >58º, sensitivity and specificity for gastric band slippage were 100% and 81%, respectively, on CT (k=0.93), but 73% and 75% on radiography (k=0.94). For inferior displacement by >2.4 cm, sensitivity and specificity were 89% and 100% on CT

(k=0.98), while 100% and 98% on radiography (k=0.92). For presence of an "O sign", sensitivity and specificity were 13% and 100% on CT (k=0.04), while 30% and 94% on radiography (k=0.64). For presence of an air-fluid level above the gastric band, sensitivity and specificity for slippage were 83% and 99% on CT (k=0.92), while 90% and 100% on radiography (k=0.95).

CONCLUSION

Both inferior gastric band displacement by >2.4 cm from the diaphragm, and the presence of an air-fluid level above the gastric band, are highly reproducible signs of band slippage in the emergency department, and can be identified on both radiography and CT.

CLINICAL RELEVANCE/APPLICATION

Signs of gastric band slippage that were recently defined on barium swallow studies can be effectively applied to simple radiography and CT, thus improving efficiency of diagnosis in the emergency department.

RC208-03 Epiploic Appendagitis is Associated with Peritoneal Inflammation and Visceral Obesity

Monday, Nov. 28 9:10AM - 9:20AM Room: S102AB

Participants
James P. Nugent, Vancouver, BC (*Presenter*) Nothing to Disclose
Hugue A. Ouellette, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
D. P. O'Leary, PhD, Limerick, Ireland (*Abstract Co-Author*) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Patrick D. McLaughlin, FFRRCSI, Vancouver, BC (*Abstract Co-Author*) Speaker, Siemens AG

PURPOSE

The location, size and coexisting local inflammatory findings in acute epiploic appendagitis have not been reported outside of isolated case reports. The association between EA and increased body mass index is controversial and disputed in the radiological and surgical literature. Our aim is to investigate if abdominal adipose volume (AAV), visceral adipose area (VAA) and subcutaneous adipose area (SAA) quantified by CT scans is higher in EA patients than matched controls. We also report the location, size and frequency of coexisting local inflammatory findings in a series of patients with acute epiploic appendagitis.

METHOD AND MATERIALS

Consecutive patients with an imaging diagnosis of EA scanned between January 2009 and June 2014 were selected for inclusion (n = 100). 100 consecutive patients imaged with abdominal CT for non-EA related acute abdominal pain were selected as controls. OsiriX v.5.5.2 (Pixmeo, Geneva, Switzerland) was used to retrospectively quantify abdominal adipose tissue volume and cross-sectional area using Hounsfield unit threshold based semi-automated segmentation between -50 HU and -180 HU. The site, size and severity of inflammation of the involved appendage was also recorded.

RESULTS

EA had a male sex predilection, with 67% of EA versus 41% of acute abdominal cases ($p = 0.0002$). EA patients had 34% greater AAV, 197% greater VAA, and 135% greater SAA than the control subjects ($p < 0.0001$). The inflamed appendage was found in the sigmoid colon in 49% of cases, descending colon in 23% and right colon in 19%. Peritoneal thickening was a frequently reported associated sign of inflammation found in 76% of cases. Bowel wall thickening was common (47%) and diverticulosis co-existed incidentally in 28% of cases.

CONCLUSION

VAA was almost 200% larger in patients with EA as compared with control subjects. Peritoneal thickening was a frequently reported associated sign of inflammation found in 76% of cases. Inflammation of the parietal peritoneum may contribute to the clinical presentation with acute pain.

CLINICAL RELEVANCE/APPLICATION

The association between EA and increased body mass index is controversial and disputed in radiological and surgical literature. Our study finds that visceral adipose area is almost 200% higher in EA.

RC208-04 CT and MRI of Biliary Tract Emergencies

Monday, Nov. 28 9:20AM - 9:50AM Room: S102AB

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

LEARNING OBJECTIVES

1) Understand the clinical situations where CT or MR are appropriate alternatives to US for the diagnosis of acute conditions affecting the biliary tract. 2) Recognize the CT and MR findings that allow the specific diagnosis of common acute diseases of the biliary tract. 3) Be aware of potential imaging pitfalls that can lead to missed diagnoses or misinterpretations of CT or MR examinations in the setting of suspected acute biliary disease.

Honored Educators

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Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

RC208-05 Abdominal Ultrasound for Identifying Cholecystitis after Pain Medication Administration

Monday, Nov. 28 9:50AM - 10:00AM Room: S102AB

Awards
Student Travel Stipend Award

Participants
Joel P. Thompson, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Jason G. Birnbaum, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Timothy M. Baran, PhD, Rochester, NY (*Abstract Co-Author*) Research Consultant, Zenalux Biomedical Inc
Vikram S. Dogra, MD, Rochester, NY (*Abstract Co-Author*) Editor, Wolters Kluwer nv ;

PURPOSE

The Murphy sign is reported to have the highest likelihood ratio and specificity for the diagnosis of acute cholecystitis with or without the presence of gallstones. However, many patients receive pain medication prior to ultrasound (US) examination, limiting the ability to elicit a Murphy sign. We sought to identify US signs of cholecystitis in patients after pain medication administration.

METHOD AND MATERIALS

IRB-approved retrospective review of adult emergency department and inpatients with right upper quadrant pain who received an US within 2 hours of receiving pain medication. Cholescintigraphy (HIDA) performed within 48 hours of the US served as the gold standard to identify patients with and without cholecystitis. Patients post cholecystectomy were excluded. US exams were reviewed for the presence of gallstones, gallbladder distention, wall thickening, sludge, wall hyperemia, and pericholecystic fluid. Gallbladder length and width was measured on a single sagittal image and were used to calculate gallbladder volume.57 patients met inclusion criteria; 6 patients with hepatitis or choledocholithiasis were excluded. US findings compared between 16/51 patients with normal HIDA and 35/51 with positive HIDA.

RESULTS

Stones in the gallbladder neck were highly associated with cholecystitis (40% vs 6% of controls, p=0.002), particularly when stones were immobile (29% vs 0%, p=0.001). Increased gallbladder distention and lumen width were associated with cholecystitis (67 mL3 vs 34 mL3, p=0.002; width 34 mm vs 27 mm, p=0.014). Lumen width >31 mm had a sensitivity of 60% and specificity of 88% for cholecystitis. Gallbladder sludge was also associated with cholecystitis (54% vs 25%, p=0.045). The presence of gallstones, gallbladder wall thickening, and wall hyperemia were not significantly associated with cholecystitis. No US findings significantly differentiated acute from chronic cholecystitis.

CONCLUSION

US can reliably identify cholecystitis even when a Murphy's sign cannot be elicited in patients medicated for pain. Immobile gallbladder neck stones, sludge, gallbladder distention, and gallbladder lumen width >31mm are highly associated with cholecystitis.

CLINICAL RELEVANCE/APPLICATION

US can reliably identify cholecystitis even when a Murphy's sign cannot be elicited in patients medicated for pain, potentially decreasing time to diagnosis and treatment.

RC208-06 Seeing is Believing: Visualization of Radiolucent Gallstones on Dual-Energy CT

Monday, Nov. 28 10:00AM - 10:10AM Room: S102AB

Participants
Tim O'Connell, MD, Meng, Vancouver, BC (*Presenter*) President, Resolve Radiologic Ltd Speake, Siemens AG
Patrick D. McLaughlin, FFRRCSI, Vancouver, BC (*Abstract Co-Author*) Speaker, Siemens AG
Faisal Khosa, FFR(RCSI), FRCPC, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Mohammed F. Mohammed, MBBS, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Luck J. Louis, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG

PURPOSE

Gallstone disease affects 10-15% of the population, and is a frequent cause of presentation to the ER for abdominal pain. Unfortunately, up to 80% of gallstones are radiolucent, making their diagnosis on x-ray or CT very difficult, and requiring an ultrasound or MRI for diagnosis. In this study, we hypothesized that radiolucent calculi not visible on standard CT could be diagnosed using dual-energy CT with post processing using a virtual noncalcium (VNC) technique.

METHOD AND MATERIALS

40 dual-energy CT scans in unique patients without evidence of cholelithiasis were obtained, in 20 patients with cholelithiasis and 20 without as proven on a recent ultrasound. CT scans were performed on a dual-tube, dual-energy multidetector CT scanner (either a Siemens Definition Flash or Force). Post processing was performed with Siemens Syngo.Via software using VNC with a threshold set at 0 HU, and these images were reviewed alongside the standard blended-energy greyscale images. Three reviewers (two staff and one fellow), all with abdominal radiology fellowships, reviewed all 40 cases in a blinded and randomized fashion, and scored whether cholelithiasis was present or absent, along with a confidence rating (0-10).

RESULTS

Of the 20 cases with radiolucent cholelithiasis, 15 were identified correctly by all readers. Of the 20 cases without cholelithiasis, 19 were identified correctly by all readers. Across all readers, diagnostic performance (95% CI) was: Sensitivity 85% (72.9-92.5%), Specificity 98.3% (89.8-99.9%), PPV 98.1%(88.4-99.8%), NPV 86.8% (75.8%-93.4%). Average reader confidence was 9.6/10. If only cases with calculi > 5mm are included, performance improves to: Sensitivity 91.1% (79.6-96.7%), Specificity 98.1% (88.8-99.9%), PPV 98.1% (88.4-99.9%), NPV 91.3% (80.3-96.8%).

CONCLUSION

We have demonstrated that dual-energy CT can be used to diagnose cholelithiasis in cases of radiolucent calculi. It is suggested

that sensitivity may be better in cases where calculi are larger. Limitations of this study include the small sample size, and a lack of post-surgical correlation for calculus type. Future study will expand the sample size, include ex-vivo calculus evaluation, and also evaluate for cases of choledocholithiasis.

CLINICAL RELEVANCE/APPLICATION

Diagnosing cholelithiasis at CT will reduce costs of US and MRI usage and will help patients through diagnosis of biliary colic and may improve diagnostic accuracy for cholecystitis.

RC208-07 Imaging of Bowel Obstruction

Monday, Nov. 28 10:10AM - 10:40AM Room: S102AB

Participants
Vincent M. Mellnick, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Utilize CT to identify and characterize bowel obstruction and to correlate these findings with plain film and fluoroscopy. 2) Identify patients for whom MRI would be a reasonable alternative diagnostic imaging choice when radiation dose is a primary concern. 3) Compare the underlying causes and imaging findings of bowel obstruction, including common causes such as adhesions, malignancy, and hernias, emphasizing the differences in epidemiology between small and large bowel obstruction. 4) Assist referring clinicians in identifying the cause and severity of bowel obstruction, including cases complicated by or at risk for ischemia, to guide operative versus nonoperative management.

ABSTRACT

Bowel obstruction is a common cause for abdominal pain in emergency department patients. A timely diagnosis is critical – when left untreated, bowel obstruction can lead to vascular compromise and potentially necrosis and perforation. CT has become the diagnostic mainstay for evaluating bowel obstruction, and is typically preferred over plain film and fluoroscopy due to its superior performance in identifying an underlying cause as well as patients who have or are at risk for intestinal ischemia. In young patients, particularly those with chronic bowel obstruction and/or who are pregnant, MRI can be a reasonable alternative imaging exam choice, however. Causes of bowel obstruction vary based on anatomic location, but broadly include adhesions, tumors, and hernias. These common causes as well as more rare diagnoses will be discussed in this case-based review.

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Vincent M. Mellnick, MD - 2016 Honored Educator

RC208-08 New Trends in the Management of Acute Diverticulitis: Predicting Outcomes with MDCT and Clinical Parameters

Monday, Nov. 28 10:40AM - 10:50AM Room: S102AB

Awards
Student Travel Stipend Award

Participants
David D. Bates, MD, Boston, MA (*Presenter*) Nothing to Disclose
Marina C. Bernal Fernandez, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Cecilia Ponchiardi, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael von Plato, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Joshua Teich, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Chaitan Narsule, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Avneesh Gupta, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Christina A. LeBedis, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether MDCT imaging features and clinical findings can predict outcomes in patients with acute diverticulitis in the Emergency Department (ED).

METHOD AND MATERIALS

This retrospective study was IRB approved; informed consent was waived. All adult patients (>18 years old) diagnosed with acute diverticulitis in the ED via contrast-enhanced abdominopelvic MDCT from 1/1/2015-12/31/2015 were included. 169 patients met inclusion criteria (males n=69, female n=100, mean age 54.7 years, range 23-90 years). The CT studies were blind reviewed by an abdominal radiologist for the presence of bowel wall thickening, inflamed diverticulum, pericolonic inflammation, pericolonic fluid collection, free fluid, free air or fistula. A Hinchey classification was also determined. Clinical data was acquired via medical chart review. Clinical parameters and CT imaging findings were compared with the clinical outcomes. Statistical analysis was performed using Fisher's exact test and Student's t-test.

RESULTS

Statistically significant imaging features on MDCT for patients requiring surgical management at any point during the study period included the presence of a pericolonic fluid collection ($p = 0.0011$), a Hinchey classification of 1b or greater ($p = 0.0002$) and the presence of a colonic fistula ($p = 0.0007$). There was no significant difference for the presence of bowel wall thickening, an inflamed diverticulum, pericolonic inflammation, free fluid, or free air. No laboratory values or vital sign parameters were significantly different.

CONCLUSION

Imaging features demonstrating a significant association with the need for surgery when compared with diverticulitis patients who were successfully managed non-operatively include the presence of a pericolonic collection, a colonic fistula, or a Hinchey classification of 1b or higher. In addition, increased hospital length of stay was associated with the need for surgical management.

CLINICAL RELEVANCE/APPLICATION

In light of a trend in surgical management away from colonic resection, CT imaging and clinical parameters may predict which patients will require operative management in acute diverticulitis.

RC208-09 Inter-Reader Agreement of CT Features of Acute Mesenteric Ischemia

Monday, Nov. 28 10:50AM - 11:00AM Room: S102AB

Participants
Pauline Copin, MD, 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
Julie Benzimra, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Anne Kerbaol, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Magaly Zappa, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Valerie Vilgrain, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the inter-reader agreement of CT features of acute mesenteric ischemia (AMI)

METHOD AND MATERIALS

This study was approved by the IRB and informed consents were waived. Between 2006 and 2014, all patients admitted in our institution with the diagnosis of acute mesenteric ischemia were included. CT scans were retrospectively reviewed by two abdominal radiologists. Inter-observer agreement of imaging features of vascular insufficiency, bowel ischemia, and complication was assessed with the percentage of agreement and the kappa statistics.

RESULTS

The final population included 109 patients (57 men, 52%, mean age 50 years [17-83]), including 42% initially managed in our institution. AMI was occlusive in 102 patients (94%), including 72 (66%), 30 (28%), and 10 (9%) patients with an arterial, venous, and combined cause of AMI. respectively. The median time delay between symptoms onset and CT scan acquisition was 1 day, and 71% were performed during the first 48-hours. CT protocol included unenhanced images in 77 (71%) patients, arterial phase images in 73 (67%) patients, and oral contrast media ingestion in 11 (10%) patients. The image quality was rated as excellent for the majority of the patients (65% for reader 1 and 75% for reader 2). Inter-observer agreement was highly variable (k=0.25-0.98). Decreased/absent bowel wall enhancement showed moderate inter-observer agreement (k=0.52), but rose to excellent (k=0.82) in the 47 patients (43%) with both unenhanced and arterial phase images, no oral contrast medium, and excellent image quality ("optimal" CT protocol). It was also improved in patients with serum lactate level >2mmol/L and when CT scan was performed during the first 24-hours after the symptoms onset. Inter-observer agreement for thickened wall (k = 0.56 vs. k = 0.61), and bowel loop dilatation (k = 0.63 vs. k = 0.65) were not improved in patients with an optimal CT protocol, but that for the small bowel feces sign was significantly higher (k = 0.65 vs. k = 0.44).

CONCLUSION

Most imaging features of AMI show moderate to substantial inter-reader agreement. An optimal CT protocol acquisition leads to an improved inter-observer agreement of imaging features of AMI, especially for the decreased/absent bowel wall enhancement.

CLINICAL RELEVANCE/APPLICATION

An optimal CT scan protocol acquisition should be performed to improved inter-observer agreement of imaging features of AMI, and better identify patients with bowel necrosis.

RC208-10 MRI of Acute Right Lower Quadrant Pain

Monday, Nov. 28 11:00AM - 11:30AM Room: S102AB

Participants
Jennifer W. Uyeda, MD, Boston, MA, (juyeda@bwh.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the current utilization of MR imaging in acute right lower quadrant pain in the emergency setting. 2) To describe potential pitfalls in interpretation of MR in acute right lower quadrant pain. 3) To illustrate cases of various etiologies for acute right lower quadrant pain and their imaging manifestations on MR imaging.

ABSTRACT

RC208-11 Magnetic Resonance Imaging of Pregnant Appendicitis: Sensitivity, Specificity and Inter-reader Reliability

Monday, Nov. 28 11:30AM - 11:40AM Room: S102AB

Participants
Richard Tsai, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Joseph W. Owen, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Vincent M. Mellnick, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Constantine A. Raptis, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Kathryn J. Fowler, MD, Chesterfield, MO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The literature on MR imaging of suspected appendicitis in pregnancy demonstrates a low negative predictive value which may be the result of a low incidence of disease. Despite this low reported negative predictive value, the MR diagnosis of appendicitis is not binary, with findings such as free fluid and increased appendiceal diameter alone lacking specificity and frequently producing an indeterminate result. A retrospective review was performed of all cases of suspected appendicitis in pregnancy imaged with MR to assess the rate of acute appendicitis after an indeterminate interpretation.

METHOD AND MATERIALS

A retrospective chart review of MR interpretations for pregnant patients with suspected appendicitis presenting to the emergency room was performed from 1/1/2003 to 4/1/2015. MR interpretations that were not read as unequivocally positive or negative were categorized as "indeterminate" for appendicitis. Patient outcomes were categorized as "acute appendicitis," "no acute appendicitis," and "other appendiceal pathology". Reference standard was surgical pathology and clinical outcomes.

RESULTS

There were 240 cases of abdominal MR performed in pregnant women for suspected appendicitis at our institution with 13 cases of acute appendicitis. 206 cases were interpreted as negative with 1 false negative. 19 cases were interpreted as positive, 12 had acute appendicitis, 3 had non acute appendiceal pathology, 3 had a normal appendix, and 1 patient was observed and released without antibiotics (7 false positives). 15 cases were interpreted as indeterminate (e.g. upper limits of normal appendix with adjacent free fluid or dilated appendix but no free fluid or stranding), 4 patients went to surgery and 8 patients were admitted for observation, no patient had acute appendicitis and 1 patient who was observed was a new presentation of Crohn disease which was included in the differential.

CONCLUSION

MR imaging of appendicitis has a low negative predictive value, likely due to the low prevalence, and a high rate of indeterminate interpretations. Equivocal findings of appendicitis including adjacent free fluid and "upper limits of normal appendix" should not be managed surgically, but may warrant admission for observation.

CLINICAL RELEVANCE/APPLICATION

MR imaging of pregnant appendicitis can help triage patients to those that may be managed conservatively, surgically, or may provide an alternative diagnosis.

Honored Educators

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Vincent M. Mellnick, MD - 2016 Honored Educator

RC208-12 Anatomic Reasons for Failure to Visualize the Appendix with Graded Compression Sonography: Insights from Concurrent CT

Monday, Nov. 28 11:40AM - 11:50AM Room: S102AB

Awards
Trainee Research Prize - Resident

Participants
Wilson Lin, MD, Redwood City, CA (*Presenter*) Nothing to Disclose
Angela Trinh, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Eric W. Olcott, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
R. Brooke Jeffrey Jr, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To identify anatomic reasons from CT for non-visualization of the appendix on graded compression sonography (GCS)

METHOD AND MATERIALS

A searchable database retrospectively yielded 197 consecutive patients with suspected appendicitis, enrolled over 22 months, who met inclusion criteria including: 1) appendiceal GCS was the initial imaging examination, performed in typical fashion at 8-15 MHz, 2) appendix was not visualized on GCS, and 3) appendix was visualized on CT performed within 48 hours after sonography. The following were evaluated on post-sonography CT, defining appendix position as that of the appendiceal tip: depth from the skin surface, position above or below the iliac crest, and axial location in one of four quadrants centered on the ileocecal valve, designated anteromedial (AMQ), posteromedial (PMQ), posterolateral (PLQ), and anterolateral (ALQ). Statistical evaluations with Stata 14.1 software employed the two-sided multinomial test to evaluate appendiceal distribution among quadrants collectively, and the exact binomial test to evaluate appendiceal distribution in quadrants specifically and to determine 95% confidence intervals (CI).

RESULTS

The depth of the appendix from the skin surface ranged 7 to 163 mm (mean 78.9 mm, 95% CI 75.1 - 82.7 mm) overall, and 94 to 163 mm in the deepest quartile of appendices. Of the 197 patients, 39 (19.8%, 95% CI 14.4-26.1%) had appendices lying above the iliac crest. Frequencies of the appendix found in the ALQ, PMQ, PLQ, and AMQ were 18 (9.1%), 123 (62.4%), 43 (21.8%), and 13 (6.6%), respectively, with highly significant non-uniformity among the quadrants collectively ($P < 0.0001$) favoring the PMQ specifically ($P < 0.0001$).

CONCLUSION

Appendices not visualized on sonography are significantly likely to lie in the PMQ, at a depth of 94-163 mm in 25% of patients and above the iliac crest in 19.8% of patients. Because these regions are not typically scanned in GCS, additional scanning for the

nonvisualized appendix is indicated specifically through the PMQ, above the iliac crest, and with atypically low frequency (e.g., 6 MHz or less) sufficient to reach 9-16 cm in depth.

CLINICAL RELEVANCE/APPLICATION

When the appendix is not initially visualized on sonography, further specific scanning should be performed posteromedially to the ileocecal valve as well as above the iliac crest, and with sufficiently low frequency (i.e. 6 MHz or less) to interrogate 9-16 cm from the skin surface.

RC208-13 Are Spectral Doppler Waveforms Useful to Diagnose Acute Appendicitis?

Monday, Nov. 28 11:50AM - 12:00PM Room: S102AB

Participants
Lewis Shin, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Eric W. Olcott, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Gerald Berry, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
R. Brooke Jeffrey Jr, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To test the hypothesis that appendiceal spectral Doppler waveforms distinguish patients with and without acute appendicitis.

METHOD AND MATERIALS

With IRB approval and HIPAA compliance, sonograms performed for suspected appendicitis in 337 consecutive patients over 5 months were retrospectively blindly reviewed. Of the 155 (46%) patients in whom the appendix was visualized, spectral Doppler tracings with peak systolic velocities (PSV) and resistive indices (RI) were successfully acquired in 95 (61%). These 95 patients were categorized as appendicitis-positive [A(+)] by histopathologic examination after appendectomy or by CT confirmation of appendicitis, or as appendicitis-negative [A(-)] when 6-week post-sonography clinical chart review demonstrated no further evidence of appendicitis. Data were compared and confidence intervals (CI) obtained with Stata 14.1 software utilizing the 2-tailed T test for means and the exact binomial test for proportions.

RESULTS

The 95 patients with spectral Doppler tracings included 74 children (age <19 years) and 21 adults (ages 1-56 years, mean 13.3 years), with 54 males and 41 females, of whom 56 were A(-) and 39 were A(+).The mean PSV for A(-) and A(+) subjects were 7.1cm/s (95% CI 6.4-7.8 cm/s) and 19.2cm/s (95% CI 7.1-21.2 cm/s), respectively (P<0.0001). The mean RI for A(-) and A(+) subjects were 0.49 (95% CI 0.47-0.52) and 0.68 (95% CI 0.64-0.73), respectively (P<0.0001).Utilizing PSV >10 cm/s as abnormal, sensitivity and specificity for appendicitis were 87.2% (95% CI 72.6-95.7%) and 94.6% (95% CI 85.1-98.9%), respectively. Utilizing RI >0.60 as abnormal, sensitivity and specificity were 69.2% (95% CI 52.4-83.0%) and 89.3% (95% CI 78.1-96.0%), respectively. Utilizing both PSV >10cm/s and RI >0.60 as abnormal, sensitivity and specificity were 64.1% (95% CI 47.2-78.8%) and 96.4% (95% CI 87.7-99.6%), respectively.

CONCLUSION

Patients with appendicitis exhibit significantly higher PSV and RI than patients without appendicitis, and are distinguishable with high specificity utilizing PSV >10cm/s and RI >0.60 as diagnostic criteria.

CLINICAL RELEVANCE/APPLICATION

Spectral Doppler interrogation appears potentially useful for distinguishing patients with appendicitis from those without appendicitis, providing a high level of specificity utilizing straightforward criteria based on PSV and RI.

RC209

Gastrointestinal Series: Bowel Imaging

Monday, Nov. 28 8:30AM - 12:00PM Room: E350

GI

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

Participants
Michael S. Gee, MD, PhD, Jamaica Plain, MA, (msgee@partners.org) (*Moderator*) Nothing to Disclose

Sub-Events

RC209-01 Optimizing Diagnostic Accuracy of Crohn Disease

Monday, Nov. 28 8:30AM - 8:50AM Room: E350

Participants
Tracy A. Jaffe, MD, Durham, NC, (tracy.jaffe@duke.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Examine the role of CT Enterography (CTE) and MR enterography (MRE) in Crohn disease. 2) Review consensus guidelines for interpretation and utilization of CTE and MRE in Crohn disease. 3) Assess available imaging-related disease activity indices in Crohn Disease.

ABSTRACT

This lecture will review the indications for and role of CT and MR imaging of Crohn disease (CD) with an exploration of consensus guidelines regarding the interpretation and utilization of CTE and MRE in CD. Assessment of the available imaging-related disease activity indices will allow for better understanding of which imaging findings impact management of CD.

RC209-02 MRE Index for Grading Crohn's Disease: A Comparison

Monday, Nov. 28 8:50AM - 9:00AM Room: E350

Participants
Jordi Rimola, MD, Barcelona, Spain (*Presenter*) Consultant, Robarts Clinical Trials
Almudena Cofino, MD , La Fresneda (Siero), Spain (*Abstract Co-Author*) Nothing to Disclose
Tamara Perez-Jeldres, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Ingrid Ordas, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Sonia Rodriguez, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Julian Panes, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the accuracy of three MRE indices for detecting activity and for detecting severe disease.

METHOD AND MATERIALS

Magnetic Resonance Enterography (MRE) and ileocolonoscopies performed within 1 month from 43 patients with CD were reviewed. MRE images were interpreted with proper blinding. MaRIA, Clermond and London scores for each colonic segment and terminal ileum were calculated. Simplified Endoscopy Score for CD (SES-CD) was considered the gold standard.

RESULTS

224 segments were included in the analysis.
Correlations between MaRIA, Clermond and London indices and SES-CD were 0.68, 0.68 and 0.80 respectively ($p<0.01$). According to the established cut-off points for detecting activity using MaRIA, Clermond and London indices, the sensitivity was 0.88, 0.90, and 0.71, and the specificity was 0.97, 0.78 and 0.98 respectively.The MaRIA (94.6%) and London (92%) indices had the highest overall accuracies, that were significantly superior to Clermont index (81.3%, $p<0.0001$, and $p<0.007$, respectively). Sensitivity for detecting ulcerations was 0.90 and 0.83, and specificity 0.92 and 0.89 for MaRIA and Clermond respectively (London index does not currently have cut-off point for ulcers). When comparing the sensitivities and specificities for detecting ulcers at endoscopy, no statistical significant differences were found between MaRIA and Clermont indices, but the MaRIA showed significantly higher accuracy than Clermont index ($p=0.03$).

CONCLUSION

The three MRE-based indices evaluated in the current study have high diagnostic accuracy for assessment of disease activity. The MaRIA index has the best operational characteristics for detecting not only disease activity but also for grading severity, which supports its use in clinical studies and practice.

CLINICAL RELEVANCE/APPLICATION

Magnetic resonance enterography (MRE) is an accurate technique for assessing activity in Crohn’s disease (CD). Different MRE indices are available for use in research.

RC209-03 Role of Elastosonography and Entero-MRI for the Characterization of Mesentery and Bowel Wall in Patients with Crohn's Disease: Preliminary Results

Monday, Nov. 28 9:00AM - 9:10AM Room: E350

Participants

Dario Picone, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Federica Vernuccio, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Laura Scopelliti, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Ambra di Piazza, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Salvatore Serraino, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Chiara Tudisca, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Sergio Salerno, PhD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Tommaso V. Bartolotta, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Lo Re, MD, Palermo, Italy (*Presenter*) Nothing to Disclose
Massimo Midiri, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Lagalla, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic role of elastosonography (USE), apparent diffusion coefficient (ADC) and T2 signal in discriminating edematous and fibrotic change of mesentery and of the bowel wall in patients with Crohn's disease (CD).

METHOD AND MATERIALS

From July 2014 to March 2016, thirty-five patients (mean age 35,81 ± 5,15) with CD underwent MR enterography and a real-time USE at the same time. ADC values were calculated in the mesentery and in the bowel wall of pathological ileum (study group) and of normal ileum (control group) and were compared with the USE color-images and the T2 signal in the same location. In cases of patients with multiple pathological sites, the largest lesion was selected as being representative for each patient. These results were statistically analyzed.

RESULTS

In the study group, the USE color-scale coding showed a color variation from blue to red in the fibrotic pattern of mesentery and bowel wall in 15 patients, and blue to green in the edematous pattern in 20 patients. Moreover, the signal of the bowel wall and mesenteric fat was iso/hypointense on T2-weighted sequence in the fibrotic pattern and hyperintense in the edematous pattern. There was a significant diffusion restriction in 18 patients with CD in the active phase (mean ADC values for the fibrotic mesentery: 2,88 ± 0,33 x 10-3, mean ADC values for edematous mesentery: 2,14 ± 0,28 x 10-3). However, there was a significant difference between the control and the study group. In according to the data in the control group there was not a significant diffusion restriction and there were a isointense T2 signal and a predominantly green USE color-scale of the mesentery and bowel wall.

CONCLUSION

USE, ADC and signal intensity on T2-weighted sequences on MR prove to be useful tools for the evaluation of CD. USE allows the evaluation of the fibrotic or edematous changes of the mesentery and bowel wall, thus having an important potential clinical impact, mainly for therapy.

CLINICAL RELEVANCE/APPLICATION

The unique feature of USE is the non-invasive assessment of the bowel wall and mesentery; moreover, USE improves the diagnostic accuracy in the evaluation of CD in both detection and characterization of pattern changes, as well as in the guidance and evaluation of response to therapy.

RC209-04 Combined PET/MR Enterography for the Non-invasive Assessment of Inflammatory Activity in Crohn's Disease

Monday, Nov. 28 9:10AM - 9:20AM Room: E350

Participants
Karsten J. Beiderwellen, MD, Essen, Germany (*Abstract Co-Author*) Speaker, Siemens AG; Speaker, Bracco Group
Yan Li, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt Gomez, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
Jost Langhorst, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas C. Lauenstein, MD, Essen, Germany (*Presenter*) Nothing to Disclose

PURPOSE

To assess the performance of combined PET/MR enterography in the assessment of inflammatory activity in Crohn's disease.

METHOD AND MATERIALS

38 patients with Crohn's disease (female: n=24; mean age: 44 ± 13 years) underwent PET/MR enterography with [18F]Fluorodeoxyglucose (FDG) using an integrated PET/MR scanner. For bowel distension an oral contrast solution (1500 cc of mannitol and locust bean gum) was ingested. The MR protocol comprised: 1) TrueFISP cor; 2) T2w HASTE fs cor and ax.; 3) dyn. T1w VIBE cor post gadolinium; 4) T1w FLASH 2D cor and ax post gadolinium as well as 5) EPI DWI ax (b=0, 500, 1000). PET was acquired for 8 min per bed. The datasets were reviewed by two readers in consensus regarding the presence of active inflammation. For each segment of the lower gastrointestinal tract SUVmax as well as SULmax (SUVmax/SUVmaxLiver) was determined. Ileocolonoscopy with a segment-based analysis served as standard of reference. ROC analysis for SUVmax and SULmax was performed to determine an optimal cutoff value. Furthermore, accuracy, sensitivity and specificity for PET, MRI and combined PET/MR were determined.

RESULTS

219 ileocolonic segments were evaluated. According to the reference standard, active inflammation was present in 33 segments. A cutoff value for SULmax of > 1 was associated with the highest accuracy (SULmax > 1: 0.78; SULmax>1.5 : 0.66; SULmax > 2: 0.74; SULmax > 3: 0.64) for the detection of inflammation. Using a cutoff value of SULmax < 1 sensitivity for PET was 88%, specificity 76%. MRI alone was associated with a higher specificity (sensitivity: 75%, specificity: 96%). Compared to MRI alone the combination of PET and MRI lead to an increase in sensitivity as well as decrease in specificity (sensitivity: 88%, specificity: 87%).

CONCLUSION

In combined PET/MR enterography FDG-PET as well as the MR data provide complementary information for the non-invasive assessment of inflammatory activity. In the present study the combination of PET with MRI lead to an increase in sensitivity.

CLINICAL RELEVANCE/APPLICATION

Combined PET/MR enterography allows for a multimodal and non-invasive assessment of inflammatory activity in Crohn's disease.

RC209-05 Demystifying Obscure GI Bleeding

Monday, Nov. 28 9:20AM - 9:40AM Room: E350

Participants
Jeff L. Fidler, MD, Rochester, MN, (fidler.jeff@mayo.edu) (*Presenter*) Nothing to Disclose

Active Handout:Jeff L. Fidler

http://abstract.rsna.org/uploads/2016/16000486/ACTIVE RC20905 Demystifying GI Bleeding RSNA 2016 handout.pdf

LEARNING OBJECTIVES

1) Define the types of GI bleeding. 2) List the most common causes of GI bleeding. 3) Develop appropriate management algorithms for patients with GI bleeding. 4) Describe the typical appearances of the most common causes of GI bleeding.

ABSTRACT

This lecture will review the current definitions for GI bleeding and the typical appearances of the most common lesions causing GI bleeding. Appropriate management algorithms will be discussed. Tips for optimizing detection will be demonstrated.

RC209-06 Predictive Value of CT for First Esophageal Variceal Bleeding in Patients with Cirrhosis: Value of the Para-umbilical Vein Patency

Monday, Nov. 28 9:40AM - 9:50AM Room: E350

Participants
Paul Calame, Besancob, France (*Abstract Co-Author*) Nothing to Disclose
Maxime Ronot, MD, Clichy, France (*Presenter*) Nothing to Disclose
Jean-Paul Cervoni, Besancon, France (*Abstract Co-Author*) Nothing to Disclose
Sebastien Bouveresse, Besancon, France (*Abstract Co-Author*) Nothing to Disclose
Valerie Vilgrain, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Eric Delabrousse, MD, Besancon, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate if the presence of a patent PUV assessed on contrast-enhanced CT is associated with a lower risk of first esophageal variceal bleeding (EVB) in patients with cirrhosis.

METHOD AND MATERIALS

From January 2010 to June 2012 patients with cirrhosis without preventive treatment for portal hypertension who underwent a contrast-enhanced CT and an upper gastrointestinal (GI) endoscopy within six months were included. Imaging were retrospectively reviewed by two abdominal radiologists to assess 1) presence and diameter of a PUV, 2) spleen size, 3) presence of ascites. PUV were considered large (LPUV) when > 5mm. Factors associated with a first EVB were identified by multivariate analysis, and a predictive score was built. It was validated in another prospectively included cohort of 55 patients with similar inclusion criteria, and followed up during at least 12 months after the initial CT.

RESULTS

172 patients (113 male, 67%, mean 60±12 yo) were included, including 43 (25%) who experienced a first EVB. The mean delay between CT and upper GI endoscopy was 1.6±1.7 months. Overall, 122 patients (71%) had high-risk esophageal varices. The mean PUV diameter was significantly higher in patients with no bleeding (mean 4.0±4.0 vs. 2.3±2.0 mm, p 0.001). A LPUV was more frequent in patients with low-risk varices (43 vs. 21 %, p=0.024). A LPUV was also more frequent in the group without EVB (27% vs. 7%, p=0.005). At multivariate analysis, factors associated with a first EVB were spleen size>135mm (OR=1.32 [95%CI-1.16-1.51], p<0.001), ascites (OR=4.07 [95%CI-1.84-9.01], p=0.001) and small/absent PUV (OR=3.06 [95%CI-1.86-5.05], p<0.001). By combining these factors, an 5-points imaging score was built, and showed significant associated with first EVB in the study cohort. The predictive value of the score was confirmed in the validation cohort (EVB in 0%, 19%, and 33% when score 0-1, 2-3, and 4-5, respectively).

CONCLUSION

The presence of a large PUV (i.e. >5mm) at CT, together with an enlarged spleen and ascites combined in a simple imaging scoring system could help predict first esophageal varice bleeding in cirrhotic patients.

CLINICAL RELEVANCE/APPLICATION

In cirrhotic patients, the presence/absence of a large PUV at CT could help predict the first esophageal variceal bleeding. Such findings may be valuable for patient management (performing upper GI endoscopy or discussing the introduction of preventive medical treatment).

RC209-07 Pearls and Perils of Imaging Bowel Ischemia and Obstruction

Monday, Nov. 28 10:10AM - 10:30AM Room: E350

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

LEARNING OBJECTIVES

1) Identify the signs of bowel obstruction on CT and properly classify obstruction as "high grade" or "low grade". 2) Recognize the characteristic signs of closed loop obstruction. 3) Detect signs of bowel wall ischemia that warrant early surgical therapy.

ABSTRACT

This presentation will review the typical signs of small bowel obstruction on CT, along with potential imaging pitfalls. Findings suggestive of complications that require surgical therapy (mainly ischemia and closed loop) will be emphasized. Various causes of small bowel obstruction will be illustrated.

Honored Educators

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Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

RC209-08 Improved CT-Diagnosis of Bowel Wall Ischemia by using A Novel Frequency Selective Non-linear Blending Algorithm

Monday, Nov. 28 10:30AM - 10:40AM Room: E350

Participants
Sven Schneeweiss, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose
Wolfgang M. Thaiss, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christopher Kloth, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Malte N. Bongers, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Georg Bier, MD, Tubingen, 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
Marius Horger, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Georg Bier, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether the use of a frequency selective non-linear blending algorithm called "best contrast(BC)" complementary to the standard linear blending for portal-venous phase CECT-image data of the GI-tract improves early detection of mesenteric ischemia.

METHOD AND MATERIALS

We retrospectively analysed CECT-image data from 26 consecutive patients with acute mesenteric ischemia. Reference standard was the intraoperative + histologic diagnosis. The appropriate pre-sets of BC algorithm were determined (center 40, delta 20, slope 5) by prior training in 30 patients with GI-tract disorders. Two timely separate reading sessions for CECT and for BC were performed. Bowel wall attenuation was measured for both techniques in both phases (non-enhanced and portal-venous(p.v.)) in the abnormal (ischemic) bowel segments as well as in the non-involved duodenal wall and ratios were calculated. The extent of ischemia was classified: jejunal, ileal, right or left colonic and pancolonic. Diagnostic performance of decreased bowel wall enhancement and confidence in the diagnosis were compared between the two readings by using McNemar and Wilcoxon signed rank tests.

RESULTS

Intra-operative examination + histologic work-up classified the extent of bowel ischemia as jejunal (n= 7), ileal (n=22), right colonic (n=11), left colonic (n=0) and pancolonic (n=3). Sensitivity/specificity/accuracy of CECT and BC diagnosis was 88.8%/ 77.27/ 66.66% and 90.0%/ 67.5%/ 73.77%, respectively. Bowel wall attenuation values in p.v. phase in non-involved bowel segments measured with BC (137.1, SD: 41.6) were significantly higher compared to CECT (69, SD: 18.7, p=0.001). Correspondingly, the ratio between p.v. bowel wall enhancement values and those measured in non-enhanced CT was also significantly higher (4.3 vs. 2.1, p=0.01).Generally, delineation between involved and non-involved bowel segments was more evident using BC blending. In 2 patients CECT could not detect bowel ischemia whereas in 6 patients additional involved bowel segments were diagnosed only by BC.

CONCLUSION

The use of a frequency selective non-linear blending algorithm complementary to standard image windowing significantly increases the portal-venous/non-enhanced bowel wall attenuation ratio and thus detection and delimitation of mesenteric ischemia.

CLINICAL RELEVANCE/APPLICATION

Better and eventually also earlier diagnosis of mesenteric ischemia is imperative for optimal patient management.

RC209-09 Improving Your CT Colonography Interpretation Skills

Monday, Nov. 28 10:40AM - 11:00AM Room: E350

Participants
Judy Yee, MD, Clayton, CA, (judy.yee@ucsf.edu) (*Presenter*) Research Grant, EchoPixel, Inc

LEARNING OBJECTIVES

1) Examine time-efficent methods of interpretation while maintaining high accuracy. 2) Identify common and uncommon causes of false positives on CT colonography. 3) Define accurate methods of polyp measurement. 4) Classify findings using the C-RADS

scheme.

ABSTRACT

This lecture will focus on providing strategies for time-efficent interpretation of CT colonography while maintaining high accuracy. Multiple causes of common and uncommon pitfalls will be demonstrated to help readers improve interpretation skills. Suggested techniques for lesion measurement on 2D and 3D images will be demonstrated for cases with and without tagging. Case review will be performed to show classification of colonic findings using the C-RADS scheme.

RC209-10 Comparative Effectiveness of CT Colonography versus Other Strategies in Colorectal Cancer Screening

Monday, Nov. 28 11:00AM - 11:10AM Room: E350

Participants
Vinay A. Duddalwar, MD, FRCR, Los Angeles, CA (*Presenter*) Nothing to Disclose
Afsaneh Barzi, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Tapas Tejura, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Heinz Lenz, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
David I. Quinn, MD, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Sarmad Sadeghi, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT Colonography (CTC) is not recommended by the US Preventive Services Task Force and Centers for Medicare and Medicaid. It is thought that the incidence reduction (IR) and cancer mortality reduction (CMR) associated with screening with optical colonscopy (OC) and flexible sigmoidoscopy (FS) are derived from their role in detection of adenomas as opposed to invasive cancer and down-staging. CTC is able to detect adenomas but data for its efficacy in IR and CMR is unavailable

METHOD AND MATERIALS

A Markov model was built to represent the CRC incidence and its natural history in the US general population. Individual level simulation was used to compare the benefits of CRC screening from a societal perspective. Costs and effects were discounted (Dis) at 3%. 13 screening strategies (ST) were compared to no screening. The sensitivity of CTC for detection of adenomatous polyps > was set at .8 relative to CS. Dis Life Years (LY), IR, CMR, and Dis costs of screening and total costs of care were measured. Incremental cost effectiveness ratios (ICERs) were calculated

RESULTS

OC emerged as the most effective screening strategy. CTC is the second most effective strategy and has an ICER of $1000/LYG.

CONCLUSION

Although CTC was dominated by OC, it would be next most cost effective strategy among the remaining screening strategies. While further research into the efficacy of CTC and its ability to reduce the CRC incidence and mortality is warranted, it can be seen from these results that it has an important role in the screening for colorectal cancer. In this model, the cost effectiveness of CTC was better than strategies such as fecal DNA.

CLINICAL RELEVANCE/APPLICATION

CT colongraphy has an important role in the different possible strategies for screening for colorectal carcinoma

RC209-11 Computer-aided Detection of Colorectal Polyps at CTC: Prospective Evaluation of Clinical Performance and Third-party Reimbursement

Monday, Nov. 28 11:10AM - 11:20AM Room: E350

Participants
Timothy J. Ziemlewicz, MD, Madison, WI (*Presenter*) Consultant, NeuWave Medical, Inc
Vu Lam, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
David H. Kim, MD, Middleton, WI (*Abstract Co-Author*) Consultant, Viatronix, Inc; Co-founder, VirtuoCTC, LLC; Medical Advisory Board, Digital ArtForms, Inc; Stockholder, Cellectar Biosciences, Inc
J. Louis Hinshaw, MD, Middleton, WI (*Abstract Co-Author*) Stockholder, NeuWave Medical Inc; Stockholder, Cellectar Biosciences, Inc
Meghan G. Lubner, MD, Madison, WI (*Abstract Co-Author*) Grant, Koninklijke Philips NV; Grant, Johnson & Johnson;
Jessica B. Robbins, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Perry J. Pickhardt, MD, Madison, WI (*Abstract Co-Author*) Co-founder, VirtuoCTC, LLC; Stockholder, Cellectar Biosciences, Inc; Stockholder, SHINE Medical Technologies, Inc; Research Grant, Koninklijke Philips NV

PURPOSE

To date, computer-aided detection (CAD) at CT colonography (CTC) has been studied using retrospective case review. We assess the prospective performance and initial third-party reimbursement rates of computer-aided detection (CAD) at CT colonography (CTC) for detecting colorectal polyps ≥6 mm in actual clinical practice.

METHOD AND MATERIALS

An FDA-approved version of CAD (iCAD) is currently employed in our routine CTC clinical practice. We prospectively assessed the performance of this CAD system in second-reader mode in 347 adults (mean age, 57.6 years; 205 women, 142 men) undergoing CTC evaluation over a 5 month period. All individuals underwent cathartic bowel preparation with stool tagging; electronic cleansing was not applied. The reference standard consisted of the prospective interpretation by experienced radiologists combined with subsequent optical colonoscopy (OC), if performed. We also assessed the current rate of third-party reimbursement for CAD for studies performed over a 3-month period, where CPT code 76497 and a $30 charge were applied.

RESULTS

Of 347 total patients in the cohort during the study period, 69 patients (mean age, 59.0 ±7.7 years; 32 men, 37 women) were

called positive for 129 total colorectal polyps ≥6 mm. Overall per-polyp CAD sensitivity was 88.4% (114 of 129), including 88.3% (83 of 94) for 6-9 mm polyps and 88.6% (31 of 35) for polyps ≥10 mm, respectively. Of the 129 detected polyps, 58 were detected by CAD on two views, and 56 on a single view. On retrospective review, there were five additional polyps ≥6 mm seen at OC but not prospectively called at CTC, three of which were marked by CAD, but dismissed as false positives. The mean number of false-positive CAD marks/series was 5.3 ± 2.6. Out of the 144 cases within the 3-month interval for reimbursement assessment, 26.9% of the total charges had been recovered to date from a variety of third-party payors.

CONCLUSION

In our routine clinical practice, CAD demonstrated good sensitivity for detecting colorectal polyps ≥6 mm, with an acceptable number of false-positive marks. Importantly, CAD is already being reimbursed by some third-party payors in our clinical practice.

CLINICAL RELEVANCE/APPLICATION

This is the first study to evaluate CAD in routine clinical practice and demonstrates good sensitivity for polyp detection as well as confirming reimbursement, both of which stand to improve adoption.

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Meghan G. Lubner, MD - 2014 Honored Educator
Meghan G. Lubner, MD - 2015 Honored Educator
Perry J. Pickhardt, MD - 2014 Honored Educator

RC209-12 Spectral Photon-Counting Computed Tomography: Initial Experience with Dual Contrast Agent K-Edge Colonography

Monday, Nov. 28 11:20AM - 11:30AM Room: E350

Participants
Daniela Muenzel, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Bar-Ness, Bron, France (*Abstract Co-Author*) Nothing to Disclose
Ewald Roessl, PhD, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ira Blevis, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Alexander A. Fingerle, MD, Munchen, Germany (*Presenter*) Nothing to Disclose
Stefan Ruschke, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Philippe Coulon, PhD, Suresnes, France (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Heiner Daerr, DIPLPHYS, Hambrg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
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Loic Boussel, MD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Franz Pfeiffer, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Roland Proksa, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Philippe C. Douek, MD, PhD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Peter B. Noel, PhD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the potential of spectral photon-counting computed tomography (SPCCT) to improve CT colonography (CTC) by differentiating between gadolinium and non-ionic iodine based contrast agent in the colon by using the characteristic K-edge of gadolinium.

METHOD AND MATERIALS

A custom-made colon phantom was filled with non-ionic iodine based contrast agent, and a gadolinium-filled capsule, representing an enhanced polyp, was positioned on the colon wall. The colon phantom was scanned with a pre-clinical spectral photon-counting CT system. By fully utilizing the multi-bin spectral information, material decomposition was performed to generate iodine and gadolinium maps. Quantitative measurements were performed, within the lumen and the polyp, to determine quantitatively the absolute concentrations of iodine and gadolinium.

RESULTS

In a conventional CT slice, absorption values of both contrast agents were approximately 110 HU. Contrast material maps clearly differentiate the distributions, with gadolinium solely in the polyp and iodine in the lumen of the colon. Quantitative measurements, in the colon and polyp, of contrast material concentrations matched well with actual prepared mixtures.

CONCLUSION

Dual contrast SPCCT colonography with iodine filled lumen and gadolinium tagged polyps may yield significant improvement of discrimination between polyps and tagged fecal material.

CLINICAL RELEVANCE/APPLICATION

Dual contrast SPCCT with material decomposition offers laxative-free colonography with optimized image quality.

RC209-13 Challenges in Interpretation of MRI in Primary Rectal Cancer

Monday, Nov. 28 11:30AM - 11:50AM Room: E350

Participants
Daniele Marin, MD, Durham, NC, (daniele.marin@duke.edu) (*Presenter*) Research support, Siemens AG

LEARNING OBJECTIVES

1) Clarify the indications and technical considerations for MRI in primary rectal cancer. 2) Recognize the challenges and artifacts associated with MRI of the rectum. 3) Identify specific solutions to the imaging challenges and artifacts with MRI of the rectum.

ABSTRACT

This lecture will review the current indications and technical considerations for MRI in primary rectal cancer. Common challenges and potential artifacts associated with MRI of the rectum will be presented with a discussion of potential solutions and practical tips.

RC209-14 Evaluation of Rectal Cancer Response to Therapy: Role of Magnetic Resonance Tumour Regression Grade (MR-TRG) to Predict Pathological Complete Response

Monday, Nov. 28 11:50AM - 12:00PM Room: E350

Participants
Marco Rengo, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Simona Picchia, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Damiano Caruso, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Davide Bellini, MD, Latina, Italy (*Abstract Co-Author*) Nothing to Disclose
Domenico De Santis, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Andrea Laghi, MD, Rome, Italy (*Abstract Co-Author*) Speaker, Bracco Group Speaker, Bayer AG Speaker, General Electric Company Speaker, Koninklijke Philips NV

PURPOSE

To evaluate if the rectal cancer response to radiochemotherapy (RCT) can be accurately predicted by the tumor regression grade performed with Magnetic Resonance (MR)

METHOD AND MATERIALS

We carried out a multicentric prospective study. 65 patients were examined, with locally advanced rectal adenocarcinoma (Stage II and III), candidated for preoperative radiochemotherapy. All the analysis were performed on a 3 Tesla scanner before, during and after RCT. All patients underwent total mesorectal excision 6-8 weeks after the end of RCT. MR-TRG was performed only on T2-weighted images during and after therapy, by evaluating the percentage of fibrosis with an automatic quantitative assessment. We used the platform Matlab to implement the algorithm K-Means. We divided the examined tumors into four classes, according to the increasing percentage of fibrosis (<25%, >25-50%, >50-75%, >75%) and we organized the results into two groups, unfavorable (MR-TRG class 1-2-3) and favorable group (MR-TRG class 4). Then the MR-TRG was correlated with pathology, with P-TRG and with patient's prognosis

RESULTS

In the MR performed after therapy, all complete responders at histology were included into the favorable group (MR-TRG class 4), while in the MR performed during therapy 5 complete responders were included in the unfavorable group (MR-TRG class 3). The correlation between the percentage of fibrosis obtained with P-TRG and MR-TRG was good during therapy and excellent after therapy. Significant differences in terms of overall survival(OS) and disease free survival(DFS) were found between favorable and unfavorable group.

CONCLUSION

MR-TRG is easy to be performed. MR-TRG has shown to be an important imaging biomarker, that can predict the complete response to therapy, and a significant prognosis' factor. When a MR-TRG class 1-2-3 was observed after therapy, the persistence of disease should be suspected. MR-TRG can offer to multidisciplinary team alternative treatment options.

CLINICAL RELEVANCE/APPLICATION

MR-TRG can be considered a biomarker for the evaluation of the response to CRT and correlates with patient's prognosis

RC210

Gynecologic Ultrasound (An Interactive Session)

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

GU OB US

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

Participants

Sub-Events

RC210A Uterus and Endometrium

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

LEARNING OBJECTIVES

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

RC210B Ovarian Masses

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

LEARNING OBJECTIVES

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

ABSTRACT

RC210C Ultrasound for Deeply Infiltrative Endometriosis

Participants
Luciana P. Chamie, MD, PhD, Sao Paulo, Brazil, (luciana@chamie.com.br) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define clinical and epidemiological aspects of endometriosis. 2) Define the importance of imaging mapping for deeply infiltrative endometriosis before clinical counseling. 3) Apply the most appropriate technique to investigate endometriosis. 4) Define the bowel preparation required for the transvaginal ultrasound to investigate endometriosis. 5) Apply the imaging algorithm to map deeply infiltrative endometriosis. 6) Assess the ultrasonographic findings of deeply infiltrative endometriosis in the most common sites such as bladder, vesicouterine pouch, retrocervical space, vagina, ureters, appendix and rectosigmoid colon.

ABSTRACT

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

URL

http://chamie.com.br/download

RC211

Update on Radionuclide Therapies

Monday, Nov. 28 8:30AM - 10:00AM Room: S504CD

IR NM OI

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

Participants

Sub-Events

RC211A 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.

RC211B Lu177-DOTATATE Therapy for Neuroendocrine Tumore

Participants
Ronald C. Walker, MD, Nashville, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the selection process for patients likely to benefit from 177Lu-DOTATATE therapy. 2) Learn how to safely administer 177Lu-DOTATATE therapy. 3) Understand the risks and benefits from 177Lu-DOTATATE therapy. 4) Recognize the side effects from 177Lu-DOTATATE therapy and ways to mitigate them. 5) Know how and when to assess for treatment response to 177Lu-DOTATATE therapy.

ABSTRACT

Peptide receptor radionuclide therapy (PRRT) is a revolutionary treatment for patients with neuroendocrine tumors that express somatostatin receptors, including patients with progressive disease on standard treatments who are not candidates for surgical extirpation. In patients with sufficient uptake of somatostatin analogs on imaging (Krenning score 2 or greater), PRRT can result in significant improvement in overall survival and progression free survival. This lecture will review the patient selection process and summarize the treatment protocol, radiation safety issues, and assessment of treatment response.

Active Handout:Ronald Clark Walker

http://abstract.rsna.org/uploads/2016/16001977/ACTIVE RC211B.pdf

RC211C Hepatic Artery Infusion Therapy with Y90 Microspheres

Participants
Charles Y. Kim, MD, Durham, NC (*Presenter*) Consultant, Halyard Health, Inc; Consultant, Cryolife, Inc; Consultant, Merit Medical Systems, Inc

LEARNING OBJECTIVES

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

ABSTRACT

Intra-arterial Yttrium-90 (Y90) therapy is an important treatment modality for a variety of hepatic tumors. While numerous types of embolotherapies are employed by interventional radiologists for treatment of cancer, Y90 therapy is unique in its multimodality and multi-procedural nature. Not only does this treatment effect rely on deposited ionizing radiation therapy, but scintigraphic imaging is also an integral component of treatment.
Two types of Y90 therapies are available, made by two different manufacturers. The differences between the two types are subtle,

but there are differences in administration and manufacturer-recommended dosimetric calculation. These various differences will be highlighted.
Y90 therapy is comprised of several steps and is frequently subclassified into a “planning” phase and “treatment” phase. In the planning phase, detailed angiographic imaging is performed to delineate arterial anatomy , determine 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.

RC212

Open and Endovascular Aortic Repair: Imaging Essentials

Monday, Nov. 28 8:30AM - 10:00AM Room: E351

VA IR

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

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC212A Aortic Root: Surgical Procedures and Complications

Participants
Kate Hanneman, MD, FRCPC, Toronto, ON, (kate.hanneman@uhn.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe various surgical techniques for repair of the aortic root. 2) Differentiate between normal and abnormal imaging findings after aortic root surgery. 3) Identify post-operative complications including dehiscence and pseudoaneurysms.

ABSTRACT

RC212B New Thoracic and Abdominal Endografts

Participants
Constantino S. Pena, MD, Miami, FL (*Presenter*) Speakers Bureau, Cook Group Incorporated; Speakers Bureau, Medtronic, Inc ; Advisory Board, C. R. Bard, Inc; Advisory Board, Boston Scientific Corporation;

RC212C What 3D Reconstructions are Needed for Endografting?

Participants
Michael A. Winkler, MD, Lexington, KY, (michael.winkler@uky.edu) (*Presenter*) Research support, Teleflex Incorporated

LEARNING OBJECTIVES

1) Optimize axial image reconstruction to potentiate 3D processing. 2) Comprehend 3D post processing techniques used for the planning of endografts. 3) Demonstrate post processing tool utilized in the processing of suboptimal volume data.

ABSTRACT

RC212D Endograft Complications: What the Radiologist Needs to Know

Participants
Terri J. Vrtiska, MD, Rochester, MN, (vrtiska.terri@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Determine the significance of early versus delayed endograft complications. 2) Describe types of endoleaks, prevalence and significance. 3) Summarize imaging follow-up versus treatment of endograft complications.

ABSTRACT

Honored Educators

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

Terri J. Vrtiska, MD - 2016 Honored Educator

RC213

Pediatric Series: MSK

Monday, Nov. 28 8:30AM - 12:00PM Room: N230B

MK PD

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

Participants
Andrea S. Doria, MD, Toronto, ON (*Moderator*) Research Grant, Bayer AG; Research Grant, Novo Nordisk AS;
Jennifer Stimec, MD, Toronto, ON (*Moderator*) Nothing to Disclose
Sarah D. Bixby, MD, Boston, MA (*Moderator*) Nothing to Disclose
Lynn A. Fordham, MD, Chapel Hill, NC, (fdh@med.unc.edu) (*Moderator*) Nothing to Disclose

Sub-Events

RC213-01 Overuse Injuries in the Pediatric Athlete

Monday, Nov. 28 8:30AM - 8:50AM Room: N230B

Participants
Jennifer Stimec, MD, Toronto, ON (*Presenter*) Nothing to Disclose

RC213-02 Novel MRI Techniques for Early Detection of Stress Injury of the Distal Radial Physis in Young Gymnasts

Monday, Nov. 28 8:50AM - 9:00AM Room: N230B

Participants
Laura S. Kox, MD, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Valentina Mazzoli, MSc, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Aart N. Nederveen, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jos Oudeman, MD, amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Anne M. Mol, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mario Maas, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To improve the early detection of radial physeal stress injury using MRI and to provide quantitative measures useful for classification and prognosis.

METHOD AND MATERIALS

15 gymnasts (10 with wrist pain and 5 without wrist pain) and 1 non-gymnast control, aged 12-17 years, were included for the first analysis of this ongoing study. Al participants underwent radiography and MRI of the wrist. MRI was performed on a 3T scanner and included coronal PD images with and without fat saturation, as well as 3D WATSc and T1-weighted and T2-weighted Dixon series. Besides evaluation of appearance of the physis by an experienced musculoskeletal radiologist, 3D reconstructions of the physis were created using ITK-SNAP. The water fraction in the adjacent metaphyseal bone was quantified using Dixon water-only images. MR images of symptomatic gymnasts were compared with those of asymptomatic gymnasts and of non-gymnast controls, matched on skeletal age and sex.

RESULTS

The median calendar ages and skeletal ages were 13 years (range 12-15 years) and 13 years (range 11.5-15 years) for symptomatic gymnasts and 15 years (range 12-17 years) and 14 years (range 11.5-18 years) for asymptomatic gymnasts, respectively. The initial results show that the median volume of the physis was 1216 mm3 (range 680-3045 mm3) in symptomatic gymnasts and 1199 mm3 (range 616-2370 mm3) in asymptomatic gymnasts ($p>0.05$). The median water fraction in the metaphysis was 40% (range 21-56%) in symptomatic gymnasts and 33% (range 10-49%) in asymptomatic gymnasts ($p>0.05$). Various abnormalities were identified in both symptomatic and asymptomatic gymnast MR images, such as metaphyseal intrusions and disruption of the physeal layers, that were not recognized on radiographic images.

CONCLUSION

Subtle changes due to early physeal stress injury may be better visible on MRI. Initial results of this study show that physeal volume and metaphyseal water fraction measurement are promising and non-invasive methods to quantify physeal stress injury of the wrist.

CLINICAL RELEVANCE/APPLICATION

This study emphasizes the importance of MRI in the early diagnosis of physeal stress injury and shows the utility of a broadly applicable, easy to implement MRI protocol in this diagnostic process.

RC213-03 Ultrasound Assessment of Adaptive and Overuse Changes in the Fingers of Adolescent Competitive Rock Climbers

Monday, Nov. 28 9:00AM - 9:10AM Room: N230B

Participants
Kathryn Garcia, Los Altos , CA (*Presenter*) Nothing to Disclose
Karin Kuhn, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Diego Jaramillo, MD, MPH, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Erika Rubesova, MD, MSc, Stanford, CA (*Abstract Co-Author*) Researcher, Siemens AG

PURPOSE

To examine the impact of high intensity rock climbing in adolescents on finger health and development.

METHOD AND MATERIALS

This IRB approved prospective ultrasound study was performed in 19 adolescent rock climbers (ages 11-18) and 6 non-climbing, age-matched controls (ages 11-15). A Siemens S3000 with 9-18 MHz linear transducer (n=12) and Sonnoscanner U-lite with 8MHz linear transducer (n=3) were used to examine the third and fourth digits of the right hand to assess for differences in thickness of soft tissue, flexor and extensor tendon, and volar plate as well as bony and physeal deformities. Number of hours/week (range: 4-15 h), years of climbing (range: 1-10 years) and preferred climbing technique were used to group the climbers in 3 levels (3=most intense training). Mann-Whitney test was used for statistical analysis.

RESULTS

Compared with non-climbing controls, climbers demonstrated significantly thicker flexor tendons; volar plates of the DIP and MCP; and soft tissues (for all $p<0.05$). Increased thickness of extensor tendons and PIP volar plates did not achieve significance. Larger bony tubercles at flexor digitorum profundus insertion were observed in climbers but not in controls. Joint effusions were found in 13/19 (68%) climbers. Significant phalangeal malalignment was seen in 10/19 (53%) climbers. Physeal deformities were identified in 4 climbers, all of whom were level 3.

CONCLUSION

Participation in high-intensity rock climbing in a group of adolescents resulted in physiologic adaptations, including significant soft tissue hypertrophy of the flexor compartment and bony remodeling compared to controls. 53% of climbers also demonstrated overuse injuries, likely due to repetitive trauma and imbalance of mechanical forces. The long-term effects of these changes require further investigation.

CLINICAL RELEVANCE/APPLICATION

Competitive rock climbing is among the fastest growing sports among youth in the United States. The sport demands repetitive, high-intensity training, the effect of which is relatively unknown.

RC213-04 Skeletal Maturation and Stress Injury of the Growth Plate at the Base of the Coracoid Process: MRI Features

Monday, Nov. 28 9:10AM - 9:20AM Room: N230B

Participants
Erin F. Alaia, MD, New York, NY (*Presenter*) Nothing to Disclose
Zehava S. Rosenberg, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ignacio Rossi, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Johannes B. Roedl, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lynne P. Pinkney, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Lynne S. Steinbach, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Jonathan Zember, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Assess, utilizing MRI, the normal maturation and stress injury to the coracoid process and bipolar growth plate, at the interface with the underlying scapula. To the best of our knowledge this has not yet been described in the literature.

METHOD AND MATERIALS

The study was divided into 2 parts: A. Maturation of the coracoid process and bipolar growth plate. Retrospective review of 182 consecutive shoulder MRIs in 160 children without clinical or MRI evidence of coracoid pathology (107 boys, 53 girls, ages 0 to <5, n=36, 5 to <10, n=25, 10 to <15, n=67, and 15 to 18, n=54). The studies were reviewed with special attention to the development and fusion of the coracoid to the scapula, via the bipolar growth plate.B. Growth plate injuries. Retrospective review of shoulder MRIs with coracoid growth plate disturbance (7 boys, 1 girl, mean age 15).

RESULTS

A. Maturation of the coracoid process and bipolar growth plate. At 0 to < 5 years the cartilaginous coracoid precursor conformed to the shape of a mature coracoid process, with a small oval primary ossification center within it. The bony margins at the coracoid-scapular interpface transformed from smooth to irregular with advancing age. At 5 to < 10 years of age, a more distinct, undulating, bipolar growth plate developed. Complete closure of the bipolar plate was observed as early as 11 years of age and was noted in 41% of patients by age 14 and in 86% of 15 to 18 year olds. B. Growth plate injuries. The 8 patients with growth plate stress injuries included 2 patients with neuromuscular disorders and 6 patients with sports related symptoms. The growth plate demonstrated widening, irregularity and increased signal, with surrounding soft tissue and opposing bony marrow edema and hypertrophy.

CONCLUSION

MR imaging of normal maturation as well as stress injury of the base of the coracoid is crucial for accurate imaging diagnosis. Injury to the base of the coracoid, while uncommon, should be considered when assessing adolescents with shoulder symptomatology.

CLINICAL RELEVANCE/APPLICATION

Radiologists should be aware of the normal MRI appearance of coracoid maturation and coracoid stress injury to differentiate between normal development and pathology.

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/

Zehava S. Rosenberg, MD - 2014 Honored Educator

RC213-05 The Interpretation of 'Asymptomatic MCL Injury of the Elbow in Youth Baseball Players on MRI'

Monday, Nov. 28 9:20AM - 9:30AM Room: N230B

Participants
Yoshikazu Okamoto, MD, Tsukuba, Japan (*Presenter*) Nothing to Disclose
Manabu Minami, MD, PhD, Yokohama, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Our previous study has clarified injury of the medial collateral ligament (MCL) , which does not frequently occur in youth baseball players showed unexpectedly high at 41.9% in MRI elbow screening for healthy youth baseball players.The purpose of this study was to clarify the clinical interpretation of 'asymptomatic MCL injury of the elbow in youth baseball players observed on MR'I by comparing the results of standard clinical orthopedic examinations including palpation and US.

METHOD AND MATERIALS

62 players from 9 to 13 years were recruited. MRI was performed using a 0.2 T open-type MRI.MCL injury was diagnosed by criterion 1-6.The laterality of the joint space opening by valgus stress (laterality of cleft between articulations) was calculated by US, which represented MCL function.MCL tenderness, Moving valgus test, and Milking test were also performed as physical examinations.The laterality of the joint space opening was compared between subjects with MCL injury on MRI and subjects without MCL injury by using t-test. MRI findings and physical findings were analyzed with the $\chi 2$ and Fisher's exact test.

RESULTS

34 subjects (53.1%) were diagnosed as MCL injury on MRI. The mean laterality of the cleft between articulations was 0.29 mm in the subjects with MCL injury and 0.08 mm in the subjects without MCL injury on MRI without statistical differences (P=0.16). As for the coefficient between MRI findings and physical findings, Milking test and Criterion 1 (φcoefficient=0.27, P=0.048) and 4 (φcoefficient= 0.39, P=0.004) showed a weak correlation.

CONCLUSION

'Adaptation' refers to normal MCL thickening on MRI in a baseball player after epiphyseal closing. We hypothesized asymptomatic MCL injury in youth baseball players on MRI might represent the transition period to adaptation because ligament function was normal. However, some subjects showed weak correlations between positive physical findings and positive MCL injury on MRI. These might become a 'symptomatic' MCL injury in the near future.We conclude 'asymptomatic MCL injury in youth baseball players on MRI' includes the group of changing to adaptation, and the group of changing to symptomatic MCL injury (pre-injury) group (Fig).

CLINICAL RELEVANCE/APPLICATION

'asymptomatic MCL injury of the elbow in youth baseball players on MRI' is not always need to be treated but careful observation is needed.

RC213-06 Pediatric Trigger Fingers: Preliminary Result of Diagnostic Ultrasonographic Features and Quantitative Assessment

Monday, Nov. 28 9:30AM - 9:40AM Room: N230B

Participants
Chun-Geun Lim, Daegu, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jae Hyuck Yi, MD, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evalue ultrasonographic features of pediatric trigger fingers and classify the types based on the features.

METHOD AND MATERIALS

Between August 2014 and March 2016, 17 patients (age range, 10111 months) with clinical suspicion of pediatric trigger finger underwent ultrasound examination. (2 patients; both hands; 14 patients; unilateral hand [right; 13, left; 1]). Ultrasound images were evaluated for location, shape, echogenicity, discernibility of A1 pulley, thickness of flexor tendon and volar plate, thickness ratio (lesion/normal side), and dynamic study (gliding limitation). All lesions were compared with the other hand as a normal range. For statistical analysis, independent-sample t-test was performed.

RESULTS

There were 18 trigger fingers in 16 patients (1st finger: 16, 3rd finger: 2). Pediatric trigger finger was divided into two types depended on the location of abnormal tendon morphology by A1 pulley – proximal and distal type. There were 4 distal types (1st finger: 2, 3rd finger: 2) and 14 proximal types. The tendon showed wavy contour (type 1, 6 cases), focal thickening (type2, 8 cases), or combined (type3, 3 cases). In all cases, there was hypoechoic infiltration. A1 pulley was readily distinguishable in distal type. But in proximal type, it might be distinguishable or not. The mean thickness of tendon (2.7±0.4, 1.9±0.3 and 38±22%, p<0.000) and volar plate (1.5±0.3, 1.0±0.2 and 41±23%, p<0.002). During dynamic study, there were 3 poorly cooperative patients. 10 patients displayed severe gliding limitation and 3 patients displayed moderate.

CONCLUSION

Ultrasound is a useful modality to diagnose and classify the pediatric trigger fingers. The difference in the mean thickness of tendon of both hands was seen commonly. The pathophysiology of pediatric

trigger fingers is not clear. But based on result from test, we presumed that the thickening of A1 pulley was causative of pediatric trigger fingers in distal type. In proximal type, the disproportionate growth of space including flexor tendon, volar plate and A1 pulley was postulated as the cause.

CLINICAL RELEVANCE/APPLICATION

Ultrasound may be instrumental in the diagnosis and classification of the pediatric trigger fingers and is recommended when the cause of contracture of fingers in pediatrics is uncertain.

RC213-07 Imaging of Tarsal Coalition

Monday, Nov. 28 9:40AM - 10:00AM Room: N230B

Participants
Sarah D. Bixby, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstration of the various types of tarsal coalition in children. 2) Discussion of the anatomy of the subtalar joint with respect to the location of various forms of subtalar coalition. 3) Description and demonstration of a variant of subtalar coalition, the posteromedial subtalar coalition, and discussion around its importance.

ABSTRACT

RC213-08 Imaging of Osteochondritis Dissecans

Monday, Nov. 28 10:20AM - 10:40AM Room: N230B

Participants
Jonathan D. Samet, MD, Chicago, IL, (jsamet@luriechildrens.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify imaging features of osteochondritis dissecans (OCD), with a focus on MRI. 2) Recognize the spectrum of findings between stable and unstable lesions. 3) Identify the varying postoperative appearances after surgical intervention.

RC213-09 Fishtail Deformity of the Distal Humerus; Be Aware of the Associated Osteochondritis Dissicans of the Capitellum

Monday, Nov. 28 10:40AM - 10:50AM Room: N230B

Participants
Matthew R. Wanner, MD, Carmel, IN (*Presenter*) Nothing to Disclose
Boaz Karmazyn, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the association of osteochondritis dissicans of the capitellum in patients with fishtail deformity of the distal humerus (FTD).

METHOD AND MATERIALS

Using the radiology information system, we identified all patients (<18 years) with FTD (2002-2016). Imaging were reviewed for presence of OCD of the capitellum (OCD). Medical charts were reviewed for type of initial injury, time until presentation with FTD, and presenting symptoms.

RESULTS

We identified 7 cases of FTD (3 females). Age at diagnosis ranged from 9.7-14.4 years (mean 12.5 years). 5 patients had a known prior fracture, all supracondylar humerus fractures; type-3 (n=3) and type-1 (n=1). They presented on average 8 years (5.2- 10.9 years) after the fracture.Symptoms at diagnosis included either limited range of motion (n=2), pain (n=3), or both pain and limited range of motion (n=2).Five (71%, 5/7) of the patients were found to have OCD. Only 2 (40%, 2/5) cases were diagnosed with radiographs, 3 were diagnosed with MRI and 1 with CT.Two patients had surgery to treat the OCD; drilling (n=1) and osteoplasty, microfracture, and removal of loose body (n=1).

CONCLUSION

OCD of the capitellum is often present in patients with FTD, but may be occult on radiographs.

CLINICAL RELEVANCE/APPLICATION

Our series is the first to show a high prevalence of OCD of the capitellum in patients with fishtail deformity, suggesting MRI should be considered even in the absence of OCD on radiographs.

RC213-10 MRI Findings in Non-traumatic Causes of Pediatric Knee Pain

Monday, Nov. 28 10:50AM - 11:00AM Room: N230B

Participants
Sonja Kinner, MD, Madison, WI (*Presenter*) Nothing to Disclose
Richard Kijowski, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Jie C. Nguyen, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the frequency and spectrum of knee joint pathology on MRI in pediatric patients with knee pain who have no history of acute trauma.

METHOD AND MATERIALS

A retrospective review of imaging archive and medical records systems was used to identify 150 consecutive patients between 6 and 18 years with knee pain who underwent a MRI study and had no history of acute trauma, arthritis, or neoplasm. All studies were retrospectively reviewed separately by a pediatric musculoskeletal radiologist and a musculoskeletal radiologist with any discrepancies settled through a consensus read. The frequency and spectrum of knee joint pathology was determined. T-tests were used to compare the age, body mass index (BMI) and referring physician with and without each type of knee joint pathology.

RESULTS

Knee joint pathology was present in only 69 of 150 patients (46%). Patients with no pathology were referred by an orthopedic specialist in 52% and primary care provider in 57%. The spectrum of pathology included effusion in 25, superior lateral Hoffa's fat pad edema in 18, bone marrow edema lesion in 10, cartilage lesion in 10, Osgood-Schlatter disease in 8, osteochondritis dissecans (OCD) lesion in 7, patellar tendinopathy in 7, Baker's cyst in 7, discoid meniscus in 5, meniscal tear in 5, and edematous bipartite patella in 2 patients. There was no significant difference for age and BMI with and without each type of knee joint pathology. Cartilage lesion, OCD lesion, and edematous bipartite patella were more likely to be referred from an orthopedic specialist. Otherwise, there is no difference in the positive knee pathology rates between those referred by orthopedic specialists and primiary care providers (48% verses 43%, respectively). Seven patients (10%) underwent subsequent surgical intervention (3 with OCD lesions and 4 with meniscal tears).

CONCLUSION

Although almost half of the pediatric patients with knee pain and no history of acute trauma showed knee joint pathology on MRI, only 10% of them required subsequent surgical intervention. Our results raise questions regarding the need for immediate use of MRI for assessing knee pain in those patients.

CLINICAL RELEVANCE/APPLICATION

MRI in children with non-traumatic knee pain shows pathologies in less than half of the patients and only 10% of them require surgical intervention. MRI therefore might be overused for this indication.

RC213-11 Unexplained Fractures in Infants and Young Children: (Ir)relevance of Serum Vitamin D

Monday, Nov. 28 11:00AM - 11:10AM Room: N230B

Participants
Elaine Pang, Sheffield, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sujatha Gopal, Sheffield, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alan Sprigg, MBChB, FRCR, Sheffield, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Amaka C. Offiah, MBBS, PhD, Sheffield, United Kingdom (*Presenter*) Speaker, Alexion Pharmaceuticals, Inc; Speaker, BioMarin Pharmaceutical Inc; Speaker, Infomed Research and Training Ltd; Travel support, Alexion Pharmaceuticals, Inc; Travel support, BioMarin Pharmaceutical Inc; Travel support, Infomed Research and Training Ltd; Director, OCIN Ltd

PURPOSE

To test the hypothesis that low serum total 25-hydroxyvitamin D (VitD) predisposes children aged ≤2years to fractures, even when there is no overt rickets.

METHOD AND MATERIALS

A retrospective single centre study.The hospital database was interrogated for children ≤2years who had VitD measured between 01/01/10 and 12/31/14 AND at least 1 skeletal radiograph within 2 weeks of this. Blinded to VitD, 2 observers independently scored the anonymised full skeletal surveys (SS) and individual radiographs (XR) for fracture (yes/no), bone density (reduced/normal) and rickets (Thacher score 0/≥1). Discrepancies were arbitrated by a third observer in a final consensus read.Analyses (SPSS V22.0 for Mac, $p \leq 0.05$) included descriptive statistics (prevalence of clinical and radiographic parameters), Cohen's kappa (interobserver reliability for radiographic parameters) and binomial logistic regression (likelihood of fracture based on VitD, bone density or Thacher score). Further analyses (calcium/phosphate/ethnicity/breast fed) are on-going.Research and Development approval was granted; Ethics Committee approval was waived.

RESULTS

388 children, mean age 9 months (0-24), 167 SS and 239 XR were included. Mean VitD was 67nmol/L (<6-778nmol/L); 77 children (20%) were VitD deficient (≤25nmol/L); 78 (20%) insufficient (25.1-50nmol/L); 69 (18%) had at least one fracture; 39 (10%) reduced bone density; 22 (6%) Thacher ≥1. Interobserver kappa was very high for fracture (0.915) and Thacher score (0.842) and good for bone density (0.706). Logistic regression (Table) showed that radiographic bone density was the only statistically significant variable predictive of presence of fracture, with an odds ratio of 4.61 (95%CI 2.05-10.38). The odds ratio for VitD level was 1.02 (0.99-1.06).

CONCLUSION

Observer reliability for diagnosing reduced bone density and rickets from radiographs ranges from good to very high. This study provides objective evidence to support mainstream thinking that in the absence of radiographic evidence of reduced bone density and/or rickets, a low vitD should not be interpreted as the cause of unexplained fractures in a child below 2 years of age.

CLINICAL RELEVANCE/APPLICATION

In children aged ≤2years with unexplained fractures, whose radiographs reveal normal bone density and/or a Thacher score of zero, serum VitD level is irrelevant to the etiology of the fractures.

RC213-12 The Assessment of IDEAL-IQ Technique in Quantifying the Fatty Infiltration of Leg Muscles in Duchenne Muscular Dystrophy

Monday, Nov. 28 11:10AM - 11:20AM Room: N230B

Participants
Jing Du, MD, Beijing, China (*Presenter*) Nothing to Disclose

Jiangxi Xiao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ying Zhu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the thigh muscle fat fraction level (FF) using IDEAL-IQ technique in Duchenne Muscular Dystrophy, and to correlate the FF with multiple clinical data.

METHOD AND MATERIALS

One hundred and seventy three boys (ranged from 2 to 13 years old, medium 6 years) with genetically confirmed DMD were recruited. Imaging was performed on a 3.0-T MR scanner. A quantitative water-fat separation method (IDEAL-IQ) were used to image leg muscles. Images of the IDEAL-IQ were processed on an GE ADW4.6 workstation to obtain the thigh muscle involvement pattern. Spearman correlation test was used to evaluate the correlation between FF and clinical data. The Kruskal-Wallis H test was used to compare the thigh muscle FF among three gene mutation groups.

RESULTS

The gluteus maximus was the most severely infiltrated muscle (the involvement frequency 100%, mean FF 28.6%±20.6%), followed by the adductor magnus (the involvement frequency 89%, mean FF 22.6%±22.5%). The least affected muscle were the adductor longus and gracilis, with the involvement frequency 10%-15%, mean FF less than 6.5%.FF value exhibited positive correlation with patients age ($r=0.76$, $P<0.05$). The FF value showed a significant positive correlation with the Brooke score ($r=0.80$, $P<0.05$). Negative correlation was obtained between FF value and muscle force ($r=-0.68$, $P<0.05$) and negative correlation was also obtained between FF value and CK values ($r=-0.33$, $P<0.05$). There was no significant differences of muscle fatty infiltration level among the three gene mutation forms.

CONCLUSION

IDEAL-IQ technique could be used to assess thigh muscle fatty infiltration level in DMD patients. The muscle fatty infiltration level evaluated by MRI was correlated with the clinical data.

CLINICAL RELEVANCE/APPLICATION

The application of IDEAL-IQ technique in DMD patients.

RC213-13 Use of Adding T2 Mapping Sequence to a Routine MR Imaging Protocol to Evaluate of the Articular Cartilage Changes of the Knee and Ankle Joint with Hemophilia in Children

Monday, Nov. 28 11:20AM - 11:30AM Room: N230B

Participants
Ningning Zhang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yanqiu Lv, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Di Hu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Huiying Kang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yue Liu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
RuiHui Wu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yun Peng, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Hua Cheng, MD, Beijing, China (*Presenter*) Nothing to Disclose

PURPOSE

The using of T2 mapping sequence is little known in the early cartilage changes in hemophilia patients. This study was to evaluate whether addition a T2 mapping sequence to a routine magnetic resonance (MR) imaging protocol could improve diagnostic performance in the detection of early changes of cartilage lesions within the knee and ankle joints at 3.0 T

METHOD AND MATERIALS

Fifteen clinically diagnosed hemophilia boys aged 8-17 years (12.2±3.5 years) with hemophilia A were involved in this study, with the approval of local IRB. Seven knee joints and eight ankles were scanned by a Philips Achieva TX 3.0T MR with a 8 channel knee coil and a head coil for ankle. Routine MR imaging protocol included T1W, T2W, T2/FFE, T2 SPAIR, PDW/TSE and T1 3D-WATS. The outline of cartilage was drawn manually by two experienced radiologists, then the area was divided into anterior(A), central(B) and posterior(C) regions automatically by the commercial software in the IntelliSpace portal. Statistical Package 17.0 was used for data analysis. The Kappa index (k) was calculated to test the degree of agreement between the two radiologists of the measurement results. Agreement was considered insignificant if $k< 0.20$, weak if between 0.21 and 0.40, moderate if between 0.41 and 0.60, strong if between 0.61 and 0.80 and very strong if ≥0.80. $P \leq 0.05$ was considered significant

RESULTS

The cartilage of T2 relaxation time of distal femur cartilage, proximal tibia, distal tibia talus surface, and the average T2 relaxation time of whole layer cartilage and the normal reference, please see fig.1. The degree of correlation in the measurement of the two radiologists was very strong ($k= 0.84$, $p<0.05$). T2 relaxation time of both Knee distal femur and proximal tibia articular cartilage were higher than those of healthy children (4).There were four morphologically normal joint cartilage in the routine MR protocol where their T2-mapping showed visible unevenness, out of these two cases were ankle (fig. 2) and the other two were knees

CONCLUSION

T2 mapping has the ability of detecting early cartilage degeneration prior to morphologic changes in pediatric patients with hemophilia.So T2 mapping has the potential to monitor the progression of cartilage damage in hemophilia and help to improve future treatment options

CLINICAL RELEVANCE/APPLICATION

T2 mapping has the potential to monitor the progression of cartilage damage in hemophilia and help to improve future treatment option

Handout:Ningning Zhang

http://abstract.rsna.org/uploads/2016/16009484/Ningning Zhang_T2mapping last version 2016.11.28 Abstract ID 16009484.ppt

RC213-14 Non-Invasive Assessment of Synovitis in Juvenile Idiopathic Arthritis: DWI is Powerful as Potential Biomarker

Monday, Nov. 28 11:30AM - 11:40AM Room: N230B

Participants
Anouk M. Barendregt, BSC, MSc, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Robert Hemke, MD,PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Charlotte M. Nusman, MSc, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Cristina Lavini, DPhil, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Taco Kuijpers, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mario Maas, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare two imaging biomarkers, the already established dynamic-contrast-enhanced MRI (DCE) and the new non-invasive diffusion-weighted imaging (DWI), in quantitatively assessing synovial inflammation in patients with juvenile idiopathic arthritis (JIA).

METHOD AND MATERIALS

35 JIA patients underwent MRI of the knee on a 1.0T scanner. In addition to standard sequences an axial T1W DCE and axial T2W SE EPI DWI (b-values 0, 50, 600) were acquired. DWI was post-processed into apparent diffusion coefficient (ADC)50-600 maps to eliminate signal intensity from vascular flow. To quantify signal from the synovium on DCE and DWI, regions of interest (ROI) were manually drawn in synovium on the DCE images and secondly on the ADC map using an in-house developed Matlab program (Dynamo). Collected DCE perfusion parameters include maximum enhancement (ME), slope of enhancement (slope), time-to-peak (TTP) and % of time-intensity curves (TIC) 2-5. A subset of patients (n=5) was measured twice to check consistency of ROI drawing. Patients were subdivided based on the validated JIA MRI score (JAMRIS), a score of 0 for synovial hypertrophy corresponds to inactive disease (n=16), a score ≥1 to active disease (n=19). Mann-Whitney U was used for testing DCE and DWI parameters between patients with active and inactive disease, the intraclass correlation coefficient (ICC) was used to assess reliability of ROI drawing and Spearman's rank for correlation between DCE and DWI parameters.

RESULTS

High correlations for all parameters (ICCs 0.89-0.99, $p<0.05$) were found when assessing the twofold ROI placements. Correlation between ME and ADC was good (r 0.62, p=0.000), other correlations were not significant. ME, slope, TTP, % TIC 2-5 (all $p<0.05$) as well as ADC were significantly different in the active vs. the inactive patients with median ADC-active 1.49x10-3 mm^2/sec, median ADC-inactive 1.26 x10-3 mm^2/sec, p=0.003.

CONCLUSION

Similar to DCE parameters, non-invasive DWI-derived ADC can differentiate active JIA from inactive JIA in the knee using a ROI drawing method that proved to be uniform. Diffusion in inflamed synovium is increased compared to non-inflamed synovium.

CLINICAL RELEVANCE/APPLICATION

Active JIA could be differentiated from inactive JIA with DWI; this could make contrast-enhanced MRI superfluous in the future, making MRI more patient-friendly and feasible in this young population.

RC213-15 Pediatric Temporomandibular Joint Imaging

Monday, Nov. 28 11:40AM - 12:00PM Room: N230B

Participants
Arthur B. Meyers, MD, Orlando, FL, (arthurbmeyers@yahoo.com) (*Presenter*) Author with royalties, Reed Elsevier

Active Handout:Arthur Benjamin Meyers

http://abstract.rsna.org/uploads/2016/16000446/RC21315 tmj.handout.pdf

LEARNING OBJECTIVES

1) List pathology that occurs in the pediatric temporomandibular joint. 2) Identify the normal anatomy of the temporomandibular joint on MRI. 3) Detect and describe pathology in the temporomandibular joint on MRI.

RC214

Interventional Series: Venous Disease

Monday, Nov. 28 8:30AM - 12:00PM Room: S406B

CH VA IR

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

FDA Discussions may include off-label uses.

Participants
Robert J. Lewandowski, MD, Chicago, IL, (r-lewandowski@northwestern.edu) (*Moderator*) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc
Brian S. Funaki, MD, Riverside, IL (*Moderator*) Data Safety Monitoring Board, Novate Medical Ltd
Charles E. Ray JR, MD, PhD, Chicago, IL (*Moderator*) Data Safety Monitoring Board, Novate Medical Ltd; Editor, Thieme Medical Publishers, Inc; Consultant, W. L. Gore & Associates, Inc; Consultant, Medtronic plc; ; ; ; ;

LEARNING OBJECTIVES

1) Describe the use of radio frequency wire in central venous occlusion. 2) List rationale for venous thrombolysis. 3) Describe the indications for balloon retrograde transvenous occlusion (BRTO). 4) Discuss one approach to establishing a PE response team.

ABSTRACT

Sub-Events

RC214-01 PE I: Diagnosis and Triage of Pulmonary Embolism

Monday, Nov. 28 8:30AM - 8:45AM Room: S406B

Participants
Akhilesh K. Sista, MD, New York, NY, (Akhilesh.Sista@nyumc.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

Learning objectives:1) Be able to distinguish between the Wells criteria and the simplified PESI score.2) Be able to distinguish between massive, submassive, and low-risk PE3) Know the major prospective trials of CDT for pulmonary embolism

LEARNING OBJECTIVES

View learning objectives under main course title.

RC214-02 PE Treatment Options and PERT

Monday, Nov. 28 8:45AM - 9:00AM Room: S406B

Participants
Sanjay Misra, MD, Rochester, MN, (Misra.sanjay@mayo.edu) (*Presenter*) Data Safety Monitoring Board, Flexible Stenting Solutions, Inc

LEARNING OBJECTIVES

1. Discuss different endovascular treatment options for PE.2. Become familiar with the technology used for treating PE.3. Identify components of a PE Response Team (PERT)

ABSTRACT

LEARNING OBJECTIVES

View learning objectives under main course title.

RC214-04 The Selection of Blood Suppression Inversion Time in Unenhanced MR Pulmonary Angiography in Diagnosis of Pulmonary Embolism

Monday, Nov. 28 9:10AM - 9:20AM Room: S406B

Participants
Sishu Yuan, Wuhan, China (*Presenter*) Nothing to Disclose
Zi Wang, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the detection accuracies in diagnosis of pulmonary embolism (PE) with different blood suppression inversion time (BSP-TI) in unenhanced MR angiography by applying spatial labeling with multiple inversion pulses sequence (SLEEK) imaging, and evaluate the image quality.

METHOD AND MATERIALS

61 patients (38 males and 23 females) diagnosed with pulmonary embolism (PE) using computed tomographic pulmonary angiography (CTPA) underwent SLEEK MR angiography within 48 hours. Taking the results of as CTPA a reference, accuracy for PE detection were calculated and compared SLEEK MRA sequences with different BSP-TIs, the images quality were also evaluated.

RESULTS

When BSP-TI=900ms, the best image quality was obtained. Diagnose accuracy for PE of different BSP-TIs (BSP-TI=500ms, 700ms, 900ms, 1100ms, 1300ms, 1500ms) were 62.3%, 89.3%, 90.4%, 84.6%, 77.0%, 69.3%, respectively. However, if there was atelectasis or pulmonary infection, BSP-TI=1300ms and 1500ms may help to better depict the pulmonary artery and PE.

CONCLUSION

For most of patients, the best image quality and the hightest diagnose accuracy of PE was obtained when BSP-TI=900ms. However, if there was atelectasis or pulmonary infection, evaluating BSP-TI could help to show the pulmonary artery and embolus in that area.

CLINICAL RELEVANCE/APPLICATION

For most of patients, the best image quality and the hightest diagnose accuracy of PE was obtained when BSP-TI=900ms. However, if there was atelectasis or pulmonary infection, evaluating BSP-TI could help to show the pulmonary artery and embolus in that area.

RC214-05 Risk of Venous Thromboembolism Following a Single Negative Proximal Compression Ultrasound

Monday, Nov. 28 9:20AM - 9:30AM Room: S406B

Awards
Student Travel Stipend Award

Participants
Myles M. Mitsunaga, MD, Honolulu, HI (*Presenter*) Nothing to Disclose
Shannon Kogachi, MS, Honolulu, HI (*Abstract Co-Author*) Nothing to Disclose
Hyo-Chun Yoon, MD, PhD, Honolulu, HI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

There is ongoing discussion regarding the optimal ultrasound scanning protocol for diagnosing deep vein thrombosis (DVT): imaging of the proximal veins with one additional proximal venous scan 1 week after the initial scan, versus a one-time whole-leg compression ultrasound, evaluating both proximal and distal infrapopliteal veins. At our institution, we have performed only a single, one-time proximal compression ultrasound limited to the femoral and popliteal veins (single proximal CUS) without a serial examination. Purpose: To determine the 3-month rate of venous thromboembolism (VTE) and clinical outcomes of symptomatic inpatients and ambulatory patients with normal findings on single proximal CUS.

METHOD AND MATERIALS

Single proximal CUS results and clinical data of all inpatient and ambulatory patients with suspected acute (DVT) were retrospectively reviewed during a 12-month period between January and December 2014. 3 month follow-up data were reviewed for all these patients who received all their care from a single geographically isolated health maintenance organization.

RESULTS

1295 patients with suspected deep vein thrombosis underwent single proximal CUS during the 12-month period. 111 of 1295 (8.6%) patients were positive for acute DVT at the initial proximal CUS. Of the remaining 1184 patients with initially negative proximal CUS sampled at 3-months follow-up, 1075 (90.8%) had no VTE event, 11 (0.9%) suffered from a subsequent VTE event (confirmed by a subsequent positive CUS or pulmonary embolism study), 53 (4.5%) died from causes unrelated to VTE, and 45 (3.8%) were lost to follow-up.

CONCLUSION

Overall, our 3-month cumulative rate of VTE following a single negative proximal CUS was 11 of 1184 or 0.9% (95%, confidence interval 0.4-1.5). Our confidence interval overlaps with those of serial proximal CUS protocols.

CLINICAL RELEVANCE/APPLICATION

Single proximal CUS is sufficient to exclude acute DVT in the vast majority of patients, rendering serial proximal CUS unnecessary for most patients.

RC214-06 Chronic Venous Recanalization

Monday, Nov. 28 9:30AM - 9:45AM Room: S406B

Participants
Marcelo S. Guimaraes, MD, Charleston, SC, (guimarae@musc.edu) (*Presenter*) Consultant, Cook Group Incorporated ; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated

LEARNING OBJECTIVES

1) Patient selection and work-up. 2) Strategy and devices to recanalize complex central venous occlusions. 3) How to avoid and how to be prepared for complications. 4) RF wire technique details.

ABSTRACT

Recanalization of chroninc venous occlusionsMarcelo Guimaraes, MD, FSIRChronic and complex central venous occlusions (brachiocephalic, SVC and IVC) are typically associated with symptoms and the recanalization may be challenging. The recanlization with RF wire technique will be presented and patient selection, work-up, technical details, how to avoid and manage complications and results will be discussed.

RC214-07 Debate: Submassive PE: Should Catheter-directed Therapy be Used?

Monday, Nov. 28 9:45AM - 10:00AM Room: S406B

Participants

Steven M. Zangan, MD, Chicago, IL (*Presenter*) Nothing to Disclose
John A. Kaufman, MD, Portland, OR (*Presenter*) Advisory Board, Bio2 Technologies, Inc; Consultant, Cook Group Incorporated; Consultant, Guerbet SA; Stockholder, Hatch Medical LLC; Stockholder, VuMedi, Inc; Stockholder, Veniti, Inc; Royalties, Reed Elsevier; Advisory Board, Delcath Systems, Inc; Researcher, W. L. Gore & Associates, Inc; Researcher, EKOS Corporation; Stockholder, EndoShape, Inc; Advisory Board, AV Medical Technologies Ltd; Advisory Board, Javelin Medical

LEARNING OBJECTIVES

1) To define submassive pulmonary embolism. 2) To examine current treatment algorithms for pulmonary embolism. 3) To assess current literature regarding catheter directed therapy for submassive pulmonary embolism. 4) To identify complications of catheter directed thrombolysis.

RC214-08 May-Thurner and Paget-Schroetter - Commonalities and Differences

Monday, Nov. 28 10:15AM - 10:30AM Room: S406B

Participants
Charles E. Ray JR, MD, PhD, Chicago, IL (*Presenter*) Data Safety Monitoring Board, Novate Medical Ltd; Editor, Thieme Medical Publishers, Inc; Consultant, W. L. Gore & Associates, Inc; Consultant, Medtronic plc; ; ; ; ;

RC214-09 IVC Filters: New Evidence and Ongoing Trials

Monday, Nov. 28 10:30AM - 10:45AM Room: S406B

Participants
Matthew S. Johnson, MD, Indianapolis, IN, (matjohns@iupui.edu) (*Presenter*) Research Consultant, Boston Scientific Corporation; Research Consultant, Cook Group Incorporated; Research Consultant, CeloNova BioSciences, Inc; Research Consultant, BTG International Ltd; Research support, BTG International Ltd; ;

LEARNING OBJECTIVES

ABSTRACT

RC214-10 Retrospective Analysis of Dwell Times and the Use of Advanced Retrieval Techniques (ART) in Patients Undergoing Inferior Vena Cava Filter (IVCF) Retrieval Procedures: A Single-center Experience

Monday, Nov. 28 10:45AM - 10:55AM Room: S406B

Participants
Laura p. Pletsch Borba, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose
Vanessa F. Furtado, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Melissa Chittle, MS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
George R. Oliveira, MD, East Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Thomas G. Walker, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Zubin Irani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gloria M. Salazar, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the impact of increased dwell times in the use of ATR and procedural complications in patients undergoing IVCF removal.

METHOD AND MATERIALS

In this IRB-HIPPA compliant study, a retrospective review of medical records was performed of patients undergoing IVCF retrieval between January 2011 and April 2016, at the Division of Interventional Radiology. The following data was collected: demographics, indications for IVCF, use of intravascular ultrasound (IVUS) on placement, dwell times (days), procedural complications, and imaging studies (CT abdomen). All complications were classified according to societal guidelines. All results are given in percentages, mean, ±SD, and range. Statistical analysis was performed with Fisher's exact and Mann-Whitney tests.

RESULTS

148 patients were identified: 81 male(age:53.83±15.45) and 67 female(age:55.06±17.26); who had the following indications for IVCF: 45.6% absolute, 14.3% relative and 40.1% prophylactic. A total of 143 patients underwent successful IVCF retrieval procedure at the first attempt (96.6%). A second attempt was performed in 5 patients with an 80% (n=4) success rate and one patient underwent filter retrieval at the third attempt. ART was performed in 8.1% (n=12) patients, in the first procedure, which included use of endobronchial forceps or the use of endovascular maneuvers. The overall complication rate was 6.8% (n=10), including: leg embedded into caval wall (n=7), emboli trapped in the filter (n=2), filter tilt (n=6), filter unable to retrieve (n=5) and need for controlled filter fracture during the procedure (n=1). Mean filter dwell time was 145.30(3–716) days. Increased dwell times (>100 days) was significantly associated with the use of ART ($p<.05$). Retrieval complications were significantly associated with ART ($p<.05$). Use of IVUS was not associated to retrieval complications or ATR.

CONCLUSION

IVCF can be successfully retrieved at the first procedure, with a 96.6% success rate, with the addition of ART. Increased dwell time was significantly associated with the use of ART. Consideration of ART should be done earlier in filters with dwell times higher than 100 days.

CLINICAL RELEVANCE/APPLICATION

IVCF retrieval rates remain low nationally with implications for patient outcomes. We sought to evaluate the impact of prolonged indwelling time in the use of ATR in filter retrieval procedures.

RC214-11 Keen Endovascular sNare Strategy (KENS) - Fluoroscopic Procedure Time as a Prognosticator of IVC Filter Retrieval Success

Monday, Nov. 28 10:55AM - 11:05AM Room: S406B

Awards
Student Travel Stipend Award

Participants
Jin Qian, MD, Burlington, VT (*Presenter*) Nothing to Disclose
James B. Allison, MD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose
Richard Watts, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher S. Morris, MD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose
Anant D. Bhave, MD, Richmond, VT (*Abstract Co-Author*) Nothing to Disclose
Joseph T. Shields, MD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if there is a reliable time point during an IVC filter retrieval attempt after which the success rate for removal becomes unlikely without using advanced techniques, which are defined as any technique other than loop snare removal.

METHOD AND MATERIALS

IRB approval was obtained for the retrospective analysis of IVC filter retrieval procedures performed between 2011 and 2015 by the authors' institutional IR division. The fluoroscopic time, retrieval technique, type of filter, and operator experience were analyzed. Mann-Whitney rank-sum tests were used to compare the difference between the group using standard technique and those requiring advanced technique. Cumulative success rates of the two were plotted against the fluoroscopic time. A time point after which continued attempts with standard retrieval method would result in diminishing returns was determined.

RESULTS

The overall filter retrieval success rate was 93.0%. Standard technique was successful in 99.2% of cases, while advanced techniques were only successful in 57.1% of attempts. Procedures using advanced techniques were associated with longer fluoroscopic time than the standard technique (mean time 1665 sec; 95% CI: 1252, 2078 vs. 330 sec; 95% CI: 278, 383, X2 = 384, p-value<0.0005). Transition points were determined at 612 seconds (94.2% success) for standard technique and 1386 seconds (48.0% success) for advanced technique when the success rates taper off. A ROC curve revealed that at 654 seconds (sensitivity=0.952, specificity=0.950), most operators in our department had completed the procedure using the standard technique or had switched to an advanced technique.

CONCLUSION

IVC filter retrievals are less likely to be successful if standard retrieval techniques require more than 10 minutes of fluoroscopic time. If the fluoroscopic time is greater than 23 minutes, advanced techniques are also unlikely to succeed and the operator should consider aborting the procedure to avoid further radiation to the patient.

CLINICAL RELEVANCE/APPLICATION

Operators with different level of experience performing IVC filter retrieval can refer to our data in determining optimal times to change technique or terminate the procedure when a particular method is not successful. This may apply to academics or private practice settings. It will limit the patient and operator radiation doses in instances where the benefit of continued attempts will likely be limited.

RC214-12 Electric Field Ablation of Venous Thrombosis Prevents Clot Organization and Increases Vein Patency: Novel Deep Vein Thrombosis Intervention

Monday, Nov. 28 11:05AM - 11:15AM Room: S406B

Participants
Rahmi Oklu, MD, PhD, Scottsdale, AZ (*Presenter*) Nothing to Disclose
Hassan Albadawi, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study was to examine whether targeted low voltage electric fields could cause non-thermal decellularization of venous thrombus and promote natural resolution.

METHOD AND MATERIALS

Electric field (EF) parameters were optimized using neutrophils, HUVECS and blood clots formed within microfluidic chambers fabricated by replica molding of PDMS and standard photolithography techniques. Rheological analysis and temperature measurements were made using Anton Paar MCR 301 rheometer and IT-21, Ø=0.4 mm, PhysiTemp system, respectively; in vitro and in vivo currents were measured using PicoScope 4224 Oscilloscope. Once non-thermal EF conditions were optimized in vitro, in vivo experiments on venous thrombosis using a rat bilateral femoral vein ligation model was performed. Following groin exposure, all visible side branches including the inferior epigastric and the muscular branch were ligated except for the profunda femoris vein. One side was subjected to EF while the other side did not receive treatment serving as the control. After 3 or 7 days, the ligated veins were processed for histology, immunohistochemistry (NETs, collagen, MPO, tissue factor), Western blotting (tissue factor) and cytokine analysis from tissue lysates (27 growth factors). Patency, nucleated cell counts, vein circumference and immunostaining were measured using ImageJ.

RESULTS

Live/dead cell assays using microfluidic chambers and ex-vivo 6 mm PDMS realistic vessel like structures revealed non-thermal, optimal cell death (>90%) at 60-120 V/mm. Using Instron testing system, the ability to clot fresh blood was not affected at EF up to 460V/mm. At day 3 and at day 7, EF treated venous thrombi compared to sham control groups demonstrated wide patency ($P<0.0001$); reduced collagen levels ($P=0.003$); decreased nucleated cells ($P<0.0001$); decreased neutrophils, macrophages and NETs ($P< 0.0001$); decreased tissue factor, IL-4, TGF-β1, TGF-β2, and TGF-β3 ($P<0.05$) and the average circumference of the veins was similar ($P=0.18$) suggesting that the treatment did not cause venous aneurysms.

CONCLUSION

Non-thermal EF ablation of nucleated cells within DVT significantly impacts the organization capability of the thrombus, promoting natural clearance.

CLINICAL RELEVANCE/APPLICATION

EF ablation for treatment of DVT may potentially decrease the incidence of post-thrombotic syndrome associated with conventional anticoagulant therapies.

RC214-13 DVT Iysis: An Update

Monday, Nov. 28 11:15AM - 11:30AM Room: S406B

Participants
Kush R. Desai, MD, Chicago, IL, (kdesai007@northwestern.edu) (*Presenter*) Speakers Bureau, Cook Group Incorporated; Consultant, Cook Group Incorporated

LEARNING OBJECTIVES

Venous thrombolysis is a rapidly evolving space. Several devices/approaches have been recently introduced, improving procedural ease and patient outcomes. Prospective data on the benefits of thrombolysis in the prevention of post-thrombotic syndrome is forthcoming as well. In this session, we will review the history, rationale, and data behind deep venous thrombolysis, followed by a discussion of current practice, emerging technologies, and future directions.

ABSTRACT

LEARNING OBJECTIVES

1) Venous thrombolysis is a rapidly evolving space. Several devices/approaches have been recently introduced, improving procedural ease and patient outcomes. Prospective data on the benefits of thrombolysis in the prevention of post-thrombotic syndrome is forthcoming as well. In this session, we will review the history, rationale, and data behind deep venous thrombolysis, followed by a discussion of current practice, emerging technologies, and future directions.

ABSTRACT

N/A

RC214-14 IVC Filters: Past, Present, and Future

Monday, Nov. 28 11:30AM - 11:45AM Room: S406B

Participants
John A. Kaufman, MD, Portland, OR (*Presenter*) Advisory Board, Bio2 Technologies, Inc; Consultant, Cook Group Incorporated; Consultant, Guerbet SA; Stockholder, Hatch Medical LLC; Stockholder, VuMedi, Inc; Stockholder, Veniti, Inc; Royalties, Reed Elsevier; Advisory Board, Delcath Systems, Inc; Researcher, W. L. Gore & Associates, Inc; Researcher, EKOS Corporation; Stockholder, EndoShape, Inc; Advisory Board, AV Medical Technologies Ltd; Advisory Board, Javelin Medical

RC214-15 Debate: Retrievable Filters: Get Them All Out!

Monday, Nov. 28 11:45AM - 12:00PM Room: S406B

Participants
Bulent Arslan, MD, Chicago, IL, (bulent_arslan@rush.edu) (*Presenter*) Advisory Board, Nordion, Inc Advisory Board, Angiotech Pharmaceuticals, Inc Speakers Bureau, Nordion, Inc Speakers Bureau, W. L. Gore & Associates, Inc Consultant, Bayer AG
Robert J. Lewandowski, MD, Chicago, IL, (r-lewandowski@northwestern.edu) (*Presenter*) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

LEARNING OBJECTIVES

LEARNING OBJECTIVES

1) Understand the importance of removing IVC filters that are no longer required. 2) Name the risks of potentially retrievable IVC filters. 3) Cite literature demonstrating safety and efficacy of removing IVC filters with advanced techniques.

RC215

Breast Series: Hot Topics in Breast Imaging

Monday, Nov. 28 8:30AM - 12:00PM Room: Arie Crown Theater

BR

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

FDA Discussions may include off-label uses.

Participants
Christiane K. Kuhl, MD, Bonn, Germany (*Moderator*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Moderator*) Nothing to Disclose
Edward A. Sickles, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC215-01 Breast Density

Monday, Nov. 28 8:30AM - 8:50AM Room: Arie Crown Theater

Participants
Jennifer A. Harvey, MD, Charlottesville, VA, (jharvey@virginia.edu) (*Presenter*) Research Grant, Hologic, Inc; Stockholder, Hologic, Inc; Research Grant, Volpara Health Technologies Limited; Stockholder, Volpara Health Technologies Limited;

LEARNING OBJECTIVES

1) Describe current political environment surrounding breast density. 2) State degree of decreased sensitivity due to dense tissue. 3) State risk of density and breast cancer, relative to traditional risk factors.

ABSTRACT

RC215-02 Validation Study of the Publically-Available Fully-Automated "LIBRA" Software for Mammographic Density Estimation: Results from a Case-Control Study of Breast Cancer

Monday, Nov. 28 8:50AM - 9:00AM Room: Arie Crown Theater

Participants
Kathleen R. Brandt, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Meng-Kang Hsieh, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Christopher G. Scott, MS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Matthew Jensen, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Stacey Winham, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Dana H. Whaley, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Carrie B. Hruska, PhD, Rochester, MN (*Abstract Co-Author*) Institutional license agreement, Gamma Medica, Inc
Fang Fang Wu, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Aaron Norman, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Vernon S. Pankratz, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Andrew Oustimov, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Hologic, Inc; Consultant, Siemens AG
Karla Kerlikowske, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Despina Kontos, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Celine M. Vachon, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Area and volumetric breast density measures are strong risk factors for breast cancer (BC). We compared breast density estimates from a publically available, fully-automated software tool, the Laboratory for Individualized Breast Radiodensity Assessment (LIBRA), which can be run both on "For Processing" and "For Presentation" digital mammogram formats, to those from commercial software, which are only run on "For Processing" format.

METHOD AND MATERIALS

Digital mammograms in both formats were obtained prior to diagnosis on 437 incident BC cases and 1225 age-matched controls from a large screening mammography practice. LIBRA estimates included dense area (DA) and percent density (PD) averaged from four mammogram views of both digital mammogram formats. Volumetric percent density (VPD) and dense volume (DV) estimates were also obtained on four views of "For Processing" formats only, using Volpara (Matakina Ltd.) and Quantra (Hologic Inc.) software. We compared density measures using Pearson correlations (R) among controls, and odds ratios and 95% confidence intervals (OR (95%CI)) for BC per standard deviation (SD) density measure from conditional logistic regression, adjusting for age and body mass index.

RESULTS

LIBRA PD showed strong correlation with Volpara VPD (R=0.80-0.87), but moderate correlation with Quantra VPD (R=0.53-0.60). LIBRA DA was low to moderately correlated with Quantra DV (R=0.28-0.52) and Volpara DV (R=0.52-0.65). The strongest associations of LIBRA with BC were seen with "For Presentation" density measures, OR=1.3 (1.1-1.5) per SD of PD and OR=1.2 (1.1-1.4) per SD of DA, while estimates from "For Processing" images were attenuated: OR=1.1 (1.0-1.3) and OR=1.1 (0.97-1.2),

per SD of PD and DA respectively. For commercial measures, risk estimates for VPD with BC were slightly larger (OR=1.4 (1.2-1.6) and OR=1.3 (1.1-1.4) per SD VPD) than DV (OR=1.2 (1.1-1.4) and OR=1.2 (1.0-1.3) per SD DV) for Volpara and Quantra respectively, but not significantly different.

CONCLUSION

Our results confirm prior smaller studies showing that LIBRA, a publically available, fully-automated breast density estimation software run on readily available "For Presentation" mammograms, has similar BC associations as commercial software.

CLINICAL RELEVANCE/APPLICATION

A publically available, fully-automated software utilizing "For Presentation" images could further enable research on quantitative density measures in personalized screening and cancer risk assessment.

RC215-03 Use of Deep Learning in Breast Cancer Risk Assessment: Evaluation of Convolutional Neural Networks on a Large Clinical Dataset of FFDMs

Monday, Nov. 28 9:00AM - 9:10AM Room: Arie Crown Theater

Participants
Hui Li, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Benjamin Q. Huynh, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Maryellen L. Giger, PhD, Chicago, IL (*Abstract Co-Author*) Stockholder, Hologic, Inc; Stockholder, Quantitative Insights, 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 Corporation;
Natalia O. Antropova, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Li Lan, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We evaluated the potential of deep learning in the assessment of breast cancer risk in which convolutional neural networks (CNNs) extract features directly from FFDM images instead of measuring breast density and parenchymal textures.

METHOD AND MATERIALS

The study included 456 clinical FFDM cases from two high-risk datasets - BRCA1/2 gene-mutation carriers (53 cases) and unilateral cancer patients (75 cases), and a low-risk dataset (328 cases). All FFDM images [12-bit quantization and 100 micron pixels] had been acquired with a GE Senographe 2000D system and were retrospectively collected under an IRB-approved, HIPAA-compliant protocol. Regions of interest (ROIs) of 256x256 pixels were selected from the central breast region behind the nipple in the craniocaudal projection of the FFDMs. We compared the use of direct image features, which were automatically extracted using transfer learning and pre-trained CNNs, and the use of features from radiographic texture analysis (RTA). Each feature set was input to a support vector machine classifier and underwent leave-one-case-out cross validation. Area under the ROC curve (AUC) served as the figure of merit in the task of distinguishing between high-risk and low-risk subjects.

RESULTS

In the task of distinguishing between the BRCA1/2 gene-mutation carriers and low-risk women, comparable classification performance was obtained using features extracted from CNNs (AUC=0.83; SE=0.03) and from RTA (AUC=0.82; SE=0.03). However, in the task of distinguishing between unilateral cancer and low-risk women, the performance was significantly improved with the CNNs (AUC=0.82; SE=0.03) compared to RTA (AUC=0.73; SE=0.03) with a p-value of 0.009.

CONCLUSION

Deep learning with CNNs appears to be able to extract textural characteristics directly from FFDMs as well as, or better than, conventional texture analysis in the task of distinguishing between cancer risk populations.

CLINICAL RELEVANCE/APPLICATION

Deep learning has potential to help clinicians in assessing mammographic parenchymal patterns for breast cancer risk assessment.

RC215-04 A Masking Index to Predict Reduced Sensitivity of Mammography Due to Breast Density

Monday, Nov. 28 9:10AM - 9:20AM Room: Arie Crown Theater

Participants
James G. Mainprize, PhD, Toronto, ON (*Presenter*) Institutional research agreement, General Electric Company
Olivier Alonzo-Proulx, Toronto, ON (*Abstract Co-Author*) Institutional research agreement, General Electric Company
Roberta A. Jong, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Heba M. Hussein, MD, toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Jennifer A. Harvey, MD, Charlottesville, VA (*Abstract Co-Author*) Research Grant, Hologic, Inc; Stockholder, Hologic, Inc; Research Grant, Volpara Health Technologies Limited; Stockholder, Volpara Health Technologies Limited;
Martin J. Yaffe, PhD, Toronto, ON (*Abstract Co-Author*) Research collaboration, General Electric Company Founder, Matakina International Ltd Shareholder, Matakina International Ltd Co-founder, Mammographic Physics Inc

PURPOSE

The sensitivity of screening mammography is reduced for dense breasts. BI-RADS density assessment emphasizes the masking potential of breast density, but the assessment is qualitative and achieves only moderate agreement between radiologists. We are refining a masking index based on the local "detectability map", that predicts the probability of missing a cancer (if present) due to the amount and patterns of dense tissue in the breast. The maps are automatically calculated from the image and the DICOM header contents.

METHOD AND MATERIALS

Simulated breast cancer lesions are sequentially "inserted" into digital mammograms (contralateral to actual cancer), one location at a time. An automated computer "observer" is used to combine measured image features (contrast, noise power, texture) to

create a detectability map whose pixels represent the probability of detecting a possible cancer at each location in the mammogram. From the map, a masking index, giving the probability of missing a cancer due to reduced contrast or clutter caused by superposition of dense breast tissue, is calculated for the entire mammogram. Under IRB approval, for initial development, we analyzed a set of de-identified mammograms consisting of 8 cancers missed on mammography and 40 screen-detected cancers. Results from a larger set consisting of 106 interval cancers and 596 screen-detected cancers are currently under analysis. The masking index predictions are compared against truth status (cancer missed vs. cancer found).

RESULTS

In our preliminary ROC analysis, the ability to predict detected/missed status was found to have an AUC of 0.74 (0.54-0.87, 95% confidence interval). Interestingly, volumetric breast density alone was not as informative in predicting missed cancer status, AUC 0.67 (0.4-0.84 CI).

CONCLUSION

A masking index is being developed that has shown promise in predicting the probability of masking in a mammogram. It is based on detectability maps that indicated regions of high/ low detectability and have been shown to correlate with radiologists' impressions of mammograms and screening performance.

CLINICAL RELEVANCE/APPLICATION

A quantitative, objective measure of masking could become a key tool in determining when the performance of screening mammography in an individual woman is compromised due to breast density.

RC215-05 Associations of Volumetric Mammographic Density Measures with Breast Cancer Risk in 5,746 Women

Monday, Nov. 28 9:20AM - 9:30AM Room: Arie Crown Theater

Participants
Bennett Battle, MD, Little Rock, AR (*Presenter*) Nothing to Disclose
Sharp F. Malak, MD, MPH, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Ishwori Dhakal, MPH, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Jeannette Lee, PhD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Noel Keith, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Barbara Fuhrman, PhD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Previously, methods for measurement of mammographic density (MD) have been either time-consuming, or subjective and only modestly reliable. Because MD offers information both about individual risk and about the efficacy of screening, a standardized and robust method for measurement of this prevalent risk factor has been a goal of many researchers.

METHOD AND MATERIALS

Using Volpara software (Matakina, New Zealand), we measured volumetric mammographic density on images from 42,527 screening mammograms done on 13,942 women seen at our institution between 2006-2012. Billing data and data collected by the cancer registrar was gathered to document person-level and procedure-level factors on 25,034 women seen for mammography assessment in the same period. A retrospective cohort was defined using women with both imaging and billing data who were initially seen for a screening mammogram, had no previous history of breast cancer, and were followed at our institution for at least 6 months following their first captured visit.

RESULTS

Among 5746 eligible women, 92 registry-confirmed breast cancers and a total of 121 registry-confirmed or treated breast cancer cases were ascertained. We observed monotonically increasing risks of registry-verified incident breast cancers by quartile of VMD% with HR= 1.0, 1.2 (0.7-2.2), 1.2 (0.7-2.2), and 2.2 (1.2-4.1), Ptrend=0.02; a similar trend was seen by quartile of DV, with HR across quartiles = 1.0, 1.5 (0.8-2.9), 1.8 (0.9-3.4), and 2.9 (1.5-5.4) (Ptrend=0.0009). Among women without a breast cancer diagnosis, changes in MD were significantly modified by birth cohort; while both VMD% and DV increased significantly in serial images taken over time in women born before 1940, VMD% declined significantly over time (P<0.0001) and DV decreased on average, but not statistically significantly (p=0.46), in women born between 1950-1959.

CONCLUSION

Automated measurement of Volumetric MD allows for assessment of this important breast cancer risk factor in a large number of women and on repeated mammographic assessments. In this cohort, assembled using the Enterprise Data Warehouse, mammographic density was associated with increased risk of subsequent breast cancer as expected, supporting the validity of the automated measures.

CLINICAL RELEVANCE/APPLICATION

Automated volumetric mammographic density measurement allows for the identification of women at increased risk of developing breast cancer.

RC215-06 Parenchymal Pattern Analysis in Digital Mammograms versus Central Source Projection Tomosynthesis Images: A Case-Control Study for Breast Cancer Risk Estimation

Monday, Nov. 28 9:30AM - 9:40AM Room: Arie Crown Theater

Participants
Lin Chen, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Andrew Oustimov, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Meng-Kang Hsieh, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Hologic, Inc; Consultant, Siemens AG
Despina Kontos, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

PURPOSE

We evaluate the association of breast parenchymal texture features to breast cancer risk with full-field digital mammography (FFDM) versus digital breast tomosynthesis (DBT) central source projections (CSP) images.

METHOD AND MATERIALS

We retrospectively analyzed images from women who underwent routine breast cancer screening at our institution using a combined FFDM and DBT protocol (Selenia Dimensions, Hologic Inc.), during 9/2011-6/2014. Each DBT source projection was acquired at approximately 90% dose reduction, for a total of 15 source projection images per breast and view. A total of 86 women were diagnosed with unilateral invasive breast cancer. From these, 72 had "For Processing" DBT-CSP images available for analysis that were of sufficient image quality (no artifacts, implants, pace-makes), and were used as cases. A total of 360 controls were randomly selected from women who had negative screening exams and confirmed one-year negative follow-up, which were age-, race- and side-matched to cases at 1:5 ratio. The mediolateral oblique (MLO) view of the "For Processing" FFDM and CSP-DBT images were used for parenchymal pattern analysis; for cases the contralateral (unaffected images) were analyzed. Multiple texture descriptors were extracted, including gray-level histogram, co-occurrence, run-length, and fractal dimension features, using a previously validated, fully-automated, lattice-based texture analysis pipeline. The discriminatory capacity of the texture features based on FFDM versus DBT-CSP was tested via a logistic regression classifier and the area under curve (AUC) of the receiver operating characteristic (ROC). The ROC AUCs were compared using DeLong's test.

RESULTS

The model with FFDM texture features had an AUC=0.75 (95% CI:0.69-0.82). Texture features from the corresponding low-dose DBT-CSP images had an AUC=0.76 (95% CI:0.70-0.82). No significant difference was found between FFDM and DBT-CSP based on the performance of the lattice texture features (p=0.87).

CONCLUSION

Our study suggests that parenchymal texture analysis from DBT-CSP images, acquired at substantially lower x-ray dose, is feasible and may result to similar associations to breast cancer risk compared to standard-dose FFDM images.

CLINICAL RELEVANCE/APPLICATION

Parenchymal texture analysis can provide robust indicators of cancer risk from low-dose DBT-CSP images, which may become important as DBT is increasingly replacing FFDM in breast cancer screening.

RC215-07 Over Diagnosis

Monday, Nov. 28 9:40AM - 10:00AM Room: Arie Crown Theater

Participants
Mark A. Helvie, MD, Ann Arbor, MI (*Presenter*) Institutional Grant, General Electric Company

LEARNING OBJECTIVES

1) Define overdiagnosis of breast cancer. 2) Differentiate overdiagnosis from overtreatment. 3) Estimate magnitude of overdiagnosis from screening.

ABSTRACT

RC215-08 High Breast Compression in Mammography May Reduce Sensitivity

Monday, Nov. 28 10:10AM - 10:20AM Room: Arie Crown Theater

Participants
Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Presenter*) Shareholder, Matakina Technology Limited Consultant, QView Medical, Inc Shareholder, QView Medical, Inc Director, ScreenPoint Medical BV Shareholder, ScreenPoint Medical BV
Katharina Holland, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Ioannis Sechopoulos, PhD, Atlanta, GA (*Abstract Co-Author*) Research agreement, Siemens AG; Research agreement, Toshiba Medical Systems Corporation; Speaking agreement, Siemens AG
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research agreement; Siemens AG; Research agreement, Seno Medical Instruments, Inc
Gerard J. den Heeten, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Founder, SigmaScreening BV
Carla H. van Gils, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Software support, Matakina Technology Limited

PURPOSE

While firm breast compression is generally thought to be required for high quality mammograms the relationship between the amount of compression and screening performance has not been studied systematically. The aim of this study is to determine breast cancer screening outcomes in relation to the compression pressure applied during mammography.

METHOD AND MATERIALS

A consecutive series of 111,870 digital screening examinations performed in 53,684 women between July 2003 and December 2011 was collected from a screening centre operating within a nationwide breast cancer screening program. A total of 662 screen-detected cancers were included in this series, while 280 interval cancers corresponding to the selected exams were identified by linkage to the Dutch Cancer Registry. Using a research version of Volpara Density software (Volpara Solutions, Wellington, NZ) breast volume (V), dense tissue volume (VD), and volumetric density grade (VDG), were estimated for each exam, while compression pressure was estimated for medio-lateral oblique (MLO) view by dividing the compression force by the area of contact surface between the breast and the compression paddle. We calculated frequencies of recalls, screen-detected cancers, and interval cancers stratified by compression pressure in five groups and derived program sensitivity, specificity, and positive predictive value (PPV). In addition, for each group we computed mean values of V, VD, and VDG. For statistical analysis Pearson's Chi-squared test was used.

RESULTS

Screening outcomes were different in the five compression pressure groups (p=0.004). Program sensitivity decreased with

increasing pressure (77.0%, 69.7%, 74.5%, 63.2%, 66.7%) (p=0.02), specificity was similar, and PPV was highest in the midrange of pressure (28.5%, 31.0%, 34.2%, 26.7%, 25.7%) (p=0.03). Cutoff points for pressure dividing the data in groups of 20% were 7.7, 9.2, 10.7, 12.8 kPa. V and VD both decreased with increasing pressure. Mean VDG moderately increased (1.75, 2.0, 2.2, 2.4, 2.8).

CONCLUSION

Results suggest that if too much pressure is applied during mammography this may increase interval cancer rates and decrease PPV.

CLINICAL RELEVANCE/APPLICATION

Controlling pressure during mammography is important to decrease the discomfort experienced by women, but it may also be required to optimize screening outcomes.

RC215-09 Harms of False Positive Stereotactic-biopsy: Does a Benign Biopsy Affect Screening Compliance?

Monday, Nov. 28 10:20AM - 10:30AM Room: Arie Crown Theater

Participants
Alana A. Lewin, MD, New York, NY (*Presenter*) Nothing to Disclose
Yiming Gao, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Leng Leng Young Lin, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Marissa L. Albert, MD, MSc, New York, NY (*Abstract Co-Author*) Nothing to Disclose
James S. Babb, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hildegard B. Toth, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Samantha L. Heller, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Critics of screening mammography argue that the harms of screening include unnecessary recalls and biopsies. The purpose of our study is to evaluate whether false positive biopsy affects subsequent mammographic screening compliance.

METHOD AND MATERIALS

This was an IRB approved, HIPAA compliant retrospective review of women with stereotactic-guided core biopsies performed between 2012-2014. Patient age, clinical history, biopsy pathology, short-term follow-up, and first post-biopsy screening mammogram were reviewed. Statistical analyses were performed using Fisher exact, Mann-Whitney, and Chi-square tests.

RESULTS

913 stereotactic vacuum assisted biopsies (SVAB) performed with a 9 Gauge Suros needle were performed in 2012-2014. Women with malignant or high-risk lesions or biopsies resulting in a recommendation of surgical excision were excluded. 458 SVABs yielded benign pathology in 436 women (average age is 53.7 years, range 24-85 years). Findings were matched with 29,774 patients who had a BI-RADS 1 or 2 screening mammogram in the same time period. 226/458 (49%) women who had a biopsy returned for annual follow-up compared to 20,256/29,774 (68%) women without biopsy who returned for follow-up ($p<0.001$). 228/458(63%) women who had a biopsy returned for follow-up within 2 years compared to 21,677/29,774 (73%) women without biopsy who returned ($p<0.001$). Women with a past history of cancer or atypia who had benign SVAB were more likely to return to screening ($p=0.027$ and $p=0.049$, respectively). Women who had unilateral short-term follow-up for evaluation of biopsy (30.6% [140/458]) were also more likely to return than women with no such follow-up ($p<0.001$). There was no association between pathology type or multi-site biopsy and return to subsequent screening mammography.

CONCLUSION

A significantly greater percentage of patients who did not undergo stereotactic-biopsy returned to screen compared with benign biopsy patients, suggesting that benign SVAB may have a negative impact on screening compliance. Biopsied patients with a history of cancer/atypia and those who had a post-biopsy diagnostic unilateral follow-up were more likely to return to screen.

CLINICAL RELEVANCE/APPLICATION

Benign breast biopsies may affect screening compliance. Additional education and discussion may be warranted when discussing future screening recommendations with patients after benign biopsy.

RC215-10 Trends in Breast Density Assessment Over Time: Patterns Related to Legislation and Patient Age

Monday, Nov. 28 10:30AM - 10:40AM Room: Arie Crown Theater

Awards
Student Travel Stipend Award

Participants
Krystal C. Buchanan, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Patricia C. Barrett, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Paul H. Levesque, MD, Madison, CT (*Abstract Co-Author*) Nothing to Disclose
Jaime L. Geisel, MD, New Haven, CT (*Abstract Co-Author*) Consultant, QView Medical, Inc Consultant, Siemens AG
Regina J. Hooley, MD, New Haven, CT (*Abstract Co-Author*) Consultant, FUJIFILM Holdings Corporation; Consultant, Siemens AG
Liane E. Philpotts, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Breast density notification legislation is being passed in more states every year. Density classification on mammography is primarily achieved by subjective means. With such laws in effect, there is the possibility of radiologists overtly or subconsciously changing density, particularly downgrading such that supplemental tests will not be required. The purpose of this study was to determine the effect of density classification over time and by patient age.

METHOD AND MATERIALS

A search of the electronic breast imaging database (PenRad, MN) was performed to determine the density classifications (BI-RADS categories a,b,c,d) reported on digital screening mammograms over a 10 year period (2006 – 2015). Our state density notification law went into effect in 2009. Prior to 2011 these were FFDM and after 2011, the majority were tomosynthesis exams (all Hologic, MA). The combined data was assessed and additionally, the data were subdivided by patient age by decade: 40-49, 50-59, 60-69, 70 and up.

RESULTS

A total of 76,924 screening exams were assessed. For all age groups, there was a small decrease in dense breast categories and corresponding increase in non-dense of 5% in 2009, which returned to usual the following year. However, there has been a consistent trend of increasing percentage of heterogeneously dense since that time, from 23% to 34%. When assessed by age, this trend is found mostly in women in the 50's and 60's decade. No specific pattern change was noted in 2011 with the conversion to tomosynthesis.

CONCLUSION

The patterns of density reporting appear to be initially affected by state legislation, yet the pattern did not return to previous rates, but actually shows increase towards more women being reported as dense, particularly women in the 50-69.

CLINICAL RELEVANCE/APPLICATION

Density reporting appears to be affected by legislation, but such trends may change over time, with increase towards more women being reported as dense. This may be a reflection of radiologists not downgrading density as women age, or leaning towards allowing more women the possibility of supplemental screening.

RC215-11 Clinicopathologic and Immunohistochemical Characteristics of Invasive Breast Cancers Visible Only on Digital Breast Tomosynthesis

Monday, Nov. 28 10:40AM - 10:50AM Room: Arie Crown Theater

Participants
Jin You Kim, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hyun Jung Kang, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Hyun Lee, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Tae Hong Lee, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Suk Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze the clinicopathologic and immunohistochemical features of invasive breast cancers visible only on digital breast tomosynthesis (DBT) compared to those visible on both DBT and full-field digital mammography (FFDM).

METHOD AND MATERIALS

The medical records of 205 women with invasive breast cancer who underwent FFDM and DBT prior to surgery between April 2015 and February 2016 were retrospectively reviewed. For women with multifocal or bilateral cancer, the largest tumor was included. To assess the visibility of each lesion, two radiologists first reviewed the FFDM data alone and then the DBT combined with FFDM data; consensus was attained. The clinicopathologic and immunohistochemical features of tumors visible on DBT only and both DBT and FFDM were compared.

RESULTS

Of 205 cancers, 175 (85.4%) were visible on both DBT and FFDM ("both-visible" group). Twenty cancers (9.6%) not visible on FFDM were recognized by DBT as a mass (55.0%), an asymmetric density (35.0%), or an architectural distortion (10.0%) ("DBT-only" group). The remaining 10 tumors (4.9%) were not evident on either DBT or FFDM ("both-occult" group). The mean tumor size of the DBT-only group was significantly smaller than that of the both-visible group (1.53 ± 0.79 vs. 2.35 ± 1.26 cm, P=0.027) but did not differ significantly from that of the both-occult group (1.53 ± 0.79 vs. 1.89 ± 1.09 cm, P=0.310). Tumors of the DBT-only group had more lower histological grade (45.0% vs. 14.9%, P=0.001), estrogen receptor positivity (100.0% vs. 76.0%, P=0.013), progesterone receptor positivity (95.0% vs. 68.6%, P=0.013), human epidermal growth factor receptor-2 negativity (95.0% vs. 71.4%, P=0.023), and lower expression levels of Ki-67 (45.0% vs. 20.6%, P=0.014), compared to the both-visible group. All tumors in the DBT-only group were luminal subtype. Dense breast parenchyma was more common in the DBT-only than the both-visible group (90.0% vs. 64.0%, P=0.019). No DBT-only tumor exhibited calcification as the only mammographic finding.

CONCLUSION

In patients with invasive breast cancer, tumors visible only on DBT were less histologically aggressive than tumors visible on both DBT and FFDM.

CLINICAL RELEVANCE/APPLICATION

The use of digital breast tomosynthesis in addition to conventional mammography increases the detection of less aggressive subtype of invasive breast cancer.

RC215-12 A Randomized Controlled Trial to Evaluate Efficacy of Tomosynthesis versus Digital Mammography Screening in Reducing Interval and Advanced Breast Cancer Incidence: Preliminary Results

Monday, Nov. 28 10:50AM - 11:00AM Room: Arie Crown Theater

Participants
Valentina Iotti, MD, Reggio Emilia, Italy (*Presenter*) Nothing to Disclose
Cinzia Campari, Reggio Emilia, Italy (*Abstract Co-Author*) Nothing to Disclose
Andrea Nitrosi, PhD, Reggio Emilia, Italy (*Abstract Co-Author*) Nothing to Disclose
Rita Vacondio, Reggio Emilia, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Giorgi Rossi, Reggio Emilia, Italy (*Abstract Co-Author*) Nothing to Disclose

Pierpaolo Pattacini, Reggio Emilia, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the impact of screening with digital breast tomosynthesis (DBT) compared with digital mammography (DM) on breast cancer prognosis and mortality in a randomized test and treat study. Will be presented interim data at baseline on detection rate, recall rate, and positive predictive value on recalls.

METHOD AND MATERIALS

Consenting women attending the population-based (45-70 age range) mammography screening of our provincial program and presenting for a new screening round, were invited to participate in the study and randomized to DM (standard of care) or DBT + DM two-view bi-lateral examinations, both with double independent reading. Results of DBT only were recorded separately for analyses, and women in the investigational arm were managed based on the combined evaluation of DBT and DM. Interval between screening rounds is one and two years for women 45-49 and 50-70 age groups, respectively. The planned sample size is 20.000 women per arm (NCT02698202).

RESULTS

From March 2014 to March 2016, 38762 women have been invited. Among the 79% accepting the screening call, 50.6% consented to participate and were enrolled in the study.
Data for 9776 women were available at the interim analysis: 4832 in the DM-arm and 4944 in the DBT-arm. Recall rate was 3.6% and 3.5% with DM and DBT, respectively (RR 0.97; 95%CI:0.79-1.20); detection rate was 5.4/1000 and 7.7/1000 (RR 1.43; 95%CI:0.87-2.35), respectively; positive predictive value was 15.5% and 23.3 (RR 1.50; 95%CI:0.96-2.33). Out of 38 cancers identified in the investigational arm, 8 were detectable only in DBT. Reading time was 37" vs 60" in women at first round, (+62%, $p<0.05$) and 32" vs 56" at second round (+75%, $p<0.05$); the increase was not significant in recalled women: 99" vs 108" and 93" vs 108" at first and second round, respectively.

CONCLUSION

Initial data from this randomized two-arm study confirmed the results of higher detection rate without increasing recall rate with DBT screening. By August 2016, the second year interim results on about 20,000 women will be available.

CLINICAL RELEVANCE/APPLICATION

In this randomized two-arm study in a screening setting, tomosynthesis confimed a higher detection rate compared to digital mammography, without increasing the recall rate.

RC215-13 Breast Cancer Screening

Monday, Nov. 28 11:00AM - 11:20AM Room: Arie Crown Theater

Participants
Robert A. Smith, PhD, Atlanta, GA, (robert.smith@cancer.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe current screening guidelines and factors influencing differences. 2) State global evidence for effectiveness of breast cancer screening. 3) Describe opportunities for improved effectiveness of breast cancer screening in the U.S.

RC215-14 Trends in Screening Mammography Interpretation over 4 Years with Digital Breast Tomosynthesis: Are Recall and Cancer Detection Rates Maintained?

Monday, Nov. 28 11:20AM - 11:30AM Room: Arie Crown Theater

Awards
Student Travel Stipend Award

Participants
Christine Chen, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Melissa A. Durand, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Hologic, Inc
Madhavi Raghu, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Regina J. Hooley, MD, New Haven, CT (*Abstract Co-Author*) Consultant, FUJIFILM Holdings Corporation; Consultant, Siemens AG
Liane E. Philpotts, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Digital breast tomosynthesis (DBT) has been shown to reduce recall rate and increase cancer detection in screening compared to 2D-mammography during its initial implementation; however, outcome metrics during subsequent rounds of interpretation are uncertain. The purpose of this study was to determine whether the initial improved outcomes can be maintained and to assess trends in these metrics over time.

METHOD AND MATERIALS

A HIPPA-compliant retrospective review of the electronic database (PenRad, MN) at five clinical sites was performed over 4 consecutive years since introduction of DBT at our facility (8/1/2011-7/31/2015). DBT screens interpreted by breast-subspecialized radiologists were identified. Recall rate (RR), cancer detection rate (CDR) and positive predictive value for recall (PPV1) for each one-year study period (DBT1-4) were analyzed and compared with those of 2D digital mammography control from 8/1/2008 to 7/31/2010 (2D-DM). Differences in outcome metrics between consecutive DBT years were also assessed. Percentage of screen-detected in-situ vs invasive cancers for each study period was calculated.

RESULTS

A total of 42,470 screening DBT exams were performed during a 4-year period (vs. 20,553 2D-DM screening exams over 2-year period). Recall rate decreased slightly over 4 years of DBT (DBT1, 7.9%; DBT2, 8.7%; DBT3, 7.9%; DBT4, 7.5%) and remained significantly reduced compared with 2D-DM recall rate of 11.4% ($p<.05$). A trend toward increasing cancer detection rate per 1000 exams was observed over years 1 to 4 of DBT (DBT1, 5.7; DBT2, 5.1; DBT3, 5.9; DBT4, 6.4 vs. 2D-DM, 3.8), which was

significantly different from 2D-DM in the third and fourth DBT years (p<.05). Similarly, there was a trend toward rising PPV1 over 4 years of DBT (DBT1, 7.2%; DBT2, 5.9%; DBT3, 7.4%; DBT4, 8.5% vs. 2D-DM, 3.4%). Significant increase in PPV1 with DBT versus 2D-DM was sustained across years 2-4 of DBT (p<.05). A higher percentage of invasive cancers was detected over time (DBT1, 50%; DBT2, 55%; DBT3, 59%; DBT4, 74% vs. 2D-DM, 59%).

CONCLUSION

Significant RR reduction and increase in CDR and PPV1 with DBT screening is sustainable. Our results showed a trend toward continued improvement in these outcome metrics over time.

CLINICAL RELEVANCE/APPLICATION

The sustainable, superior performance of DBT over 2D-DM illustrates the integral role of DBT in breast cancer screening, which has important implications for policy making in the future.

RC215-15 Current Era Screening Mammography Outcomes from the National Mammography Database, Involving Nearly 7 Million Examinations

Monday, Nov. 28 11:30AM - 11:40AM Room: Arie Crown Theater

Participants
Cindy S. Lee, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Debapriya Sengupta, MBBS,MPH, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Judy Burleson, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Mythreyi Bhargavan-Chatfield, PhD, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Edward A. Sickles, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. Burnside, MD, MPH, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Zuley, MD, Pittsburgh, PA (*Abstract Co-Author*) Research Grant, Hologic, Inc;

PURPOSE

Mammography is the standard imaging examination for breast cancer screening and has substantially reduced mortality from breast cancer. In the last decade, different interpretations of the evidence on outcomes have resulted in various screening guidelines and debate regarding the balance of benefits and risks of mammography screening. There is uncertainty about when to stop screening, as women ≥75 years were not included in randomized trials, limiting available data to mostly small observational studies. This knowledge gap may be informed by new large-scale evidence from the National Mammography Database (NMD), an, up-to-date mammography outcomes database with data representing a large proportion of US states. The purpose of our study is to evaluate the relationship between patient age and screening mammography performance metrics in women age ≥40 years.

METHOD AND MATERIALS

Our HIPAA Compliant and IRB approved project analyzed data from 218 mammography facilities in 39 states in the NMD registry. The NMD receives clinical practice data including self-reported demographics, clinical findings, screening mammography interpretation, and biopsy results (the reference standard). Performance metrics calculated were cancer detection rate, recall rate, and positive predictive values for biopsy recommended (PPV2) and biopsy performed (PPV3).

RESULTS

We analyzed data for 6,980,054 screening mammograms performed between January 2008 and December 2014 in 3,416,075 women. Overall, we found a mean cancer detection rate of 3.65 per 1000 (95% CI: 3.60-3.69), recall rate of 10% (95% CI: 10-10%), PPV2 of 20% (95% CI: 19-20%), and PPV3 of 28% (95% CI: 28-29%). Based on increasing age, performance metrics demonstrate a gradual upward trend for cancer detection rate, PPV2 and PPV3, and downward trend in recall rate, until age 90 years.

CONCLUSION

The NMD provides up-to-date nationwide benchmarks for screening performance metrics. According to these metrics demonstrating preserved cancer detection, recall rate, and PPV, our study suggests that there is no clear age cut-point to inform the decision when to stop screening.

CLINICAL RELEVANCE/APPLICATION

The stability of screening mammography performance metrics in women aged 75-90 years, does not provide evidence for age-based mammography cessation but rather adds support for guidelines that encourage screening decisions based on individual patient values, co-morbidities, and health status.

RC215-16 National Performance Benchmarks for Modern Screening Digital Mammography: Update from the Breast Cancer Surveillance Consortium

Monday, Nov. 28 11:40AM - 11:50AM Room: Arie Crown Theater

Participants
Constance D. Lehman, MD, PhD, Boston, MA (*Presenter*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company
Rob F. Arao, MPH, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Brian L. Sprague, PhD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose
Janie M. Lee, MD, Bellevue, WA (*Abstract Co-Author*) Research Grant, General Electric Company
Diana S. Buist, PhD,MPH, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Diana Miglioretti, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Louise M. Henderson, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Tracy Onega, PhD,MS, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose
Anna N. Tosteson, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose
Garth H. Rauscher, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Karla Kerlikowske, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To establish performance benchmarks for modern screening digital mammography and assess performance trends over time in U.S. community practice.

METHOD AND MATERIALS

In this HIPAA compliant IRB approved study we measured performance of digital screening mammography interpreted by 359 radiologists across 95 facilities in six Breast Cancer Surveillance Consortium registries. The study population included 1,682,504 digital screening mammograms performed between 2007 and 2013 in 792,808 women. Performance measures were calculated according to the American College of Radiology BI-RADS 5th edition and compared to published prior benchmarks by the BCSC, the National Mammography Database (NMD) and published recommendations for performance by expert opinion. Benchmarks were derived from the distribution of performance metrics across radiologists and presented as 50th (median), 10th, 25th, 75th and 90th percentiles with graphic presentations using smoothed curves.

RESULTS

Mean performance measures (95% Confidence Interval) were: abnormal interpretation rate (AIR)11.6% (11.5%-11.6%); cancers detected per 1000 screens (CDR) 5.1 (5.0-5.2); sensitivity 86.9% (86.3%-87.6%); specificity 88.9% (88.8%-88.9%); false negative rate per 1000 screens 0.8 (0.7-0.8); PPV-1 4.4% (4.3%-4.5%); PPV-2 25.6% (25.1%-26.1%); PPV-3 28.6% (28.0%-29.3%); 76.9% of screen detected cancers were stage 0 or 1; 57.7% were minimal cancers; 79.4% were node negative invasive cancers. Recommended CDRs were achieved by 92.1% of radiologists in community practice and 97.1% achieved recommended ranges for sensitivity. CDR was significantly higher than that reported by the NMD (3.4/1000). Only 59.0% of radiologists achieved recommended AIR and 63.0% achieved recommended specificity.

CONCLUSION

The majority of radiologists in the BCSC surpass performance recommendations for screening mammography; however, abnormal interpretation rates continue to be higher and specificity lower than the recommended rates for almost half of radiologists interpreting screening mammograms.

CLINICAL RELEVANCE/APPLICATION

Efforts to implement advanced technology should be combined with effective educational programs to reduce false-positive rates without sacrificing high detection rates of invasive cancers.

RC215-17 Trade-Offs of Risk-Based Versus Age-Based Mammography Screening in Women Aged < 50 Years

Monday, Nov. 28 11:50AM - 12:00PM Room: Arie Crown Theater

Participants
Elizabeth S. Burnside, MD, MPH, Madison, WI (*Presenter*) Nothing to Disclose
Wendy B. Demartini, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Sarina Schrager, MD,MS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Amy Trentham-Dietz, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
John Hampton, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Christina Shafer, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Lee G. Wilke, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Risk-based screening in women < 50 years old has been promoted to increase benefits and decrease harms of a mammography screening program, but has not been evaluated in practice. We compared the impact of risk-based screening to age-based screening in women <50 to determine screening program outcomes.

METHOD AND MATERIALS

We analyzed a database of consecutive screening mammograms (1/1/2006-12/31/2013) from an academic practice—starting at 40 without an upper age limit. To evaluate only "average risk" women, we excluded those with a personal history of breast cancer or with documented BRCA mutation. We matched our population with a cancer registry as our reference standard. In women <50 we used clinical intake data at the time of each mammogram to estimate breast cancer risk using the BCSC risk calculator (https://tools.bcsc-scc.org/bc5yearrisk/calculator.htm). We emulated a risk-based screening strategy by excluding women <50 whose five-year breast cancer risk was less than the average risk for a 50-year old (≤ 1.253%). We emulated an age-based screening similar to the American Cancer Society guidelines by removing all women <45. We compared outcomes for the two strategies, including number of cancers detected, proportion of DCIS/all cancers), recalls, and biopsies using the chi-square statistical test, defining a p value of <0.05 as statistically significant.

RESULTS

In our actual clinical baseline practice, screening average risk women age ≥40, we performed 75,107 screening mammograms in 25,155 women and detected 344 cancers—230 invasive (183 local and 43 regional) and 91 DCIS, and had 4,816 recalls and 995 biopsy recommendations (Table). Clinical practice audit outcomes were cancer detection rate of 4.58/1000 and recall rate of 8.2%. Age-based screening starting at 45 detected more cancers than risk-based screening ($p<0.05$), while prompting more recalls ($p<0.0001$) and biopsies ($p<0.01$). There was no statistically significant difference in the proportion of DCIS ($p=0.99$).

CONCLUSION

Risk-based screening in women < 50 results in less recalls and biopsies but also detects fewer cancers than an age-based strategy that starts screening at age 45.

CLINICAL RELEVANCE/APPLICATION

Evaluating the potential effects of risk-based compared to age-based strategies can enumerate trade-offs: fewer cancers detected and false positives without altering the proportion of DCIS.

RC216

Tweet This: How to Make Radiology More Patient Centered (Sponsored by the RSNA Public Information Committee)

Monday, Nov. 28 8:30AM - 10:00AM Room: E352

LM PR

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

Participants
Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (*Moderator*) Advisory Board, General Electric Company; Elliot K. Fishman, MD, Baltimore, MD (*Presenter*) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company;
Susan D. John, MD, Houston, TX (*Presenter*) Nothing to Disclose
Whitney Fishman Zember, MBA, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the rationale for and growing value of increased personalization of patient interactions in diagnostic radiology. 2) Communicate patient-centered radiology principles to residents and other colleagues. 3) Identify different avenues, including traditional, digital and social media, to engage our patients.

ABSTRACT

Modern medicine has become so complicated and sub-specialized that patients and their families often are confused. Frequently patients are not even aware that a radiologist is providing important services or the nature of those services. Increasingly, patients are turning to the Internet for answers. In the current era of consumer-driven healthcare, patient portals, online health resources and social media, radiologists must provide personal and patient-friendly services and use a variety of means to connect with patients. This course will provide specific examples and strategies for harnessing the power of the Internet and social media to become more patient centered.

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/

Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
Elliot K. Fishman, MD - 2016 Honored Educator

RC217

Emerging Technology: Dual Energy CT - Opportunities and Challenges

Monday, Nov. 28 8:30AM - 10:00AM Room: S505AB

CT

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

Participants
Savvas Nicolaou, MD, Vancouver, BC (*Moderator*) Institutional research agreement, Siemens AG

LEARNING OBJECTIVES

1) Review the basic principles of dual energy CT/Spectral imaging. 2) Demonstrate the applications of new and emerging techniques implemented using dual energy CT including: liver virtual non-contrast, material characterization/decomposition, uses of monoenergetic imaging, bone and vessel subtraction, bone marrow edema and gout. 3) Discuss the current challenges with dual energy CT/Spectral imaging including: workflow implications, protocol management, and maximization of utility.

ABSTRACT

Sub-Events

RC217A Primer on DECT/Spectral CT Physics

Participants
Aaron D. Sodickson, MD, PhD, Boston, MA, (asodickson@bwh.harvard.edu) (*Presenter*) Research Grant, Siemens AG; Consultant, Bayer AG

LEARNING OBJECTIVES

1) Explain key requirements of dual energy CT acquisition, and compare different CT manufacturer approaches. 2) Describe a variety of dual energy post-processing techniques relevant to clinical practice.

ABSTRACT

Honored Educators

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

Aaron D. Sodickson, MD, PhD - 2014 Honored Educator

RC217B Practical Applications of DECT in the Abdomen

Participants
Patrick D. McLaughlin, FFRRCSI, Vancouver, BC, (mclaughlin.paddy@gmail.com) (*Presenter*) Speaker, Siemens AG

LEARNING OBJECTIVES

View learning objectives under the main course title.

RC217C Clinical Utility of Dual Energy and Spectral CT in Assessing the Musculoskeletal System

Participants
Fabio Becce, MD, Lausanne, Switzerland, (fabio.becce@chuv.ch) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Comprehend the basic principles and technical aspects of dual energy and spectral CT when imaging the musculoskeletal system. 2) Apply dual energy and spectral CT techniques when assessing various musculoskeletal disorders, notably crystal-induced arthropathies. 3) Identify the latest applications of dual energy and spectral CT techniques in musculoskeletal imaging.

ABSTRACT

RC217D A Rheumatologists Perspective on the Clinical Utility of Dual Energy CT in Gout/CPPD

Participants
Hyon-Khoo Choi, MD, Boston, MA (*Presenter*) Research Consultant, Takeda Pharmaceutical Company Limited; Research Grant, AstraZeneca PLC

LEARNING OBJECTIVES

View learning objectives under the main course title.

RC217E Implementing Dual Energy CT in Clinical Practice: A Community Radiologist's Perspective

Participants
Kenneth Wong, MD, New Westminster, BC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) As a result of attending this presentation you will be able 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.

ABSTRACT

RC218

Have RADS Gone Wild? Remaining Challenges of Standardized Reporting and Data Systems

Monday, Nov. 28 8:30AM - 10:00AM Room: S504AB

OI IN SQ

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

Participants

Sub-Events

RC218A BI-RADS: Why Bother?

Participants
Carol H. Lee, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the rationale behind the development of BI-RADS. 2) Comprehend the application of BI-RADS in clinical practice. 3) Recognize the contribution of BI-RADS in improving patient outcomes.

ABSTRACT

RC218B LI-RADS: Pros, Cons and Solutions

Participants
Claude B. Sirlin, MD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Guerbet SA; ;

LEARNING OBJECTIVES

1) To review the advantages, challenges, solutions, and future directions for standardized reporting of liver imaging examinations using LI-RADS.

RC218C PI-RADS: What Is the Supporting Evidence?

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

LEARNING OBJECTIVES

1) Understand the rationale for PI-RADS. 2) Highlight the updates included in PIRADS v2. 3) Discuss the evidence basis for PI-RADS and present the literature highlighting its strengths and limitations.

ABSTRACT

The Prostate Imaging Reporting and Data System (PI-RADS), published in 2012, was one of the first well-orchestrated efforts focused on "integration, reporting and communication of multi-parametric prostate MRI". The guideline was updated in 2015 (PI-RADS v2) to address some of the limitations of the original version. This session will cover the highlights of PI-RADS v2 and discuss the published evidence supporting or questioning the recommendations included in this guideline.

RC220

Imaging Evaluation, Target Delineation and Response Evaluation for Skull Base and Spinal Stereotactic Radiosurgery/Radiotherapy

Monday, Nov. 28 8:30AM - 10:00AM Room: S404CD

NR BQ RO

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

Participants
Simon S. Lo, MD, Seattle, WA, (simonslo@uw.edu) (*Moderator*) Research support, Elekta AB; Travel support, Accuray Incorporated; Speaker, Accuray Incorporated;

LEARNING OBJECTIVES

After the course, participants should be able to discuss:1. Imaging Evaluation, Target Delineation and Response Evaluation for Stereotactic Radiotherapy for Skull Base Tumors.2. Imaging Evaluation, Target Delineation and Response Evaluation for Stereotactic Body Radiotherapy for Spinal Metastases.

ABSTRACT

Sub-Events

RC220A Imaging Evaluation of Skull Base and Spinal Tumors

Participants
Pejman Jabehdar Maralani, MD, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To demonstrate the role of various imaging modalities for detection and follow up of spinal and skull base metastasis. 2) To demonstrate the role of imaging in pre-radiation planning with a focus on SBRT.

ABSTRACT

The aim of this presentation is to discuss the diagnostic performance of plain film, CT scan, bone scan, MRI and PET for detection and follow up of spinal and skull base bony metastasis. We will discuss the lasts trends and limitations regarding each modality. We also discuss dedicated role of imaging in planning for SBRT.

RC220B Target Delineation and Response Evaluation for Skull Base Stereotactic Radiosurgery/Radiotherapy

Participants
Lia M. Halasz, MD, Seattle, WA, (lhalasz@uw.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the challenges of target and normal structure delineation in the skull base. 2) Identify imaging modalities helpful to target and normal structure delineation. 3) Review data on pseudoprogression after radiation therapy to skull base tumors.

ABSTRACT

The aim of this session is to understand the challenges of target delineation and response evaluation in the treatment of skull base tumors. We will discuss helpful imaging modalities to aid in contouring and the issue of pseudoprogression in determining response.

RC220C Target Delineation for Spinal Stereotactic Radiosurgery/Radiotherapy

Participants
Kristin J. Redmond, MD, MPH, Baltimore, MD (*Presenter*) Research support, Elekta AB

RC220D Response Evaluation for Spinal Stereotactic Radiosurgery/Radiotherapy

Participants
Sten Myrehaug, MD, FRCPC, Toronto, ON (*Presenter*) Speakers Bureau, Pfizer Inc; Speakers Bureau, Novartis AG

LEARNING OBJECTIVES

1) Appreciate the challenges of spine response determination. 2) Issue of radiographic pseudoprogression. 3) Clinical trials and incorporation of response criteria.

ABSTRACT

The aim of this session is to understand the challenges of response determination with spine SBRT. In particular the issues of radiographic changes following high dose radiation. Clinical trials are in flux and determining how to handle response which will be discussed.

RC221

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

Monday, Nov. 28 8:30AM - 10:00AM Room: E451A

CT PH

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

Participants

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

Sub-Events

RC221A Contrast Administration for Cardiovascular Imaging and Beyond

Participants
Dominik Fleischmann, MD, Palo Alto, CA (*Presenter*) Research support, Siemens AG;

Handout:Dominik Fleischmann

http://abstract.rsna.org/uploads/2016/16001080/RSNA2016_Contrast__FLEISCHMANN.pdf

RC221B Perfusion Techniques and Applications-Stroke and Cancer

Participants
Ting-Yim Lee, MSc, PhD, London, ON (*Presenter*) License agreement, General Electric Company

RC221C Perfusion Techniques and Applications-Cardiac

Participants
Aaron So, PhD, London, ON, (aso@robarts.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Comprehend the theoretical basis and pitfalls of each myocardial CTP method (qualitative, semi-quantitative and quantitative). 2) Assess the sources and solutions of various image artifacts in myocardial CTP. 3) Evaluate the effectiveness of radiation dose reduction methods for low dose quantitative myocardial CTP. 4) Develop the optimal myocardial CTP protocol for assessing high-risk coronary artery disease. 5) Assess the recent advances in quantitative CTP for imaging myocardial edema and scar and their potential applications to guide therapy in post infarction settings.

ABSTRACT

RC222

Imaging for Proton Treatment Guidance and Verification

Monday, Nov. 28 8:30AM - 10:00AM Room: S102C

RO PH

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

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

RC222A 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.

RC222B Advanced Imaging Techniques for Range Verification

Participants
Brian A. Winey, PhD, MS, Boston, MA (*Presenter*) Research Grant, Elekta AB; Travel support, Elekta AB; Travel support, Ion Beam Applications SA

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.

Active Handout:Brian Andrew Winey

http://abstract.rsna.org/uploads/2016/15001741/ACTIVE RC222B RSNA_2016.pdf

RC223

ABR Maintenance of Certification for Medical Physicists

Monday, Nov. 28 8:30AM - 10:00AM Room: S102D

ED PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants
G. Donald Frey, PhD, Charleston, SC, (dfrey@theabr.org) (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the recent changes in the ABR MOC program for physicists. 2) Understand simplified attestation. 3) Understand the new areas for PQI.

ABSTRACT

The ABR has made significat changes to the MOC program for medical physicists. These include 1) Simplified attestation, 2) an expanded range of PQI, 3) annual lookbacks & 4) changes to the cognitive exam requirement with the introduction of the OLA program. This refresher course will review the entire program with an emphasis on recent changes.

Sub-Events

RC223A MOC Requirements

Participants
G. Donald Frey, PhD, Charleston, SC, (dfrey@theabr.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The learner will be able to prepare for the 2016 lookback. 2) The learner will understand the nature of the new OLA program as a replacement for the routine cognitive exam. 3) The learner will be able to use the changes in the MOC program.

ABSTRACT

The ABR MOC process has been in place for more than a decade. The process requires for elements. This presentation will review the four elements with an emphasis on some recent enhancements. Several years ago the ABR replaced the time limited certificates with a "continuous certification" process. Continuous certification is based on an annual "lookback." The first complete lookback was in March of 2016 and there will be one each year in March. This presentaion will help medical physicists be ready for their next lookback.

RC223B PQI Projects

Participants
Jerry D. Allison, PhD, Augusta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The learner will understand the context of and purpose for Performance Quality Improvement (PQI). 2) The learner will understand the "Plan, Do, Study, Act" PQI cycle. 3) The learner will understand requirements for PQI projects. 4) The learner will understand types of PQI projects.

ABSTRACT

Practice Quality Improvement (PQI) is a key element of the ABR MOC continuous certification process. This presentation will review the framework for PQI including the "Plan, Do, Study, Act" cycle for PQI project cycles, PQI project requirements, types of PQI projects and PQI project documentation.

RC223C The MOC Cognitive Exam

Participants
J. Anthony Seibert, PhD, Sacramento, CA, (jaseibert@ucdavis.edu) (*Presenter*) Advisory Board, Bayer AG

LEARNING OBJECTIVES

1) The learner will identify the content of the MOC cognitive exam for each of the specific Medical Physics disciplines (Therapy Medical Physics, Diagnostic Medical Physics, Nuclear Medical Physics). 2) The learner will understand the percentage of fundamental and current clinical question topics and how the exam is assembled. 3) The learner will know how to prepare for the examination based on reference materials used in developing questions, and when to consider taking the exam within the 10 year MOC cycle.

ABSTRACT

Part 3 of the MOC "Continuous Certification" policy represents the Cognitive Expertise component for participating diplomates of the American Board of Radiology, and is required to maintain the ongoing validity of the certificate (except for lifetime certificate holders). In order to fulfill this requirement, the Diplomate must pass the MOC cognitive exam within the past 10 years. The content of the exam is 30 percent fundamental core questions and the remainder represents recent advances in the field for each of the Medical Physics disciplines.Exams are offered each year at a testing center and can be taken at any time during the MOC process. The Diplomate must take an exam in each discipline in which certification is being maintained. Details of the exam, its content, any

study guides useful for preparing for the exam are discussed.

RC224

Radiological and Nuclear Terrorism: Like It or Not, Radiology Professionals Will Be in the 'Hot' Seat

Monday, Nov. 28 8:30AM - 10:00AM Room: S502AB

HP OT SQ

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

FDA Discussions may include off-label uses.

Participants
Donald P. Frush, MD, Durham, NC, (donald.frush@duke.edu) (*Moderator*) Nothing to Disclose
John Lanza, MD, Pensacola, FL (*Presenter*) Nothing to Disclose
Nick Dainiak, MD, Oak Ridge, TN, (Nick.dainiak@orau.org) (*Presenter*) Nothing to Disclose
Brooke R. Buddemeier, Livermore, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To describe the scenarios for an radiological dispersal device (RDD) or improvised nuclear device (IND). 2) To discuss roles of federal, state, and local governments. 3) To review the roles and strategies of hospital teams, including radiology professionals in the setting of an RDD/IND. 4) To provide resources for radiology professionals for response in the setting of RDD/IND. 5) Describe the very large mass casualty scenarios of concern that radiologists might be called to help with. 6) Understand is the difference between radiation contamination and exposure. 7) Understand the clinical strategies used to manage contamination and exposure. 8) Identify internet resources physicians can use to inform themselves about preparing for and participating in responses to these types of incidents.

ABSTRACT

RC225

Perspectives on Exposure and Risk-Visions of Radiation Safety: What We Can, Should and Would Do to Make Patients and Staff Safer

Monday, Nov. 28 8:30AM - 10:00AM Room: S403B

PH SQ

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

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC225A Setting Targets for 2020

Participants
Madan M. Rehani, PhD, Boston, MA, (madan.rehani@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define what ideal situation of safety of patient and staff should be. 2) Identify actions that can be taken towards that goal of ideal safety. 3) Comprehend what we would be doing if wishful in safety happens.

RC225B Increasing Level of Appropriateness

Participants
James A. Brink, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the principles of referral guidelines and appropriateness criteria for imaging examinations. 2) To review the mechanism and impact of clinical decision support for referring physicians on the appropriateness of imaging examinations. 3) To explore clinical decision support for radiologists and its potential impact on radiologists' recommendations for clinically significant imaging findings.

ABSTRACT

RC225C Reducing Doses and Risks in Nuclear Medical Procedures

Participants
Andrew J. Einstein, MD, PhD, New York, NY, (andrew.einstein@columbia.edu) (*Presenter*) Research Grant, Koninklijke Philips NV; Research Grant, Toshiba Corporation

LEARNING OBJECTIVES

1) Understand how radiation dose is estimated in nuclear medicine procedures. 2) Identify justification and optimization as the fundamental principles of radiological projection. 3) Apply dose-reduction techniques in nuclear medicine while ensuring image quality and diagnostic certainty.

ABSTRACT

This lecture will cover principles of radiation protection and how they can be practically applied in nuclear medicine.

RC225D The Broad Relevance of Safety Culture in Medical Imaging

Participants
Ehsan Samei, PhD, Durham, NC, (samei@duke.edu) (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Understand the broad concept of safety in medical imaging incorporating both the risk of sub-optimal and over-optimal imaging. 2) Understand the relevance of radiation safety in the patient well-being. 3) Understand the relative role of individual and cumulative dose.

ABSTRACT

RC225E Discussion

Participants

RC227

MACRA: Radiology Tools for Success

Monday, Nov. 28 8:30AM - 10:00AM Room: S402AB

HP

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants

Ezequiel Silva III, MD, San Antonio, TX (*Moderator*) Nothing to Disclose
Pamela Kassing, Reston, VA (*Coordinator*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON, (frybicki@toh.ca) (*Presenter*) Nothing to Disclose
Mythreyi Bhargavan-Chatfield, PhD, Reston, VA, (mchatfield@acr.org) (*Presenter*) Nothing to Disclose
J. Raymond Geis, MD, Fort Collins, CO (*Presenter*) Shareholder, Montage Healthcare Solutions, Inc; Advisor, Nuance Communications, Inc;

LEARNING OBJECTIVES

1) To define MACRA and how it applies to radiology. 2) To provide details regarding new quality programs. 3) To describe how radiologists can participate in quality initiatives as they pertain to metrics and appropriate use of medical imaging exams.

ABSTRACT

MACRA stands for the 'Medicare Acccess and CHIP (Children's Health Insurance Program) Reauthorization Act of 2015'. Details can be found at the following website: cms.gov. This legislation has several important implications for radiology as a practice, and for indivudual radiologists who add value to the overall healthcare system. MACRA is desingned to accelerate the U.S. trend to value-based care. Part of this initiative is participation in quality programs. The two types of programs are Merit-Based Incentive Payment System (MIPS) and Alternative Payment Models (APMs). MIPS, the first strategy, uses pieces of well-established programs that have been important to radiology.The purpose of this presentation is to familiarize conference attendees with ongoing initiatives to improve quality in radiology, in particular with respect to quality metrics designed by radiologists that are important to our field. The presentation will also highlight other initiatives to perform and measure appropriate imaging as a means for quality improvement.

Honored Educators

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Frank J. Rybicki III, MD, PhD - 2016 Honored Educator

RC229

Rectal Carcinoma: Pre and Post Treatment Evaluation with MRI (An Interactive Session)

Monday, Nov. 28 8:30AM - 10:00AM Room: N228

GI MR OI

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

Participants

Sub-Events

RC229A Rectal Carcinoma Pre-Treatment Staging Standardized Reporting: Have you Checked the 'DISTANCE?'

Participants
Caroline Reinhold, MD, MSc, Montreal, QC (*Presenter*) Consultant, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) To propose a MR imaging protocol for staging newly diagnosed rectal carcinoma. 2) To understand the anatomy of the rectum and mesorectum as pertains to MRI staging. 3) To propose a step-by-step approach for standardized MRI staging of pre-treatment rectal carcinoma using the mnemonic "DISTANCE".

ABSTRACT

In the Western Hemisphere, colorectal cancer is the third most common cancer in men after prostate and lung, and the second most common in women after breast cancer. One-third of colorectal cancers occur in the rectum. Survival rates for rectal cancer have improved in the past decade due to the combined effects of better staging, improved preoperative treatment strategies and total mesorectal excision (TME) surgery. Several studies have been published showing the ability of MRI to accurately stage rectal cancer and predict a negative circumferential resection margin. Moreover, advances in preoperative therapies require accurate preoperative MRI staging to select those patients who may benefit from chemoradiation prior to surgery. To accurately stratify patients according to the risk of local and distant failure, imaging takes on the same importance as tumor type and genetic susceptibility. However, rectal cancer evaluation by MRI continues to pose a challenge in non experts' hands. This presentation will present a mnemonic: "DISTANCE" to enable a systematic and standardized approach to the interpretation of MR imaging in newly diagnosed rectal cancers, thereby enabling all the clinically relevant features to be adequately assessed: DIS: for Distance from the Inferior part of the tumor to the transitional Skin, T: for T staging, A: for Anal complex, N: for Nodal staging, C: for Circumferential Resection Margin, E: for Extramural vascular invasion.

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Caroline Reinhold, MD, MSc - 2013 Honored Educator
Caroline Reinhold, MD, MSc - 2014 Honored Educator

RC229B Rectal Carcinoma Post-Treatment Evaluation: What Criteria and Imaging Protocol Should I Use?

Participants
Stephanie Nougaret, MD, Montpellier, France (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To highlight current management of rectal cancer including sphincter- and organ-sparing treatment options. 2) To describe how pretreatment multi-parametric rectal MRI may serve as a predictive biomarker of subsequent tumor response to chemoradiation (CRT). 3) To propose a step-by-step approach for accurate interpretation of rectal MRI following CRT and to illustrate how the information gleaned from post CRT multi-parametric rectal MRI may influence treatment decisions.

ABSTRACT

Recent changes in the management of patients with locally advanced rectal cancer highlight the need for accurate assessment of tumor response to chemoradiation (CRT). In the past, CRT was followed by surgical resection in nearly all patients, irrespective of response to CRT. However, new data suggest that surgery may not be necessary in patients with complete response. MR imaging has become an essential tool to enable the oncology team to make appropriate treatment decisions. MRI has so far relied on changes in morphology as a measurement for response. However, this evaluation is hampered by the difficulties in differentiating residual tumor from radiation-induced fibrosis. Recent studies have suggested that adding diffusion-weighted imaging (DWI) to conventional MRI can aid this differentiation and thus improve the prediction of response after neoadjuvant therapy.Thus, the learning objectives for this lecture are as follows:1) To learn about the value of multi-parametric rectal MRI prior to and following CRT for the prediction and subsequent assessment of response to CRT. To understand how rectal MR imaging finding are essential to making patient-centered treatment decisions.2) To become familiar with "DISTANCE" mnemonic and diagnostic clues which provide a systematic approach to the interpretation of rectal MRI images in patients with rectal cancer prior to treatment and following CRT.

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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/

Stephanie Nougaret, MD - 2013 Honored Educator

RC231

Hands-on Musculoskeletal Ultrasound: A Forum for Question and Answer (Hands-on)

Monday, Nov. 28 8:30AM - 10:00AM Room: E258

MK US

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

Participants

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

LEARNING OBJECTIVES

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

ABSTRACT

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

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/

Michael A. Dipietro, MD - 2016 Honored Educator

RC232

Value-Added Initiatives for a Healthcare System

Monday, Nov. 28 8:30AM - 10:00AM Room: N226

IN LM SQ

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

Participants

Sub-Events

RC232A Quality, Value and Outcome Metrics in Diagnostic Radiology - A New Frontier

Participants
Richard E. Heller III, MD, Chicago, IL, (richard.heller@radpartners.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of quality measures in health care and radiology. 2) Identify the two main components of total value in radiology. 3) Assess the differences between the status quo metrics and idealized measures.

ABSTRACT

RC232B Imaging Informatics

Participants
Keith J. Dreyer, DO, PhD, Boston, MA (*Presenter*) Medical Advisory Board, IBM Corporation

RC232C Leveraging IT to Optimize Quality in Radiology

Participants
Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Advisory Board, Bayer AG

RC250

Fallopian Tube Catheterization (Hands-on)

Monday, Nov. 28 8:30AM - 10:00AM Room: E260

GU OB IR

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

FDA Discussions may include off-label uses.

Participants
Amy S. Thurmond, MD, Portland, OR, (thurmondas@gmail.com) (*Presenter*) Nothing to Disclose
Ronald J. Zagoria, MD, San Francisco, CA, (ron.zagoria@ucsf.edu) (*Presenter*) Nothing to Disclose
A. Van Moore Jr, MD, Charlotte, NC (*Presenter*) Nothing to Disclose
Anne C. Roberts, MD, La Jolla, CA (*Presenter*) Nothing to Disclose
David M. Hovsepian, MD, Stanford, CA, (hovsepian@stanford.edu) (*Presenter*) Nothing to Disclose
James E. Silberzweig, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

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

ABSTRACT

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

Active Handout:Amy Suzanne Thurmond

http://abstract.rsna.org/uploads/2016/3990740/Placement of Essure tubal occlusion coils by fluoroscopy.pdf

RC252

US-guided Interventional Breast Procedures (Hands-on)

Monday, Nov. 28 8:30AM - 10:00AM Room: E264

BR US

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

Participants

Gary J. Whitman, MD, Houston, TX (*Presenter*) Book contract, Cambridge University Press
Annamaria Wilhelm, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose
Michael N. Linver, MD, Albuquerque, NM (*Presenter*) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc
Stamatia V. Destounis, MD, Scottsville, NY (*Presenter*) Nothing to Disclose
Anna I. Holbrook, MD, Atlanta, GA, (aiholbr@emory.edu) (*Presenter*) Nothing to Disclose
Alice S. Rim, MD, Cleveland, OH, (rima@ccf.org) (*Presenter*) Nothing to Disclose
Eren D. Yeh, MD, Boston, MA (*Presenter*) Consultant, Hologic, Inc; Consultant, Statlife
Gary W. Swenson, MD, Mason City, IA, (Sehwong@me.com) (*Presenter*) Nothing to Disclose
Catherine W. Piccoli, MD, Voorhees, NJ, (cpiccoli@sjra.com) (*Presenter*) Stockholder, Qualgenix LLC;
Michael P. McNamara Jr, MD, Cleveland, OH (*Presenter*) Stockholder, General Electric Company; Stockholder, Apple Inc
Selin Carkaci, MD, Miami, FL, (selincarkaci@msn.com) (*Presenter*) Author with royalties, Reed Elsevier
Jean M. Seely, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Phan T. Huynh, MD, Houston, TX (*Presenter*) Nothing to Disclose
Basak E. Dogan, MD, Houston, TX, (Basak.Dogan@UTsouthwestern.edu) (*Presenter*) Nothing to Disclose
Jiyon Lee, MD, New York, NY, (Jiyon.Lee@nyumc.org) (*Presenter*) Nothing to Disclose
Tanya W. Moseley, MD, Houston, TX (*Presenter*) Nothing to Disclose
Michelle D. McDonough, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose
Peter R. Eby, MD, Seattle, WA (*Presenter*) Consultant, Devicor Medical Products, Inc
William R. Poller, MD, Pittsburgh, PA (*Presenter*) Consultant, Devicor Medical Products, Inc; Consultant, General Electric Company;
Alexis V. Nees, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
H. Carisa Le-Petross, MD, Houston, TX (*Presenter*) Nothing to Disclose
Paula B. Gordon, MD, Vancouver, BC (*Presenter*) Stockholder, OncoGenex Pharmaceuticals, Inc ; Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd
Mohammad Eghtedari, MD, PhD, La Jolla, CA, (meghtedari@ucsd.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the equipment needed for ultrasound guided interventional breast procedures. 2) Review the basic principles of ultrasound guidance and performance of minimally invasive breast procedures. 3) Practice hands-on technique for ultrasound guided breast interventional procedures.

ABSTRACT

This course is intended to familiarize the participant with equipment and techniques in the application of US guided breast biopsy and needle localization. Participants will have both basic didactic instruction and hands-on opportunity to practice biopsy techniques on tissue models with sonographic guidance. The course will focus on the understanding and identification of: 1) optimal positioning for biopsy 2) imaging of adequate sampling confirmation 3) various biopsy technologies and techniques 4) potential problems and pitfalls

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Eren D. Yeh, MD - 2015 Honored Educator

RC253

Leveraging Your Data: Informatics Approaches and Solutions to Improve Imaging Care Delivery

Monday, Nov. 28 8:30AM - 10:00AM Room: E353A

IN

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

Participants
Arun Krishnaraj, MD, MPH, Charlottesville, VA, (arunk@virginia.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify unmet needs of current and future practices with regards to emerging and existing informatics tools. 2) Apply existing and emerging informatics applications to improve report generation. 3) Demonstrate an understanding of how best to achieve consistency of radiologists' recommendations.

ABSTRACT

Existing and emerging informatics applications have the potential to markedly improve the quality of imaging care delivery. Much of the inefficiency and inconsistency of report generation could be potentially solved with the appropriate informatics application. In this session, the learner will gain an apprecation of the unmet needs of current and future pracitces and discover how novel applications developed at various institutions across the country are seeking to plug these voids and improve imaging care delivery.

Sub-Events

RC253A The Unmet Needs of Current and Future Practices

Participants
Michael E. Zalis, MD, Boston, MA (*Presenter*) Co-founder, QPID Health Inc Chief Medical Officer, QPID Health Inc Stockholder, QPID Health Inc

LEARNING OBJECTIVES

1) Describe some of the external mandates and requirements facing practicing radiologists. 2) Describe gaps in function that exist between these requirements and the functionality provided by EHR & PACS systems. 3) Provide example approaches and example solutions to bridge these gaps.

ABSTRACT

RC253B Augmenting Image Interpretation through the Use of Advanced Health Record Technology

Participants
Arun Krishnaraj, MD, MPH, Charlottesville, VA, (arunk@virgnia.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Appreciate the current state of Electronic Health Record (EHR) technology and adoption in the United States. 2) Identify areas where EHR integration into the daily workflow of Radiologists is lacking. 3) Demonstrate an understanding of the importance of incorporating data contained in the EHR to generate high quality reports. 4) Understand the consequences of under utilizing data contained in the EHR.

ABSTRACT

Advanced heath information technologies, specifically EHR systems, are undergoing
rapid dissemination and widespread adoption spurred by initiatives in the American Recovery and
Reinvestment Act of 2009. When properly integrated into clinical workflow, an EHR can improve both the quality and efficiency of care delivery. Radiology has long been at the forefront with respect to information technology (IT), however the integration of EHR data into radiolgists' workflow is lacking which affects the efficiency, safety, and costs of Imaging. Emerging advanced heatlh record technologies which incorporate natural language processing and semantic search allow the radiologists to retrieve and incorporate relevant clinical data when generating reports thereby improving both efficiency and quality. In this session, the learner will explore how one such health intelligence platform, known as QPID (Queriable Patient Inference Dossier), allows for the creation of search queries tailored to the workflow of an abdominal radiologist.

RC253C Decision Support Tools Integrated into Clinical Workflow

Participants
Cree M. Gaskin, MD, Keswick, VA, (cree@virginia.edu) (*Presenter*) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc; Research Grant, Carestream Health, Inc; ;

LEARNING OBJECTIVES

1) Review concepts for contemporary decision support tools for diagnostic radiologists. 2) Discuss bone age and skeletal atlas decision support tools integrated into clinical diagnostic workflow via context sharing.

ABSTRACT

There are numerous references available to radiologists to aid image interpretation or provide guidance on management of imaging findings. Given the vast amounts of information we are expected to know and the speed with which we are expected to perform our clinical work, it is helpful to have quick and easy access to relevant resources at our point-of-care (e.g., during image

interpretation and reporting). Such resources should be available in electronic format on our diagnostic workstations and, when relevant, be integrated with our clinical applications. Our Radiology Information System (RIS), PACS, and/or Electronic Health Record (EHR) can share study and patient context information with decision support tools to facilitate our diagnostic workflow. Examples to be shared include modern remakes of classic printed atlases in pediatric skeletal imaging, updated to contemporary electronic tools integrated with PACS and EHR applications to expedite workflow and reduce error. At a more basic level, decision support for image interpretation could be as simple as an automated feed of relevant clinical information from the electronic health record.

RC253D Advanced Decision Support Tools for the Radiologists

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

LEARNING OBJECTIVES

View learning objectives under main course title.

RC254

Precision Medicine through Image Phenotyping

Monday, Nov. 28 8:30AM - 10:00AM Room: S404AB

CA CH VA BQ IN

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

Participants

Ella A. Kazerooni, MD, Ann Arbor, MI, (ellakaz@umich.edu) (*Moderator*) Nothing to Disclose
Ella A. Kazerooni, MD, Ann Arbor, MI, (ellakaz@umich.edu) (*Presenter*) Nothing to Disclose
Eliot L. Siegel, MD, Baltimore, MD, (esiegel@umaryland.edu) (*Presenter*) Board of Directors, Brightfield Technologies; Board of Directors, McCoy; Board of Directors, Carestream Health, Inc; Founder, MedPerception, LLC; Founder, Topoderm; Founder, YYESIT, LLC; Medical Advisory Board, Bayer AG; Medical Advisory Board, Bracco Group; Medical Advisory Board, Carestream Health, Inc; Medical Advisory Board, Fovia, Inc; Medical Advisory Board, McKesson Corporation; Medical Advisory Board, Merge Healthcare Incorporated; Medical Advisory Board, Microsoft Corporation; Medical Advisory Board, Koninklijke Philips NV; Medical Advisory Board, Toshiba Corporation; Research Grant, Anatomical Travelogue, Inc; Research Grant, Anthro Corp; Research Grant, Barco nv; Research Grant, Dell Inc; Research Grant, Evolved Technologies Corporation; Research Grant, General Electric Company; Research Grant, Herman Miller, Inc; Research Grant, Intel Corporation; Research Grant, MModal IP LLC; Research Grant, McKesson Corporation; Research Grant, RedRick Technologies Inc; Research Grant, Steelcase, Inc; Research Grant, Virtual Radiology; Research Grant, XYBIX Systems, Inc; Research, TeraRecon, Inc ; Researcher, Bracco Group; Researcher, Microsoft Corporation; Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG;
John J. Carr, MD, MS, Nashville, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn what the term precision medicine means. 2) To understand how informatics intersects with clinical radiology to enable precision medicine in practice. 3) To learn through concrete examples how informatics based radiology precision medicine impacts health

ABSTRACT

Biomarkers have been emrabced by both the scientific and regulatory communities as surrogates end points for clinical trials, paving the way for their widespread use in medicine. The field of imaging biomarkers has exploded, and the their integration into clinical practice relies heaving on and intersects with the field ofbioinformatics.. Once specific biomakers are show to have value, easily integrating them into the digital environment of the radiologist and communcating them to the health care providers and or directly to patients effeiciently and seamlessly is important for their value and impact on health to be realized. Culturally, it is taking radiologists from the era of description and largely qualitative reporting, into a quantitative future state, and leveraging informatics to extract information from imaging alone ot together with data available in the electronic medical record is essential for future sucess in this new world. To get there, understanding the impact of this approach as a value of our services, and standardization of imaging technques along the lines of what the RSNA QIBA initiative is designing, are essential, so that imaging biomarkers are robust, accurate and reprodicbile. Embraching this approach enables and facilitates new appracohes, relationships of imaging and IT researchers, vendors and consumers, to fully realize the possiblities. This course willdiscuss and describe the overall constructs, and use tangible exams of using this in practice today and for the future.

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/

Ella A. Kazerooni, MD - 2014 Honored Educator

RCB21

Hands-On Basic DICOM with Horos/Osirix

Monday, Nov. 28 8:30AM - 10:00AM Room: S401CD

IN

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

Participants

Marc D. Kohli, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Simon Rascovsky, MD, MSc, Bogota, Colombia (*Presenter*) Officer, eDx Tecnologia en Salud SAS
Ross W. Filice, MD, Washington, DC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe basic DICOM object metadata structure. 2) Demonstrate familiarity with Osirix/Horos DICOM viewer functions including image display, and measurements. 3) Use Osirix/Horos to send/receive DICOM objects. 4) Name several common dcm4che toolkit tools, and describe their purpose.

RCC21

Interoperability - Imaging and Beyond: IHE, Standards and The RSNA Image Share

Monday, Nov. 28 8:30AM - 10:00AM Room: S501ABC

IN

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

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
David S. Mendelson, MD, Larchmont, NY (*Presenter*) Spouse, Employee, Novartis AG; Advisory Board, Nuance Communications, Inc; Advisory Board, General Electric Company; Advisory Board, Toshiba Medical Systems Corporation; Advisory Board, Bayer AG
Mariann Yeager, MBA, Maclean, VA (*Presenter*) Nothing to Disclose
Doug Watt, Toronto, ON (*Presenter*) Vice President, eHealth Ontario

LEARNING OBJECTIVES

1) Understand the importance of interoperability throughout healthcare. 2) Understand the importance of standards to ensure interoperability. 3) Understand the role of IHE profiles in defining workflows and the applicable standards including XDS and XDS-I. 4) Learn about real world implementations including Health Information Exchanges (The Sequoia Project) and focused Radiology solutions (Canada HealthInfoway) including Personal Health Records (The RSNA Image Share). 5) Learn the status of the RSNA Image Share and the RSNA Image Share Validation Program (To be announced at this meeting).

ABSTRACT

This course will focuson HIT inteoperability and its importance in providing for the optimal care of patients. The session will start with a review of standards and the role of IHE. The discussion will then move to a discussion of HIEs via The Sequoia Project (Heatlheway and Carequality) and in Canada where the Canada HealthInfoway project is underway.

MSCM22

Case-based Review of Magnetic Resonance (An Interactive Session)

Monday, Nov. 28 10:30AM - 12:00PM Room: S100AB

MR

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

FDA Discussions may include off-label uses.

Participants
John R. Leyendecker, MD, Dallas, TX, (john.leyendecker@utsouthwestern.edu) (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Use MRI to problem solve lesions of the breast. 2) Understand the role of MRI in the setting of pregnancy. 3) Improve diagnostic confidence in interpretation of MRI of the spine. 4) Develop effective differential diagnoses for abnormalities of the brain using MRI

ABSTRACT

Sub-Events

MSCM22A MRI of the Breast

Participants
Fiona J. Gilbert, MD, Cambridge, United Kingdom, (fjg28@cam.ac.uk) (*Presenter*) Research Grant, GlaxoSmithKline plc; Research Grant, General Electric Company; Research Grant, Hologic, Inc

LEARNING OBJECTIVES

1) Focus on MRI findings in Neoadjuvant chemotherapy in breast cancer. 2) Learn about the advantages and disadvantages of using MRI compared to mammography and ultrasound, when to undertake the examinations and how to interpret the findings. 3) The limitations of MRI interpretation during neoadjuvant chemotherapy will be presented.

ABSTRACT

Noedajuvant chemoterapy is used to downstage breast cancer to faciliate breast conservation. A complete pathological response often results in a survival advantage. Triple negative breast cancers are most likely to achieve a pthological complete response. MRI is used commonly to assess response during therapy, often being undertaken at baseline prior to chemotherapy, at mid point of treatment and at end of treatment prior to surgery. Two or three dimensional measurements are made to assess tumour size and sometimes volumes are calculated. Tumours sometimes respond by fragmetned rather than shrinking concentrically. DCE uptake curves can show the earliest change by reducing the rate and peak enhancement. ADC measures are often seen early with rises to above 1.2 in tumours which will show response. approximately 20% of pre surgicval MRI will underestimated residual disease.

MSCM22B MRI in Pregnancy

Participants
Gaurav Khatri, MD, Dallas, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Etiologies and MR findings of abdominal and pelvic pain in pregnancy will be reviewed. 2) Address safety concerns regarding imaging in pregnancy, as it pertains to MRI. 3) Attendees will be able to apply the presented concepts to effectively image pregnant women with MRI in the acute setting for maternal and placental indications.

ABSTRACT

Handout:Gaurav Khatri

http://abstract.rsna.org/uploads/2016/16000974/Khatri RSNA MRI in pregnancy - 11-28-2016_handout.pdf

MSCM22C MRI of the Spine

Participants
Lubdha M. Shah, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the different anatomical spaces of the spine and develop differential diagnoses based on spinal spaces. 2) Describe the differentiating features of neoplastic and inflammatory processes of the spinal cord. 3) Explain the imaging features suggestive of infection. 4) Recommend MRI and other modalities to assess the marrow 5) Identify imaging findings of cord ischemia.

MSCM22D MRI of the Brain

Participants
Carlos H. Torres, MD,FRCPC, Ottawa, ON, (catorres@toh.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Develop effective differential diagnoses for common and infrequent abnormalities of the brain using MRI

1) Develop effective differential diagnoses for common and infrequent abnormalities of the brain using MRI.

ABSTRACT

MSMC22

Cardiac CT Mentored Case Review: Part II (In Conjunction with the North American Society for Cardiovascular Imaging) (An Interactive Session)

Monday, Nov. 28 10:30AM - 12:15PM Room: S406A

CA CT

AMA PRA Category 1 Credits ™: 1.75
ARRT Category A+ Credits: 2.00

Participants
Jill E. Jacobs, MD, New York, NY (*Director*) Nothing to Disclose
Geoffrey D. Rubin, MD, Durham, NC (*Moderator*) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company;
Arthur E. Stillman, MD, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify cardiac and coronary artery anatomy. 2) Recognize cardiac disease processes, including coronary atherosclerosis, as diagnosed on CT. 3) Understand methods of cardiac CT and coronary CT angiography post-processing.

ABSTRACT

Sub-Events

MSMC22A Coronary Atherosclerosis I

Participants
Geoffrey D. Rubin, MD, Durham, NC (*Presenter*) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company;

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMC22B Coronary Atherosclerosis II

Participants
Smita Patel, MBBS,FRCR, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

CT Coronary Angiography is a robust tool for evaluation of coronary artery pathology and CT findings correlate well with invasive coronary angiography. CT findings have prognostic implications, particularly in the characterization of non-calcified plaque, where certain features correlate with increasing downstream acute ischemic events.

MSMC22C Valves and Cardiac Function

Participants
Andrew J. Bierhals, MD, Saint Louis, MO, (bierhalsa@wustl.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Cardiac CT can provide information on valves and function when retrospective ECG gating is used in the acquisition. These studies require extensive image post-processing to accurately depict the moving structures. This presentation will highlight basic image acquisition as well as the evaluation of normal and abnormal patients.

Active Handout:Andrew John Bierhals

http://abstract.rsna.org/uploads/2016/9001146/ACTIVE MSMC22C.pdf

MSMI22

Molecular Imaging Symposium: Oncologic MI Applications

Monday, Nov. 28 10:30AM - 12:00PM Room: S405AB

MI OI

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

FDA Discussions may include off-label uses.

Participants
Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Moderator*) Researcher, Koninklijke Philips NV; Researcher, General Electric Company; Researcher, Siemens AG; Researcher, iCAD, Inc; Researcher, Aspyrian Therapeutics, Inc; Researcher, ImaginAb, Inc; Researcher, Aura Biosciences, Inc
Umar Mahmood, MD, PhD, Charlestown, MA (*Moderator*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Ltd;

LEARNING OBJECTIVES

1) To understand the role of molecular imaging in cancer therapy. 2) To understand the impact that new molecular imaging agents could have on drug development. 3) To understand the barriers facing the development of new molecular imaging agents.

ABSTRACT

Molecular Imaging is expanding in many new directions. Most research is being performed for PET and SPECT agents. However, optical and MRI agents are also being developed. Molecular Imaging can play a role in accelerating the development and approval of new cancer therapeutics by quantifying the impact drugs have in early Phase studies and by selecting the most appropriate patients for trials. Molecular Imaging agents can be useful in determining the utility and mechanism of actions of drugs that are already approved and may provide insights to oncologists regarding the best treatment combinations for individual patients. Molecular Imaging methods have already expanded our knowledge of cancer behavior and this will ultimately lead to new forms of the therapy that will one day cure this dreaded disease.

Sub-Events

MSMI22A Hyperpolarized MRI of Prostate Cancer

Participants
Daniel B. Vigneron, PhD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, GlaxoSmithKline

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI22B Somatastatin Receptor Imaging

Participants
Ronald C. Walker, MD, Nashville, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the advantages of 68Ga-somatostatin PET/CT over 111In-DTPA-octreotide]imaging. 2) Detect patients likely to benefit from peptide receptor radiotherapy (PRRT).

ABSTRACT

68Ga-labeled somatostatin analogs (DOTATATE, DOTATOC and DOTANOC) PET/CT imaging provides higher resolution scans than 111In-DTPA-octreotide with less radiation, comparable cost, and imaging completion within 2 hours vs. 2-3 days. 68Ga-somatostatin analogs have a higher impact on care than 111In-DTPA-octreotide, including superior ability to identify patients likely to benefit from PRRT. This activity will provide results from the literature and the author's experience to illustrate the advantages of 68Ga-based PET/CT imaging of neuroendocrine tumors.

Active Handout:Ronald Clark Walker

http://abstract.rsna.org/uploads/2016/15003715/ACTIVE MSMI22B.pdf

MSMI22C Multimodal MI in Oncology

Participants
Umar Mahmood, MD, PhD, Charlestown, MA (*Presenter*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Ltd;

LEARNING OBJECTIVES

1) To understand strengths of various imaging modalities for specific target/disease assessment.

ABSTRACT

Each imaging modality has a set of characteristics that helps define optimal use. These constraints include sensitivity, depth of imaging, integration time for signal, and radiation dose, among other factors. Understanding when each modality can be used and when combining the relative strengths of differerent modalities can be synergistic allows greater molecular information to be

acquired.

MSMI22D Radiogenomics

Participants
Michael D. Kuo, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the principles behind radgiogenomics and to highlight areas of clinical application and future development.

ABSTRACT

MSMI22E Overview of MI in Oncology

Participants
Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Presenter*) Researcher, Koninklijke Philips NV; Researcher, General Electric Company; Researcher, Siemens AG; Researcher, iCAD, Inc; Researcher, Aspyrian Therapeutics, Inc; Researcher, ImaginAb, Inc; Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To understand the broad spectrum of activities in molecular imaging including PET, SPECT, optical and MRI. 2) To understand the potential impact of Molecular Imaging on cancer treatment.

ABSTRACT

Molecular Imaging is expanding at a rapid rate. This overview will provide a panoramic view of the field of Molecular Imaging and major trends that are emerging among the different modalities, PET, SPECT, optical, ultrasound and MRI that constitute molecular imaging.

MSRO22

BOOST: Gastrointestinal-Science Session with Keynote

Monday, Nov. 28 10:30AM - 12:00PM Room: S103AB

GI RO OI

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

Participants
Anna Shapiro, MD, Syracuse, NY (*Moderator*) Nothing to Disclose
Tarita O. Thomas, MD, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

MSRO22-01 Invited Speaker: Gastrointestinal Radiation Oncology

Monday, Nov. 28 10:30AM - 10:50AM Room: S103AB

Participants
Richard Tuli, MD, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

MSRO22-03 Maximum Tumor Area and Reduction Rate May Predict Pathological Complete Response to NeoAdjuvant Chemoradiotherapy for Rectal Cancer

Monday, Nov. 28 10:50AM - 11:00AM Room: S103AB

Participants
Chongda Zhang, Beijing, China (*Presenter*) Nothing to Disclose
Hongmei Zhang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of maximum area (MA) evolution in the tumor for predicting the pathological complete response (pCR) to neoadjuvant chemoradiotherapy(CRT) in patients with locally advanced rectal cancer (LARC).

METHOD AND MATERIALS

101 consecutive patients with LARC who received CRT followed by total mesorectal excision (TME) were recruited. . Maximum area before (MApre) and after CRT (MApost) was measured on high-spatial-resolution axial T2-weighted MR images showing the largest tumor area by manually tracing a region of interest. Concurrently, Maximum area reduction ratio(MARR) was calculated as follows: [(MApre−MApost) / MApre]×100%. The correlation between each parameter and pathologic response to CRT was assessed by Kruskal-Wallis Test or Analysis of Variance. In addition, receiver operating characteristic curve (ROC) was also used to determine the diagnostic performance of MApre, MApost and MARR for predicting pCR.

RESULTS

Statistically significant differences beween pathological complete responders and incomplete responders were obtained in the predictors of MApre, MApost and MARR with p value of 0.046, less than 0.000 and 0.002, respectively. Area under the ROC curve (AUC) value were 0.639 for MApre, 0.763 for MApost, 0.707 for MARR. An optimal cutoff value of 155.5 mm2 was obtained for MApost with a sensitivity of 64.6% and a specificity of 86.4% to predict PCR.

CONCLUSION

Quantitative evaluation of maximum tumor area was feasible to differentiate pCR from non-pCR groups to CRT in rectal cancer. MApre, MApost and MARR seem to be potential tools for distinguishing pathological complete responders to aid appropriate individually tailored therapies.

CLINICAL RELEVANCE/APPLICATION

Functional MR can demenstrate maximum areas of tumors in rectal cancer and is recommended as part of a MR study to evaluate rensponses to neoadjuvant chemoradiotherapy.

MSRO22-04 Prediction of Pathological Complete Response to New Adjuvant Chemoradiotherapy by T2 Signal Intensity Evolution for Locally Advanced Rectal Cancer

Monday, Nov. 28 11:00AM - 11:10AM Room: S103AB

Participants
Chongda Zhang, Beijing, China (*Presenter*) Nothing to Disclose
Hongmei Zhang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of T2 signal intensity (SI) evolution in the tumor for predicting the pathological complete response (pCR) to neoadjuvant chemoradiotherapy(CRT) in patients with locally advanced rectal cancer (LARC).

METHOD AND MATERIALS

101 consecutive patients with LARC who received CRT followed by total mesorectal excision (TME) were recruited. SI(SIt) and average SI of musculus obturator internus(SIm) were measured before and after CRT on high-spatial-resolution axial T2-weighted MRI images. To reduce the influence of image-specific factors, the SI was normalised by SIm(SI=SIt/SIm), resulting relative values before (SIpre) and after (SIpost) CRT. Concurrently, SI reduction ratio(SIRR) was calculated as follows: [(SIpre −SIpost) / SIpre

]×100%. The correlation between each parameter and pathologic response to CRT was assessed by Kruskal-Wallis Test or Analysis of Variance. In addition, receiver operating characteristic curve (ROC) was also used to determine the diagnostic performance of SIpre, SIpost and SIRR for predicting pCR.

RESULTS

Statistically significant differences beween pathological complete responders and incomplete responders were obtained in the predictors of SIpost and SIRR with p value of 0.003 and 0.001, respectively. While the difference was not considered significant with a p value of 0.783 for SIpre. Area under the ROC curve (AUC) value was 0.705 for SIpost and 0.743 for SIRR. The optimal cutoff values of 1.56 (sensitivity=70.9%, specificity=63.6%) and 0.365(sensitivity=77.3%,specificity=68.4%) were obtained for SIpost and SIRR respectively.

CONCLUSION

Quantitative evaluation of T2 signal intensity was feasible to differentiate between pCR and non-pCR groups to CRT in rectal cancer. SIpost and SIRR seem to be potential tools for distinguishing pathological complete responsers to aid appropriate individually tailored therapies.

CLINICAL RELEVANCE/APPLICATION

Functional MR can demenstrate signal intensity of tumors in rectal cancer and is recommended as part of a MR study to evaluate rensponses to neoadjuvant chemoradiotherapy.

MSRO22-05 Negative FNA of Suspicious Inguinal Nodes is Associated with a Low Risk of Recurrence in Patients with Anal Carcinoma

Monday, Nov. 28 11:10AM - 11:20AM Room: S103AB

Participants
Stephanie Markovina, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Non-metastatic anal cancer is treated with definitive chemoradiation (CRT). Standard of care includes intensity modulated radiation therapy (IMRT) with dose levels defined by clinical stage and lymph node involvement, as defined by clinical exam and 18F-fluorodeoxyglucose Positron Emission Tomography (FDG-PET), but non-specific uptake in the inguinal lymph regions can complicate staging. Fine needle aspiration (FNA) is often used to evaluate equivocal FDG-PET findings, but the accuracy of the test is not well-known, as surgical dissection is a common part of management. We report our experience with groin FNA as a component of initial work-up for anal carcinoma.Materials/Methods: Patients with non-metastatic anal carcinoma and staging FDG-PET were included and charts were reviewed. Patients were treated with Nigro regimen chemotherapy (5-fluorouracil and mitomycin C) and concurrent radiation using 3 dimensional-conformal radiotherapy (3D-CRT) or IMRT, with low-dose RT to elective regions and boost to the primary tumor and involved lymph node regions. FNA was performed under ultrasound or CT-guidance.Results: 153 patients were identified with anal cancer and staging FDG-PET treated from 2003-2013. Inguinal lymph nodes were interpreted as positive or equivocal for metastatic involvement on staging FDG-PET in 58 patients (38%). Of these, 17 underwent groin FNA (30%). 8 aspirates were positive for carcinoma (47%), 9 were negative and 1 was non-diagnostic. Median dose to inguinal regions was 30Gy (range 30-45Gy) for patients with negative FNA and 54Gy (range 50.4-56Gy) for patients with positive FNA. After a median follow-up of 30.1 months, 42 patients (27%) had died, and 28 (18%) had experienced recurrence. Of patients with negative inguinal FNA, all but one patient was alive and none had experienced recurrence of disease, compared to 5 deaths and 7 recurrences among patients with positive inguinal FNA, including 2 inguinal failures.Conclusion: In a contemporary cohort of patients with anal cancer and staging FDG-PET, FNA was commonly employed for equivocal FDG-PET findings. FNA confirmed suspicion of lymph node involvement half the time. Although accuracy of FNA cannot be determined without subsequent groin dissection, recurrence is low after negative FNA of suspicious or equivocal FDG-avid adenopathy.

MSRO22-07 Multiparametric MRI as A Predictive Response Biomarker in Esophageal Cancer

Monday, Nov. 28 11:30AM - 11:40AM Room: S103AB

Participants
Connie Yip, MBChB, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose
Musib J. Siddique, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Geoff Charles-Edwards, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Adrian J. Green, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Adrian J. Green, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
John Spence, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
John Spence, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Lyndall Blakeway, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Joanna Bell, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nick Maisey, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sarah Ngan, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
James Gossage, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrew Davies, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Jesper Lagergren, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Gary Cook, MD, FRCR, London, United Kingdom (*Abstract Co-Author*) Research support, General Electric Company; Research support, Alliance Medical Limited; Research support, Siemens AG; Research Consultant, Blue Earth Diagnostics Ltd; Speakers Bureau, Bayer AG
Gary Cook, MD, FRCR, London, United Kingdom (*Abstract Co-Author*) Research support, General Electric Company; Research support, Alliance Medical Limited; Research support, Siemens AG; Research Consultant, Blue Earth Diagnostics Ltd; Speakers Bureau, Bayer AG
Vicky J. Goh, MBBCh, London, United Kingdom (*Abstract Co-Author*) Research Grant, Siemens AG Speaker, Siemens AG

ABSTRACT

Purpose/Objective(s): We hypothesized that imaging intratumoral angiogenesis/hypoxia may be predictive response biomarkers in esophageal cancer. We evaluated the predictive value of multiparametric MRI in neoadjuvant chemotherapy response assessment in

esophageal cancer.Materials/Methods: Patients treated with neoadjuvant chemotherapy for resectable esophageal adenocarcinoma were recruited for this IRB-approved exploratory prospective study. Patients underwent baseline (TIME0), post-cycle 1 (TIME1) and post-neoadjuvant chemotherapy (TIME2) 1.5T MRI which included high-resolution T2-weighted (T2w parameters: signal intensity histogram), diffusion-weighted (DW parameters: apparent diffusion coefficient (ADC) histogram) and dynamic contrast-enhanced MRI (DCE-MRI parameters: transfer constant (Ktrans), rate constant (kep) extravascular-extracellular volume (ve), and plasma volume (vp) derived using an extended Toft's model). A whole primary tumor volume was defined as a volume-of-interest using an in-house software. Relative change in all MR parameters between TIME1/2 and TIME0 were calculated. Primary end-point was pathological tumor regression grade defined as per the Mandard's criteria with TRG1-3 classified as responders and TRG4-5 as non-responders. Mann-Whitney U test was used to assess for associations between absolute and relative change in MR parameters and pathological tumor response. Mean±SD are presented; pResults: There were 5 responders (36%) and 9 (64%) non-responders. 1/5 (7%) patients had complete response. Baseline TIME0 ADC skewness was associated with pathological response (responders vs. non-responders: -0.2±0.1 vs. -0.5±0.3, p=0.042). The following post-treatment TIME2 parameters were also significant predictive response markers: DCE Ktrans (0.7±0.1 vs. 1.6±0.9, p=0.006), T2w entropy (4.0±0.1 vs. 3.7±0.1, p=0.003), T2w fractal lacunarity (0.006±0.002 vs. 0.004±0.001, p=0.011) and T2w mean fractal dimension (2.9±0.1 vs. 2.8±0.1, p=0.045). However, relative MR changes between TIME1/2 and TIME0 were not predictive of pathological response. A complete responder had the lowest TIME2 Ktrans value (0.54 min-1) indicating that post-treatment Ktrans may be a sensitive imaging response biomarker after neoadjuvant chemotherapy, related to reduced vascular perfusion/permeability.Conclusion: Baseline MRI ADC and post-treatment DCE/T2w parameters, but not relative change over baseline, showed potential as imaging response biomarker in esophageal cancer treated with neoadjuvant chemotherapy. These results coupled with its superior soft tissue definition make MRI an attractive imaging (re)staging modality, and bodes well for future integrated PET/MRI studies in this setting.

MSRO22-09 Proton Therapy Posterior Beam Approach with Pencil Beam Scanning for Esophageal Cancer: Clinical Outcome, Dosimetry, and Feasibility

Monday, Nov. 28 11:50AM - 12:00PM Room: S103AB

Participants
Jing Zeng, MD, Seattle, WA (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): With increasing availability of proton therapy as well as evolving proton technology, more patients with esophageal cancer have access to proton therapy as a treatment option. We present the feasibility and preliminary clinical results of a novel pencil beam scanning (PBS) posterior beam technique of proton treatment for esophageal cancer in the setting of tri-modality therapy, which could potentially further lower dose to normal organs. Materials/Methods: From February 2014 to June 2015, 13 patients with locally advanced esophageal cancer (T3-4N0-2M0) were treated with trimodality therapy (neoadjuvant chemoradiation, followed by esophagectomy). Eight patients were treated with uniform scanning (US) and five patients were treated with PBS. Comparison planning with PBS was performed using 3 plans: 1) AP/PA beam arrangement; 2) PA plus left posterior oblique (LPO) beams, and 3) single PA beam (treated twice for motion mitigation). Patient outcomes, including pathologic response and toxicity were evaluated. Results: All 13 patients completed chemoradiation to 50.4 Gy (RBE) and all but one patient underwent surgery. Of the 12 evaluable patients, 100% had a R0 resection and pathologic complete response was seen in 25% (3/12). There was no difference in outcome between patients treated with PBS and US. There was one grade 5 post-operative mortality (20(10% vs 17%, PConclusion: Proton therapy with a single PA beam PBS technique for preoperative treatment of esophageal cancer appears safe and feasible. Given the superior dosimetric sparing of normal tissues compared to other proton techniques, this technique should be further explored and validated.

MSRO25

BOOST: CNS-Science Session with Keynote

Monday, Nov. 28 10:30AM - 12:00PM Room: S103CD

NR RO OI

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

Participants
Hui-Kuo G. Shu, MD, PhD, Atlanta, GA (*Moderator*) Speakers Bureau, Varian Medical Systems, Inc; Speakers Bureau, Siemens Medical Solutions USA, Inc; Stockholder, General Electric Company; Stockholder, Medtronics, Inc; Stockholder, Mylan NV; Stockholder, Apple Inc
John C. Grecula, MD, Columbus, OH (*Moderator*) Research Grant, Teva Pharmaceutical Industries Ltd Research Grant, Soligenix, Inc

Sub-Events

MSRO25-01 Invited Speaker: CNS

Monday, Nov. 28 10:30AM - 10:50AM Room: S103CD

Participants
Samuel T. Chao, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

MSRO25-03 Delayed-Contrast MRI for Differentiating Tumor/Non-Tumor Tissues in Brain Tumor Patients: Potential Application for Delineating SRS Dose Effects

Monday, Nov. 28 10:50AM - 11:00AM Room: S103CD

Participants
Yael Mardor, Ramat Gan, Israel (*Abstract Co-Author*) Reseach Consultant, BrainLAB AG; Research Grant, BrainLAB AG; License agreement, BrainLAB AG; Support, F. Hoffmann-La Roche Ltd;
Galia Tsarfaty, MD, MPH, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
David L. Last, PhD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Dianne Daniels, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Leor Zach, Rockville, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Spiegelmann, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Yuval Grober, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Dvora Nass, Tel Hashomer, Israel (*Abstract Co-Author*) Nothing to Disclose
Sharona Salomon, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Andrew Kanner, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Debora Blumenthal, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Felix Bokstein, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Yigal Shoshan, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Marc Wygoda, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Dror Limon, Petah Tikva, Israel (*Abstract Co-Author*) Nothing to Disclose
Tzahala Tzuk, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Zvi R. Cohen, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Ouzi Nissim, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Chen C. Hoffmann, MD, Ramat-Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
David Guez, Ramat Gan, Israel (*Presenter*) Nothing to Disclose

PURPOSE

We have recently presented high resolution treatment response assessment maps (TRAMs) enabling efficient separation between tumor (contrast clearance >1 hr post injection, blue) and treatment-effects (TEs, contrast accumulation, red), validated histologically in 54 resected patients. Here we demonstrate potential advantages in delineating stereotactic radiosurgery (SRS) dose-effects.

METHOD AND MATERIALS

In a preliminary study on 7 brain metastases, T1-Gd and the TRAMs were co-registered to the SRS dose-plan and pixel-by-pixel analysis was performed comparing baseline T1-Gd/TRAMs and dose-plan to T1-Gd/TRAMs acquired 141±12 days (day140) post SRS.

RESULTS

Tumor-growth rates were significantly correlated with initial tumor volumes when calculated from blue regions in the TRAMs ($r2=0.77;p<0.03$) but not when calculated from enhancing regions in T1-Gd ($r2=0.4;p<0.19$), consistent with the TRAMs superiority over T1-Gd in depicting true tumor tissues.T1-Gd showed that the % of enhancing pixels at baseline that turned non-enhancing at day140 increased moderately from 40.4% to 54.2% between 13-21.7Gy with a sharp rise to 98% above 22.8Gy. Similar analysis with the TRAMs showed linear increase in tumor-kill from 83% at 18Gy to 100% at 21.7Gy.T1-Gd also showed that the % of non-enhancing pixels at baseline (normal-appearing brain) that turned enhancing at day140 increased linearly to 20.2Gy, where it raised sharply to 48% followed by a sharp drop at 21.2Gy. The TRAMs showed that the increase to 20.2Gy may be explained by new blue/tumor growth with a sharp drop at 20.2Gy, while the sharp rise at 20.2Gy may be explained by development of TEs (red).Per-lesion analysis showed significant correlations between dose and blue growth-rates ($r2=0.81;p<0.014$). % of blue volumes exposed to >20Gy was found higher in solid (88%) vs cystic (54%) lesions.

CONCLUSION

These preliminary results demonstrate the TRAMs potential advantages in delineating SRS dose effects. Efficacy was higher at lower doses when studied by the TRAMs vs T1-Gd and thresholds were delineated better. The TRAMs suggest induction of TEs and prevention of new tumor growth in normal-appearing brain at >20Gy.

CLINICAL RELEVANCE/APPLICATION

The ability of the TRAMs to provide high resolution differentiation between tumor/treatment-effects may enable improved determination of thresholds for tumor kill and side effects, thus may be applied for individual dose painting radiotherapy

MSRO25-04 Temporally Dependent Intracranial Control of Melanoma Brain Metastasis by Stereotactic Radiotherapy in Patients Treated with CTLA-4 Blockade

Monday, Nov. 28 11:00AM - 11:10AM Room: S103CD

Awards
Student Travel Stipend Award

Participants
Wen Jiang, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Yi An, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Jing Li, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Numerous studies suggest that radiation can boost antitumor immune response via stimulating the release of tumor-specific antigens. However, the optimal timing between radiotherapy and immune checkpoint blockade to achieve synergistic benefits is unclear. Our current study investigated whether the timing of stereotactic radiosurgery (SRS) for patients who developed new brain metastases from advanced melanoma after receiving the CTLA-4 inhibitor ipilimumab affects intracranial tumor control and survival.

METHOD AND MATERIALS

This is a multi-institutional retrospective analysis of patients diagnosed with metastatic melanoma who had received ipilimumab and SRS to the brain for new metastases after immunotherapy from 2007 to 2014. A total of ninety-nine patients with metastatic melanoma to the brain were eligible and included in the analysis. All patients had received at least 2 doses of ipilimumab before SRS, and all must have had complete blood-test information available before SRS.

RESULTS

From the training cohort, patients who received SRS within 5.5 months (n=51) of their last dose of ipilimumab had significantly improved intracranial control compared with patients who received SRS after 5.5 months (n=20) (median interval 8.09 vs. 3.63 months, hazard ratio [HR] 0.474, 95% confidence interval [CI] 0.253-0.887, P=0.019). Overall survival (OS) was not significantly different between the two arms. The improved intracranial control rate was confirmed using an independent cohort of patients (n=28) treated at a second comprehensive cancer center. We also found that circulating absolute lymphocyte count before SRS predicted treatment response: those with baseline count >1000/μL had reduced risk of intracranial recurrence compared with those with ≤1000/μL (HR 0.378, 95% CI 0.212-0.675, P=0.001).

CONCLUSION

In this multi-institutional study, we found that patients who received SRS for new brain metastases within 5.5 months after ipilimumab therapy had better intracranial disease control than did patients who received SRS later; moreover, circulating lymphocyte count predicted intracranial disease control.

CLINICAL RELEVANCE/APPLICATION

Timing of radiation in relation to CTLA4 blockade is critical for promoting immune-mediated intracranial control of melanoma brain metastasis and is recommended to be delivered within close proximity to immunotherapy administration.

MSRO25-05 Radiation Dose-Dependent Hippocampal Atrophy Detected with Longitudinal Volumetric MRI

Monday, Nov. 28 11:10AM - 11:20AM Room: S103CD

Awards
Student Travel Stipend Award

Participants
Tyler Seibert, MD, PhD, La Jolla, CA (*Presenter*) Research Grant, Varian Medical Systems, Inc; Consultant, Medscape, LLC
Roshan Karunamuni, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Hauke Bartsch, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Samar Kaifi, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Anithapriya Krishnan, PhD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Burkeen, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Tanya Nguyen, PhD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Carrie R. McDonald, PhD, La Jolla, CA (*Abstract Co-Author*) Consultant, CorTechs Labs, Inc
Nikdokht Farid, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Nathan White, PhD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Vitali Moiseenko, PHD, Surrey, BC (*Abstract Co-Author*) Speaker, Varian Medical Systems, Inc; Travel support, Varian Medical Systems, Inc
James B. Brewer, MD, PhD, La Jolla, CA (*Abstract Co-Author*) Scientific Advisory Board, Human Longevity Inc; Board Member, CorTechs Labs, Inc; Stock options, Human Longevity Inc ; Stock options, CorTechs Labs, Inc ; Research Grant, Navidea Biopharmaceuticals, Inc; Scientific Advisory Board, Alkermes plc; Scientific Advisory Board, Bristol-Myers Squibb Company; Scientific Advisory Board, Otsuka Holdings Co, Ltd; Scientific Advisory Board, Novartis AG; Scientific Advisory Board, F. Hoffmann-La Roche Ltd; Scientific Advisory Board, Eli Lilly and Company
Jona Hattangadi-Gluth, La Jolla, CA (*Abstract Co-Author*) Research Grant, Varian Medical Systems, Inc

PURPOSE

Following brain radiation therapy (RT) patients often experience memory dysfunction, thought to be mediated in part by damage to the hippocampus. Hippocampal atrophy measured by MRI is a known correlate of cognitive decline in other disease processes. We sought to determine whether patients undergoing brain RT would show radiation dose-dependent hippocampal atrophy on volumetric MRI.

METHOD AND MATERIALS

Hippocampal volume was measured with MRI in 52 patients who underwent fractionated, partial brain RT for primary brain tumors. Study patients had high-resolution, 3D volumetric MRI (inversion recovery spoiled gradient-echo sequence: TE, 2.8ms; TR, 6.5 ms; TI, 450 ms; flip angle, 8 degrees; FOV, 24cm; 0.93 x 0.93 x 1.2mm; sagittal) prior to and one year post-RT. Images were processed using software with FDA clearance and CE marking for automated measurement of hippocampal volume. Processing included correction for distortion and segmentation of the hippocampus bilaterally. Automated results were inspected visually for accuracy and for censoring of tumor and surgical changes. Radiation dose data were co-registered with processed MRI data. Mean dose to each hippocampus was tested for correlation with change in hippocampal volume in the year following RT. Average hippocampal volume change was also calculated for hippocampi receiving >40 Gy mean dose and for hippocampi receiving <10 Gy mean dose. Statistical significance was evaluated with Student's t-test at $\alpha = 0.05$.

RESULTS

Median prescribed RT dose was 60 Gy (range 50.4 to 60 Gy). Most patients (96%) received temozolamide. Greater hippocampal volume loss was seen at higher mean hippocampal doses ($r = -0.24$, $p = 0.016$). Hippocampi receiving mean dose >40 Gy had a mean volume loss of 5.8% ($p = 0.009$), whereas hippocampi receiving <10 Gy had a mean volume loss of 1.2% ($p = 0.103$).

CONCLUSION

Higher mean radiation dose to the hippocampus was associated with greater hippocampal atrophy one year later.

CLINICAL RELEVANCE/APPLICATION

RT dose avoidance of the hippocampus is being tested in clinical trials. Measurement of hippocampal atrophy holds value as an imaging biomarker and may be associated with cognitive outcomes.

MSRO25-06 Variation in Outcomes of 1p19q Co-deleted Gliomas by Grade

Monday, Nov. 28 11:20AM - 11:30AM Room: S103CD

Participants
Debra Yeboa, MD, Houston, TX (*Presenter*) Travel support, Eli Lilly and Company
James B. Yu, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, 21st Century Oncology, Inc
Joseph N. Contessa, MD, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Recent retrospective molecular analyses of patients with lower grade gliomas suggest 1p19q co-deleted subtype have similar survival outcomes irrespective of pathological grade. This finding prompted a re-evaluation of glioma prognostic groups. Whether these similar outcome are present in large observational cohorts in the US are unknown. We therefore examined survival outcomes for patients with 1p19q co-deleted treated with definitive therapy. Materials/Methods: Using the National Cancer Data Base, 703 patients diagnosed between 1998 and 2012 with grade II or III gliomas with 1p19q co-deletion were identified. Median age at diagnosis, sex, Charlson-Deyo comorbidity score (CDCS), and tumor histology (anaplastic oligodendroglioma, anaplastic astrocytoma, mixed) were assessed. Grade was defined by WHO grade. Summary statistics were performed on the percentage of grade II and III glioma patients receiving surgery alone, surgery + adjuvant RT, surgery +adjuvant chemo, and surgery + concurrent chemoRT. To assess overall survival (OS), Kaplan Meiers and log-rank tests were performed.Results: Using the National Cancer Data Base, 703 patients diagnosed between 1998 and 2012 with grade II or III gliomas with 1p19q co-deletion were identified. Median age at diagnosis, sex, Charlson-Deyo comorbidity score (CDCS), and tumor histology (anaplastic oligodendroglioma, anaplastic astrocytoma, mixed) were assessed. Grade was defined by WHO grade. Summary statistics were performed on the percentage of grade II and III glioma patients receiving surgery alone, surgery + adjuvant RT, surgery +adjuvant chemo, and surgery + concurrent chemoRT. To assess overall survival (OS), Kaplan Meiers and log-rank tests were performed.Conclusion: Contrary to other studies, our data with a large observational cohort demonstrates a significant difference in overall survival between grade II and grade III gliomas that are 1p19q co-deleted. Differences in survival outcomes were partially mitigated by adjuvant therapy, suggesting that treatment variables must be considered prior to assigning this molecular subtype into a single prognostic group.

MSRO25-07 Diffusion Tensor Imaging Characterization of Long-Term Neurotoxicity in Adult Survivors of Pediatric Brain Tumors

Monday, Nov. 28 11:30AM - 11:40AM Room: S103CD

Participants
Silun Wang, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose
Jianming Ni, Wuxi, China (*Abstract Co-Author*) Nothing to Disclose
Liya Wang, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Tricia Z. King, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Hui Mao, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Radiotherapy is known to causes central nerve system injury. However, the long term effect of structural injury in white matter (WM) and functional impairment in survivors of pediatric brain tumors has not been elucidated. Functional imaging and diffusion tensor imaging may provide sensitive detection of WM injury after radiotherapy and better understanding of the functional outcome of the survivors.

METHOD AND MATERIALS

14 adult survivors of pediatric brain tumors (with median radiation dose of 5400 cGy) and 27 demographically matched healthy controls (mean age: 22.7 ± 4.5 vs. 22.9 ± 4.3, $p>0.05$) were enrolled in the study. Anatomical MRI and DTI were performed on all participants using a 3T MRI scanner. Tract-based Spatial Statistics (TBSS) was used to determine structural changes in WM tracts. Correlation matrix of DTI indices, i.e., (FA, axial diffusivities (AxD) and radial diffusivities (RD,) in whole brain WM tracts (n=50) were generated to identify the disruptions of connectivity. The correlations of DTI measurements with neurophysiological evaluations were derived from statistical analyses.

RESULTS

Significantly lower FA and AxD and higher RD values were observed in survivors comparing to the controls. However, AxD showed higher sensitivity than FA in detecting WM integrity changes, particularly in identifying changes in projection and brain stem fibers. When WM tracts were examined with inter-tracts correlation matrices, the survivor group showed weaker correlation coefficient compared to the control group in the regions of brainstem, projection and association fibers. Significantly lower IQ scores was found in survivor group compared to controls (101± 5 vs., 109 ± 8, $p<0.01$). Changes of FA, AxD and RD were found to correlate with IQ scores, with RD changes in projection fibers and association fibers exhibiting stronger correlations with all IQ scores (all $p<0.05$).

CONCLUSION

AxD shows higher sensitivity to detect radiotherapy induced WM injury and may indicate diffused axonal degeneration. RD changes strongly correlated with neurophysiological results. Overall, weaker inter-tracts correlations in survivors may indicate heterogeneous injury of white matter function groups or disruptions in connectivity.

CLINICAL RELEVANCE/APPLICATION

We have identified promising imaging biomarkers, using DTI to characterize and localize radiotherapy induced white matter injury in adult survivors with pediatric brain tumors.

MSRO25-08 Dosimetric Predictors of Freedom from Treatment Failure After Stereotactic Radiosurgery for Trigeminal Neuralgia

Monday, Nov. 28 11:40AM - 11:50AM Room: S103CD

Participants
Edward M. Marchan, MD, Augusta, GA (*Presenter*) Nothing to Disclose
John R. Vender, MD, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose
Rebecca R. Cantrell, MS, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose
Ramon E. Figueroa, MD, Martinez, GA (*Abstract Co-Author*) Nothing to Disclose
Waleed F. Mourad, MD, NewYork, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Stereotactic radiosurgery (SRS) is a treatment modality for classical trigeminal neuralgia (cTN). Success of SRS in facilitating long term pain control is dependent on maximizing prescribed dose (PD) to the trigeminal nerve. We analyzed several internationally standardized SRS treatment parameters and assessed as a primary endpoint whether either of them would predict freedom from treatment failure (TF). We hypothesized that higher energy and homogeneity indexes independently decrease the risk of treatment failure.

METHOD AND MATERIALS

Between 2007-2015, 178 cTN patients underwent Gamma Knife SRS, with a 4 millimeter collimator. Pain before and after SRS was scored as level I-V per the Barrow Neurological Institute (BNI) pain intensity scoring criteria. Pain relief was graded as an improvement to BNI levels I, II, or III from pre-SRS BNI levels IV or V. TF was graded as a return to BNI levels IV or V or need for additional SRS or operative intervention. Time to TF (TTF) was measured. The energy index, conformity index, homogeneity index (HI) [(D2% minus D98%)/D50%], and gradient index were calculated. A statistical model using Cox regression evaluating our primary endpoint was designed comparing a) TF and non-TF patients to determine TF risk.

RESULTS

Median PD was 80 Gy [range (r): 70-80]. The median follow-up was 15 months (r: 1.5-82). The median time to initial response was 1 month (r: 0.05-5) and the median TTF was 20 months (r: 0-82). Ninety percent reported initial pain relief, and actuarial rates of freedom from TF at 12, 24, 36 and 48 months were 55, 40, 33, and 28%, respectively. Statistical modeling showed that HI was the only treatment parameter that independently predicted time to TF ($p=0.0273$). Each unit increase in HI had a 88.3% decrease in TF risk (HR: 0.117 95% CI: 0.017-0.788).

CONCLUSION

This is the first cTN series showing that optimization of the HI enhances freedom from TF. Incorporation of the HI may be used to guide dosimetric treatment planning in SRS for cTN.

CLINICAL RELEVANCE/APPLICATION

Optimization of the homogeneity index (HI) enhances freedom from treatment failure and should be incorporated in SRS treatment planning for cTN.

MSRO25-09 Targeting Glucose Metabolism in Brain Tumor Initiating Cells: An Novel Therapeutic Approach for Radiosensitization

Monday, Nov. 28 11:50AM - 12:00PM Room: S103CD

Participants
Kailin Yang, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose
Xiuxing Wang, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Jeremy Rich, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Glioblastoma (GBM) is a deadly form of brain tumor for which conventional treatments including radiation therapy offer only palliation. Increasing evidence suggests that metabolic reprogramming, namely the Warburg effect, is not simply a passenger in tumorigenesis but may be an initiating event as recurrent somatic mutations of metabolic enzymes have been reported. Previously, brain tumor initiating cells (BTICs), a subset of tumor cells that exhibit radiation resistance, were found to hijack the process of high-affinity glucose uptake normally active in neurons to maintain energy demands in dynamic tumor microenvironments. Here, we aim to understand the molecular mechanism of aberrant glucose metabolism in BTICs and develop targeted approach to achieve

radiosensitization.

METHOD AND MATERIALS

BTICs were derived from patient GBM specimens. Metabolomics profiling was performed in matched pairs of BTICs and differentiated glioma cells (DGCs) labeled with U-13C-glucose. Genetic validation of identified metabolic pathways was performed using TCGA GBM dataset. Functional validation of target gene was performed in vitro for BTIC viability and self-renewal, and in vivo for tumorigenecity. Radiation treatment was delivered using Cs-137 irradiator.

RESULTS

Glucose influx, mediated by high-affinity glucose transporter GLUT3, regulates BTIC maintenance and tumorigenecity. Using unbiased metabolomics analysis, we traced carbon flow following glucose influx into BTICs, and discovered downstream glucose metabolism pathways including de novo purine synthesis were functionally upregulated, mediating glucose-sustained anabolic metabolism. Inhibiting purine synthesis through RNA interference and FDA-approved pharmacologic inhibitors such as mycophenolate mofetil or ribavirin attenuated BTIC viability after radiation, supporting metabolic reprogramming as a potential therapeutic point of fragility. Elevated expression of purine synthesis enzymes predicts poor prognosis in GBM patients.

CONCLUSION

A stem-like radioresistant state in GBM is associated with metabolic reprogramming to fuel tumor hierarchy, revealing potential BTIC cancer dependencies amenable to targeted therapy for radiation sensitization.

CLINICAL RELEVANCE/APPLICATION

This study provided scientific rationale to target aberrant glucose metabolism (such as using FDA-approved anti-purine synthesis medications) as potential adjuvant therapy to enhance efficacy of radiation treatment.

RCA22

PowerPoint Tips (Hands-on)

Monday, Nov. 28 10:30AM - 12:00PM Room: S401AB

ED IN

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

Participants
William J. Weadock, MD, Ann Arbor, MI (*Presenter*) Owner, Weadock Software, LLC
Sarah C. Abate, BS, Ann Arbor, MI, (sabate@med.umich.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the components of an optimal slide presentation. 2) Learn about common errors made in slide preparation and how they can be avoided. 3) Review features to enhance live presentations. 4) Learn tips to ensure a smooth presentation.

ABSTRACT

Electronic presentations are very common in radiology practice. This hands-on demonstration and questions and answer session will show attendees how to optimize their presentations. Discussion of live presentation tips. Additional review of image and video display and management will be covered. Demonstrations will include tips to decrease time creating and modifying presentations. Bring your questions!

RCB22

Learn Image Segmentation Basics with Hands-on Introduction to ITK-SNAP (Hands-on)

Monday, Nov. 28 10:30AM - 12:00PM Room: S401CD

IN

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

Participants
Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Philip A. Cook, PhD, Philadelphia, PA, (cookpa@mail.med.upenn.edu) (*Presenter*) Nothing to Disclose
Paul Yushkevich, PhD, Philadelphia, PA, (pauly2@upenn.edu) (*Presenter*) Investigator, KinetiCor, Inc
Joe C. Wildenberg, MD,PhD, Philadelphia, PA, (joe.wildenberg@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To use a free interactive software tool ITK-SNAP to view and manipulate 3D medical image volumes such as multi-parametric MRI, CT and ultrasound.2) To label anatomical structures in medical images using a combination of manual and user-guided automatic segmentation tools.

ABSTRACT

Quantitative analysis of medical imaging data is increasinly relevant in a growing number of radiological applications. Almost invariably, such quantitative analysis requires some structures of interest (organs, tumors, lesions, etc.) to be labeled in the image. Labeling anatomical structures is a complex task, particularly when the imaging data is complex, such as in the case of multi-parametric MRI or fusion of different imaging modalities. ITK-SNAP is a free, open-source, and easy to use interactive software tool that allows users to view multiple image volumes of the same anatomy and label structures using information from all volumes concurrently. For example, ITK-SNAP allows users to label tumors (core, edema, necrosis) using a combination of T1-weighted, contrast-enhanced T2-weighted, T2-weighted and FLAIR MRI. ITK-SNAP provides easy to use user-guided automatic segmentation functionality rooted in statistical machine learning and deformable modeling algorithms, as well as built in tools for manual editing and correction of segmentations. ITK-SNAP runs on Windows, MacOS and Linux platforms. During this hands-on course, the participants will use ITK-SNAP to label organs and tumors in various imaging modalities. After completing the course, participants will be well equipped for performing quantitative analyses of medical image data using ITK-SNAP and other compatible free software tools.

Handout:Paul Yushkevich

http://abstract.rsna.org/uploads/2016/16005010/handout_exercises.pdf

RCC22

Value-based Imaging in the ACO Model

Monday, Nov. 28 10:30AM - 12:00PM Room: S501ABC

HP IN

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

Participants
James Whitfill, MD, Scottsdale, AZ, (jwhitfill@shpcare.com) (*Moderator*) President, Lumetis, LLC;
Rodney S. Owen, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose
Gary H. Dent, MD, Macon, GA (*Presenter*) Officer, Radius LLC; Stockholder, Radius LLC; Advisory Board, Datalyst LLC;

LEARNING OBJECTIVES

1) Review the forces at work which are pushing the US Healthcare system to adopt value based care models. 2) Learn the mechanisms currently used to contract for value based care contracts. 3) Learn how imaging and radiology currently relate to new value based care models. 4) Hear from radiologists who are active leaders in value based models in their community.

ABSTRACT

SPCP21

Netherlands Presents: Advances in Neuro-degenerative and Neuro-vascular Diseases

Monday, Nov. 28 10:30AM - 12:00PM Room: E353C

NR

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

Participants

Sub-Events

SPCP21A Opening Remarks

Participants
Richard L. Baron, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT

URL

SPCP21B Introduction

Participants

SPCP21C Prediction of Stroke and Dementia Based on Population Imaging: The Rotterdam Scan Study

Participants
Meike W. Vernooij, MD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the rationale and general design of population imaging studies. 2) To learn the role of population imaging in disease prediction. 3) To realize opportunities and challenges of (new) imaging markers in prediction of stroke and dementia.

ABSTRACT

URL

SPCP21D Hemodynamic Contributions to Age-related Cognitive Decline: The Heart-Brain Connection

Participants
Mark A. Van Buchem, MD, PhD, Leiden, Netherlands, (m.a.van_buchem@lumc.nl) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To describe a large-scale multi-center study on the influence of hemodynamic status on cognitive functioning in the Netherlands.

ABSTRACT

Recently, a large-scale multi-center study entitled "the Heart-Brain Connection" started in the Netherlands. The aim of that study is to unravel the hemodynamic mechanisms that contribute to cognitive loss in old age. Imaging plays a central role in that study.

URL

SPCP21E High-Resolution Brain Imaging in Old Age: Experiences in the Virtual Institute of Seven Tesla Applications (VISTA)

Participants
Jeroen Hendrikse, MD, Utrecht, Netherlands, (j.hendrikse@umcutrecht.nl) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the role of high resolution MRI for diagnosis of macrovascular brain disease. 2) To understand the role of high resolution MRI for diagnosis of microvascular brain disease. 3) To understand the role of high resolution MRI for brain hemodynamics and functioning.

ABSTRACT

The increased signal to noise ratio (SNR) of ultra high field MRI (7 Tesla) is nowadays used for high resolution imaging of the macrovasculature, microvasculature and brain hemodynamics. High resolution imaging of the macrovasculature includes the visualization and characterization of intracranial vessel wall lesions (atherosclerosis, enhancing plaques). High resolution imaging of the microvasculature includes the visualization of cortical and non-cortical microinfarcts and characterization of white matter lesions and lacunar infarcts. Detailed imaging of brain hemodynamics includes flow velocity and pulsatility quantification of the perforating arteries and functional imaging of cerebral reserve of cortical layers and the cerebral white matter.

URL

SPCP21F Multicenter Randomized Clinical Trial of Endovascular Treatment of Acute Ischemic Stroke in the Netherlands and Follow-Up Results

Participants
Charles B. Majoie, MD, PhD, Amsterdam, Netherlands, (c.b.majoie@amc.uva.nl) (*Presenter*) Instiutional Research Grant, AngioCare BV; Instiutional Research Grant, Medtronic plc; Instiutional Research Grant, medac GmbH; Instiutional Research Grant, Penumbra, Inc; Instiutional Research Grant, Stryker Corporation

LEARNING OBJECTIVES

1) To understand the design and results of the MRCLEAN trial. 2) To comprehend its impact on clinical practice for treatment of patients with acute ischemic stroke.

ABSTRACT

In this presentation the design and results of the MRCLEAN trial will be summarized. In addition, results of subgroup analyses related to logistics and CT imaging of patients with acute ischemic stroke due to large vessel occlusions will be presented.

URL

www.mrclean-trial.org

Active Handout:Charles Bernard L. M. Majoie

http://abstract.rsna.org/uploads/2016/16000979/ACTIVE SPCP21GF Handout_MRCLEAN_Majoie_RSNA2016.pdf

SPCP21G Conclusion

Participants

SPCP21H Closing Remarks

Participants
James P. Borgstede, MD, Colorado Springs, CO (*Presenter*) Nothing to Disclose

SSC01

Cardiac (Non-Ischemic Cardiomyopathy)

Monday, Nov. 28 10:30AM - 12:00PM Room: S502AB

CA BQ MR

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

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
Balazs Ruzsics, MD, PhD, Charleston, SC (*Moderator*) Nothing to Disclose
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Karin E. Dill, MD, Evanston, IL (*Moderator*) Nothing to Disclose

Sub-Events

SSC01-01 Assessment of the Estimated 5-year Risk of Sudden Cardiac Death (SCD) by Quantitative Cardiac Magnetic Resonance Sequences in Patients with Hypertrophic Cardiomyopathy (HCM)

Monday, Nov. 28 10:30AM - 10:40AM Room: S502AB

Awards
Student Travel Stipend Award

Participants
Maxim Avanesov, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
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Enver G. Tahir, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Ulf K. Radunski, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Kai Muellerleile, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
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Gunnar K. Lund, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We evaluated the ability of clinical and quantitative cardiac magnetic resonance (CMR) parameters including T1 mapping and extracellular volume (ECV) imaging to identify hypertrophic cardiomyopathy (HCM) patients at increased calculated risk for sudden cardiac death (SCD) estimated by a novel HCM Risk-SCD score.

METHOD AND MATERIALS

The study was approved by our local IRB. CMR was performed in 65 HCM patients and 16 controls at 1.5T scanner. Myocardial fibrosis was assessed independently by 2 observers on 3 short axes at the basis, center and apex of the left ventricle. Fibrosis was quantified on late gadolinium enhancement (LGE) images in %LV using 3 standard deviations (SD) above signal intensity of reference myocardium and the full width at half maximum (FWHM) method. T1 and ECV maps were generated by 3(3)5 modified Look-Locker inversion recovery sequence. Multivariate and receiver operating curve analysis evaluated the best parameter to identify patients with increased SCD risk of ≥4%, thus advising a prophylactic ICD implantation.

RESULTS

Nineteen HCM patients (29%) had an increased SCD risk of ≥4%. From all clinical and CMR parameters, only LGE (FWHM) and global ECV discriminated between patients with low (<4%) and increased (≥4%) risk for SCD. On multivariate analysis global ECV correlated best with the HCM risk score. The best performance was obtained for global ECV with an area under the curve (AUC) of 0.83 [0.71-0.91]. LGE (FWHM) was inferior to ECV with an AUC of 0.67 [0.54-0.79], P<0.05). ECV resulted in a sensitivity and specificity of 74% (49-91%) and 82% (69-88%) to identify HCM patients at increased SCD risk.

CONCLUSION

Global ECV is the best of all clinical and CMR parameters and superior to LGE to identify HCM patients with increased risk for SCD. Therefore ECV may serve as additional parameter for non-invasive risk stratification in patients with HCM.

CLINICAL RELEVANCE/APPLICATION

ECV might have the potential to facilitate current risk prediction models for sudden cardiac death in HCM and can be of additional value in patients with reduced acoustic window on echocardiography or unclear medical history, which potentially limits the accuracy of the HCM Risk-SCD score.

SSC01-02 Comprehensive Cardiac Magnetic Resonance for Short-Term Follow-Up in Acute Myocarditis

Monday, Nov. 28 10:40AM - 10:50AM Room: S502AB

Awards
Student Travel Stipend Award

Participants
Julian A. Luetkens, MD, Bonn, Germany (*Presenter*) Nothing to Disclose
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Jonas Doerner, MD, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
Ulrike Schlesinger-Irsch, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Rene Andrie, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Alois Martin Sprinkart, MSc, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Frederic Carsten Schmeel, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
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Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel K. Thomas, MD, PhD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Cardiac magnetic resonance (CMR) can detect inflammatory myocardial alterations in patients suspected of having acute myocarditis. There is limited information about the degree of normalization of CMR parameters during the course of the disease and the time window during which quantitative CMR should be most reasonably implemented for diagnostic work-up.

METHOD AND MATERIALS

Ethics commission approval was obtained for this prospective study and written informed consent was obtained from all subjects. 24 patients with suspected acute myocarditis and 45 control subjects underwent CMR. Initial CMR was performed 2.6±1.9 days after admission. Myocarditis patients underwent CMR follow-up after 2.4±0.6, 5.5±1.3 and 16.2±9.9 weeks. CMR protocol included assessment of standard Lake Louise criteria, T1 relaxation times, extracellular volume fraction, and T2 relaxation times. A generalized linear model and independent 2-sample Student t test were used for group comparisons.

RESULTS

Group differences between myocarditis patients and control subject were highest in the acute stage of the disease ($P<0.001$ for all parameters). There was a significant and consistent decrease in all inflammatory CMR parameters over the course of the disease ($P<0.01$ for all parameters). As an indicator of myocardial edema, myocardial T1 and T2 relaxation times were the only single parameters showing significant differences between myocarditis patients and control subjects on 5.5±1.3 week follow-up (T1:986.5±44.4ms vs. 965.1±28.1ms; $P=0.022$, T2:55.5±3.2ms vs. 52.6±2.6ms; $P=0.001$).

CONCLUSION

In patients with acute myocarditis, CMR markers of myocardial inflammation demonstrated a rapid and continuous decrease over several follow-up examinations. CMR diagnosis of myocarditis should therefore be sought in an early stage of the disease. Myocardial T1 and T2 relaxation times were the only parameters of active inflammation/ edema which could discriminate between myocarditis patients and control subjects even at convalescent stages of the disease.

CLINICAL RELEVANCE/APPLICATION

CMR should be performed early to reliably detect inflammatory myocardial alterations. Repetitive CMR can monitor disease activity and may help to identify patients with persistent myocarditis.

SSC01-03 Detection of Myocardial Tissue Characterization Using Cardiac Magnetic Resonance T1 Mapping and Late Gadolinium Enhancement in; Hypertropic Cardiomyopathy

Monday, Nov. 28 10:50AM - 11:00AM Room: S502AB

Participants
Huayan Xu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
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Yingkun Guo, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Chunchao Xia, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Lei Li, Chengdu, China (*Presenter*) Nothing to Disclose

PURPOSE

To investigate the myocardial tissue characterization by using cardiac magnetic resonance(CMR) T1mapping and late gadolinium enhancement (LGE) in hypertrophic cardiomyopathy (HCM), and further compare the reproducibility of these two techniques.

METHOD AND MATERIALS

Thirty-two HCM patients and 28 healthy volunteers were enrolled in and underwent CMR examination. Modified Look-Locker Inversion recovery T1 maps and phase sensitive inversion recovery LGE images were acquired on matching short axis of basal, middle and apex segments. Parameters including native T1 values, post- contrast T1 values, extra-cellular volume(ECV) of T1maps and LGE extents(%) were measured by software(cmr42; Circle Cardiovascular Imaging Inc.Calgary; Canada). LGE extents(%) was automatically calculated by greater than 2SD threshold of normal myocardium.

RESULTS

In HCM, native T1 values were increased and post T1 values were decreased in comparison with normal controls(native T1, 1387.38±115.50 vs. 1257.53,$p=0.000$; post T1, 492.34±74.21 vs. 499.19±34.63,$p=0.000$). ECV of HCM subjects were significantly increased(39.88±10.89 vs. 28.49±3.53,$p=0.000$). LGE extent (Average, 47.34± 23.57%) was found in HCM ones. By Pearson correlation analysis, native T1 value and ECV were positively related to LGE extent(native T1, $r=0.251$,$p=0.008$;ECV, $r=o.344$,$p=0.000$,respectively).No significant relationship was found between post T1 value and LGE extent. By Intra-class correlation coefficient(ICC) analysis, inter-and intra- observer agreement representing the reproducibility of T1mapping and LGE were obtained.Inter- and intra-observer agreement of LGE was moderate(Inter-observer：ICC, 0.680; Intra-observer: ICC,

0.790).Inter- and intra-observer agreement of native T1 value,post T1 value was improved and excellent high (Inter-observer: ICC=0.997, 0.999 and 0.994, respectively; Intra-observer: ICC=0.996, 0.998 and 0.995).

CONCLUSION

CMR T1 mapping and LGE were established tools for myocardium firosis detection.In HCM patients, native T1 , ECV and LGE representing myocardium fibrosis were all higher than normal ones. However, the reproducibility of T1mapping was improved compared with LGE.

CLINICAL RELEVANCE/APPLICATION

LGE cannot detect fibrosis well in diffused fibrosis and the results can change with the different choosing of normal reference myocardium. T1 mapping may be a well modality of myocardium fibrosis by acquiring the T1 values and ECV with high reproducibility.

SSC01-04 Characterization of Left Ventricular Remodeling in Professional Soccer Players: Can we Prevent Sudden Cardiac Death Using CMR?

Monday, Nov. 28 11:00AM - 11:10AM Room: S502AB

Participants
Enver G. Tahir, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
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Marc Regier, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Regular physical activity over a long time period leads to a cardiac adaptation described as “athlete’s heart”. The purpose of this study was to determine the effects of intensive daily training in a specific type of sports- professional soccer, in regard to morphological and functional left ventricular parameters assessed by cardiac magnetic resonance imaging (CMR) and to compare these with non-athletic healthy volunteers.

METHOD AND MATERIALS

CMR was performed in 21 male professional soccer players from the German Bundesliga team squad of the Hamburger SV and 15 age-, sex- and weight-matched untrained controls at 1.5 T (Achieva, Philips) during the active season. For quantitative CMRI, an electrocardiographically triggered steady-state free precession (SSFP) cine sequence (TR/TE, 3.2/1.6ms; pixel-size, 1.7mm×1.7mm) was performed in short- and long-axis views. Quantitative analysis included end-diastolic (EDV) and end-systolic volumes (ESV), stroke volume (SV), left ventricular ejection-fraction (EF) as well as end-diastolic (EDMM) and end-systolic myocardial mass (ESMM). CMRI data were analyzed by two independent observers using the HeAT-Software. Data are given as the mean of both observers.

RESULTS

In professional soccer players a significant increase of the following parameters was determined compared to non-athletes: EDV (229 ±24 ml vs. 196 ±30 ml, P< 0.04), ESV (96 ±16 ml vs. 82 ±11 ml, P< 0.04) and LV mass (189 ±34 g vs. 143 ±19 g, P= 0.001). Stroke volume (133 ±19 ml vs. 115 ±23 ml, P= ns) and LV ejection fraction (0.58% vs. 0.58%, P= ns) were similar in both groups. The professional soccer players had a significantly lower resting heart rate than non-athletes (50 beat/min vs. 64 beat/min, P= 0.01).

CONCLUSION

Long-term training in professional soccer players is characterised by left ventricular adaptation leading to an increase in functional parameters and myocardial mass. CMRI allows an objective quantitative assessment and might help to differentiate physiologic cardiac adaptations from inherited hypertrophic cardiomyopathy.

CLINICAL RELEVANCE/APPLICATION

CMR imaging enables studies to the mechanisms of LV adaptation in professional soccer players and may help to differentiate physiological changes to high-level exercise from inherited cardiomyopathy.

SSC01-05 New Insights into Arrhythmogenic Mitral Valve Prolapse (MVP): A Cardiac Magnetic Resonance (CMR) Study

Monday, Nov. 28 11:10AM - 11:20AM Room: S502AB

Participants
Mariangela Cava, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
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Antonio Esposito, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Giovanni La Canna, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MVP is a commonly observed condition, due to improper leaflets atrial prolapse; often asymptomatic, it may bring significant complications, as severe ventricular arrhythmias, also without hemodynamic impairment, but the causes of electrical instability remain under-estimated and still unknown. Our aim was to explore the potential CMR role in evaluation of MVP combining the assessment of ventricular and mitral functions and anatomy with the evaluation of structural alterations as potential substrate for

arrhythmogenic risk.

METHOD AND MATERIALS

We enrolled 29 pts (47.2±17 y, 20F, 9M); CMR protocol consisted in evaluation of ventricular (LV and RV) function, myocardial edema (T2-STIR) and late gadolinium enhancement (LGE). Imaging post-processing included MVP assessment: prolapsed distance of posterior valve leaflet (maximum leaflet excursion beyond the mitral annular plane during systole) was measured (MVPE).

RESULTS

All patients showed systolic mitral valve leaflets excursion towards left atrium > or equal 2 mm, with mean MVPE of 8.2±5 mm.Mean mitral indexed annular diameter (MADi) was 23.3±5.12 mm; MADi and MVPE were directly related (p=0.028).During systole, a bulging of LV inferior wall near mitral valve annulus in 18 cases was recorded.Patients with bulging had greater MVPE (10.7±4.8 vs 4.2±2 mm p<0.001) and MADi (25.3±4.4 vs 19.6±4.4 mm p=0004).17 patients showed LGE, in 4 cases involving the posterior papillary muscle (PP), in 7 cases the infero-lateral LVwall (IBW), in 6 cases both.Patients showing LGE in PP frequently had systolic bulging (90% of cases, p=0.044) and showed greater MVPE (12.9±4.7 vs 5.8±3.4 p<0.001).In 17 cases patients suffered from arrhythmic events (2 VF, 9 NSVT, 5 LBBB, 1 AV-block) ; these events were significantly related with presence of ventricular LGE (p=0.006).

CONCLUSION

Mitral valve leaflets excursion has been characterized by CMR and was greater in patients with systolic bulging of LV base.The presence of LGE was related with frequent bulging and greater MPVE (when located on PP muscle) and more frequent in patients suffering from arrhythmic events.

CLINICAL RELEVANCE/APPLICATION

Cardiac magnetic resonance represents a reliable tool to characterize MVP, depicting mitral valve and ventricular features and identifying potentially arrhythmogenic LGE substrate.

SSC01-07 Myocardial T1 Mapping and Extracellular Volume Assessment in Left Ventricular Non-Compacted Miocardiopathy

Monday, Nov. 28 11:30AM - 11:40AM Room: S502AB

Participants
Jose de Arimateia B. Araujo Filho, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
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Jose R. Parga, MD, Curitiba, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluate the usefulness of native T1 Mapping and extracellular volume (ECV) quantification by MR (Magnetic Resonance) in characterizing myocardial abnormalities, mainly diffuse fibrosis in compacted myocardial areas, in patients with left ventricular non-compaction (LVNC), comparing those with and without late gadolinium enhancement (LGE) and left ventricular dysfunction (LVD).

METHOD AND MATERIALS

T1-mapping and LGE was performed in 32 patients with LVNC (diagnosed by Jenni ecocardiographic and Petersen MR criteria) and 16 normal subjects on a 1.5 T MR (PhilIps Achieva). LGE images were acquired 10-15 minutes after the intravenous injection of gadolinium. Assessment of segmental T1 values was performed on matching short axis slices, using the shortened modified Look-Locker inversion recovery (Sh-MOLLI). A region of interest was draft in the midseptum compacted myocardial, avoiding areas with LGE+, and in the LV cavity blood pool. T1 was measured pre-contrast and 15-20 min after the contrast injection and the ECV was obtained for each subject.

RESULTS

Late gadolinium enhancement (LGE) was present in 11 of the 32 LVNC patients (34%) and most often located in the anteroseptal e inferoseptal segments, mainly with mid-myocardial distribution. LVNC patients had higher native T1 (p = 0.001) an ECV (p<0.001) compared with controls, excluding areas of macroscopic fibrosis. ECV was significantly higher in LGE(+) subjects versus LGE(-) LVNC patients (0.325 ± 0.035 vs. 0.265 ± 0.028, p<0.001) and controls (0.325 ± 0.035 vs. 0.237 ± 0.018, p<0.001) - *Figure*. Although the mean native T1 and ECV were higher in the left ventricular dysfunction group compared with controls and LVNC patients with normal left ventricular function, this difference was not statistically significant (p estimated in 0.648 and 0.9 respectively).

CONCLUSION

Measurement of ECV and native T1 can provide an important non invasive assessment of interstitial myocardial involvement in LVNC and can be more sensitive than LGE imaging to detect diffuse fibrosis in these patients.

CLINICAL RELEVANCE/APPLICATION

Recent studies have correlated T1 Mapping and extracellular volume assessment by MR with diffuse fibrosis in some cardiomiopathies, with prognostic relevance, but not still in LVNC.

SSC01-08 Cardiac Magnetic Resonance Late Gadolinium Enhancement in Patients with Genetic Dilated Cariomyopathy

Monday, Nov. 28 11:40AM - 11:50AM Room: S502AB

Participants

Alexandra Sousa, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose
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Antonio Jose B. Madureira, MD, Porto, Portugal (*Presenter*) Nothing to Disclose
Adriana Belo, Coimbra, Portugal (*Abstract Co-Author*) Nothing to Disclose
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Jose Machado, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose
Elisabete Martins, Oporto, Portugal (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Dilated cardiomyopathy (DCM) has an estimated prevalence of 1:2500 in adult population, with genetic etiology explaining 30-50% of "idiopathic" cases. Genetic causality is difficult to identify because of the scarcity of distinctive red flags. In recent years, cardiac magnetic resonance (CMR) has emerged as a valuable imaging modality in this field. However, it´s utility in diagnosing genetic DCM remains largely unknown. In this work we aimed to describe CMR findings in genetically characterized DCM patients.

METHOD AND MATERIALS

We included patients with idiopathic and familial DCM, that underwent a comprehensive CMR with a 3-T scanner (Siemens, Erlangen, Germany), as part of their diagnostic work-up. Left ventricular (LV) volumes, ejection fraction (LVEF) and mass were measured using dedicated software (ARGUS Software™, Siemens Healthcare Global). LV late gadolinium enhancement (LGE) presence, pattern and location were assessed; extensive fibrosis was defined as LGE presence in >2 LV segments.Molecular analysis included LMNA/C, MYH7, MYBPC3, TNNT2, ACTC1, TPM1, CSRP3, TCAP, SGCD, PLN, MYL2, MYL3, TNNI3, TAZ and LBD3 genes.

RESULTS

We analyzed 73 patients, 47% with familial DCM, 53% men. Mean LVEF was 34±11% and LV end-diastolic volume of 128±34mL. LGE was present in 40% and non-compaction in 13%. We identified 21 genetic variants in 19 distinct patients (11 presented pathogenicity criteria).Comparing patients with or without genetic variants, we observed no difference in CMR parameters. Focusing on patients with the more frequent mutations, in MYBPC3, TNNT2 and MYH7 genes, we found only a trend toward an association of MYH7 mutations with LGE (p=0.057) – with a significant predilection for septum involvement (p=0.042), and with non-compaction (p=0.057).

CONCLUSION

LGE might have some utility in clinical recognition of patients with genetic DCM, namely those with MYH7 mutations, although additional studies are warranted to confirm these findings. Nevertheless, the exclusion of other causes of LV dysfunction and the use of more recent CMR tools, support the continued exploration of this technique in the evaluation of genetic/familial DCM patients.

CLINICAL RELEVANCE/APPLICATION

In patients with dilated cardiomyopathy, main CMR findings are not substantially different between patients with and without positive genetic test.

SSC01-09 Native Myocardial T1 Mapping and Extracellular Volume by Cardiac Magnetic Resonance Imaging in Subclinical Cardiomyopathy in Patients with Systemic Lupus Erythematosus

Monday, Nov. 28 11:50AM - 12:00PM Room: S502AB

Participants
Rui Wu, PhD, Shanghai, China (*Presenter*) Nothing to Disclose
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Binghua Chen, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jianrong Xu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to assess the utility of T1 mapping and extracellular volume for detecting the myocardial fibrosis in subclinical cardiomyopathy in patients with SLE.

METHOD AND MATERIALS

Twenty-five SLE patients without previous cardiac symptoms (21 female; mean age 38±14 years) and fifteen controls without obvious cardiovascular disease (9 female; mean age 37±12 years) underwent CMR at 3.0-T. The CMR sequence included cine, T1-maping, late gadolinium enhancement. Mean T1 value, ECV and circumferential strain parameters were determined for each subject.

RESULTS

Fibrosis on LGE was found in 15 SLE patients (60%) while none of controls. SLE patients had significantly higher native T1 values (1207±77 ms vs. 1131±26 ms; $p = 0.001$) and expansion of ECV (29.5±2.8% vs. 24.1±3.3%, $p < 0.001$) compared with controls. Left ventricular volumes, mass, stroke volumes and ejection fraction were not statistically significant between SLE patients and controls. Peak circumferential strain (-13.8±4.0% vs. -17.4±2.2%, $p = 0.003$) were significantly impaired in SLE patients. Native myocardial T1 values and ECV showed well correlation with peak circumferential strain in SLE patients ($r = 0.503$, $p = 0.01$; $r = 0.599$, $p = 0.002$, respectively).

CONCLUSION

SLE patients with subclinical cardiomyopathy had significantly higher native T1 values and expansion of ECV and associated reduction in peak systolic circumferential strain compared with normal control. Native T1 mapping and ECV may offer potential value to detect the myocardial fibrosis, aiming at preventing the progress of cardiomyopathy and receiving treatment early in SLE

patients.

CLINICAL RELEVANCE/APPLICATION

Native T1 mapping and ECV may offer as a novel biomarker to prevent the progress of cardiomyopathy and receiving treatment early in SLE patients.

SSC02

Cardiac (PET/CT/MRI/SPECT I)

Monday, Nov. 28 10:30AM - 12:00PM Room: S504AB

CA CT MR NM

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

FDA Discussions may include off-label uses.

Participants
Hildo J. Lamb, MD, PhD, Leiden, Netherlands (*Moderator*) Nothing to Disclose
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Sub-Events

SSC02-01 Wideband Cardiovascular MRI for Imaging Patients with Intracardiac Device Implantation

Monday, Nov. 28 10:30AM - 10:40AM Room: S504AB

Participants
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Michael Markl, PhD, Chicago, IL (*Abstract Co-Author*) Institutional research support, Siemens AG; Consultant, Circle Cardiovascular Imaging Inc;
Jeremy D. Collins, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
James C. Carr, MD, Chicago, IL (*Abstract Co-Author*) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA

PURPOSE

Implantable Cardiac Defibrillator (ICD) therapy is indicated for primary prevention of sudden cardiac death in patients with persistent systolic heart failure (LVEF ≤ 35%) despite optimal medical therapy. Some of these patients with conduction delays are also candidates for implantation of an ICD that provides Cardiac Resynchronization Therapy (CRT-D). It is increasingly recognized that cardiac MRI (CMR) is useful in guiding treatment strategies in heart failure. Despite the increasing awareness that CMR can be performed safely in patients with ICDs, the devices may cause significant artifacts limiting diagnostic utility. We have developed and implemented wideband MRI methods for perfusion T1 mapping, and late gadolinium enhancement (LGE) that suppress image artifacts and produce diagnostically acceptable images. This study demonstrates initial results using this wideband CMR protocol (Fig. 1A) in patients with ICDs referred for myocardial scar assessment.

METHOD AND MATERIALS

We have developed wideband (RF pulse bandwidth > 4kHz) MRI methods, including perfusion, LGE, and T1 mapping, on a 1.5T scanner (Avanto, Siemens) with specific absorption rate less than the safe limit of 2.0 W/kg. Wideband and standard MRI methods with typical imaging parameters (spatial resolution, temporal resolution, flip angle, etc.) were tested in 10 patients (age = 58 ± 19 years, 7 males) with an ICD who were scheduled to undergo clinical cardiovascular MRI. Three expert readers, blinded to each other, patient identity, and pulse sequence, independently graded the image quality on a scale of 1-5 (worst-best).

RESULTS

All study subjects completed the imaging protocol. Figure 1B shows representative perfusion, LGE, and T1 maps of patients with an ICD. Compared with standard MRI methods, wideband counterparts produced significantly ($p < 0.01$) higher image quality (perfusion: 3.4 ± 1.0 vs. 4.5 ± 0.6; LGE: 2.7 ± 1.1 vs. 3.8 ± 1.2; T1: 2.8 ± 1.1 vs. 4.1 ± 1.0) in all 10 patients.

CONCLUSION

This study demonstrates feasibility of a new wideband cardiovascular MRI protocol for comprehensive assessment of cardiac function, perfusion, and viability in patients with an ICD.

CLINICAL RELEVANCE/APPLICATION

This new protocol is a major step forward in MRI technology and may be used to advance existing or facilitate new therapies for patients with an ICD or CRT-D and to help with clinical decisions regarding: (i) VT therapies (ii) advanced therapeutics for myocardial recovery.

SSC02-02 Diffuse Fibrosis in Negative Late Gadolinium Enhancement Patients with Systemic Lupus Erythematosus-A Clinical Study using Native Myocardial T1 Mapping and Extracellular Volume Quantification

Monday, Nov. 28 10:40AM - 10:50AM Room: S504AB

Participants
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PURPOSE

To detect myocardial fibrosis in negative late gadolinium enhancement patients with SLE, using native myocardial T1 mapping and ECV quantification.

METHOD AND MATERIALS

Ten SLE patients without previous cardiac symptoms on negative LGE (7 female; 30±10 years) and fifteen control subjects without obvious cardiovascular disease (9 female; mean age 37±12 years) underwent CMR at 3.0-T. The CMR sequence included cine, T1 mapping, late gadolinium enhancement. Mean T1 value, ECV and circumferential strain parameters were determined for each subject.

RESULTS

SLE patients on negative LEG had higher native T1 values than control subjects, but was not statistically significant (1175±95 ms vs. 1131±26 ms, p = 0.104). Expansion of ECV in SLE patients on negative LEG was observed while compared with control subjects (27.1±2.1% vs. 24.1±3.3%, p = 0.019). Left ventricular volumes, mass, stroke volumes and ejection fraction were not statistically significant between SLE patients on negative LEG and control subjects. Peak circumferential strain (-14.7±4.1% vs. -17.4±2.2%, p = 0.045) were significantly impaired in negative LGE SLE patients . ECV showed well correlation with peak circumferential strain in SLE patients on negative LGE (r = 0.801, p = 0.005) while not shown in native myocardial T1 values.

CONCLUSION

ECV quantification in SLE patients on negative LEG was higher than control subjects and associated reduction in peak systolic circumferential strain. For diffuse fibrosis in negative LGE SLE patients, ECV may provide better value than native T1 values, and as a novel biomarker, helps patients receive early treatment.

CLINICAL RELEVANCE/APPLICATION

For diffuse fibrosis in negative LGE SLE patients, ECV may provide better value than native T1 values, and as a novel biomarker, helps patients receive early treatment and prevents the progress of firbrosis.

SSC02-03 3.0-Tesla Velocity-Encoded Cine MRI can Estimate Coronary Flow Reserve: Comparison with O-15-labeled Water PET

Monday, Nov. 28 10:50AM - 11:00AM Room: S504AB

Participants
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PURPOSE

Though the effects of coronary artery stenosis on downstream flow reserve are known, technical limitations to measure flow velocity on the distal vessels by MRI exist. We have developed a method to measure coronary flow velocity reserve (CFVR) on the left main trunk (LM) during stress and at rest non–invasively. The purpose here was to validate CFVR–LM on MRI by comparing with the analogous measure on O–15–labeled water PET (CFR_PET) and to evaluate its diagnostic value in detecting significant coronary artery disease (CAD).

METHOD AND MATERIALS

Eighteen healthy volunteers (age; 29±9 yr, all male) and 17 CAD patients (age; 69±12 yr, male; n=13) who underwent 3.0–T MRI and O–15–labeled water PET were studied. Coronary flow velocity on LM was measured with breath–hold velocity–encoded cine 3.0–T MRI during ATP (0.16mg/kg/min) stress and at rest (Figure a). CFVR was calculated by dividing peak–velocity during stress by that at rest. CFR_PET on the LM territory was also calculated.

RESULTS

CFVR could be assessed in all volunteers, but not in 4 CAD patients due to overtime scan during stress (n=1) or poor image quality (n=3). Among patients evaluated (n=13), 8 had 1–vessel disease (left anterior descending artery [n=5], left circumflex artery [n=3]) and 5 patients had 2–vessel disease. None had LM diseases. CFVR was well correlated with CFR_PET (r=0.61, P=0.0003) (Fig. b). A Bland–Altman plot between CFVR and CFR_PET showed agreement within 1.96 SD with bias (mean=0.83), suggesting that CFVR trended lower than CFR_PET (Fig. c). Inter–observer consistency showed good correlation (r=0.85, P<0.0001). CFVR in CAD patients was significantly lower than that in healthy volunteers (Fig. d), which was concordant with results of CFR_PET (Fig. e). In receiver operating characteristic (ROC) analysis of CFVR for the detection of CAD, the area under the ROC curve was 0.76 (P=0.0078). The Sensitivity was 76.9% and the specificity was 65.7% using a cutoff of 2.15.

CONCLUSION

CFVR with 3.0–T MRI validated with PET could accurately detect CAD. This method enables us to evaluate coronary circulatory function without radiation or contrast material.

CLINICAL RELEVANCE/APPLICATION

Coronary flow velocity reserve measured using 3.0–T MRI is clinically feasible for the detection of coronary artery disease with good sensitivity and specificity.

SSC02-04 Prospect CMR study: Prognostic Stratification in Patients with ST-Elevation myoCardial Infaction over

Transthoracic Echocardiography by CMR

Monday, Nov. 28 11:00AM - 11:10AM Room: S504AB

Participants
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PURPOSE

The prognostic stratification of patients with ST-segment elevation myocardial infarction (STEMI) and treated by primary percutaneous coronary intervention (PCI) is crucial in the management of this population. The aim of this study is to evaluate the additional value of a multi-parametric cardiac magnetic resonance (CMR) score in comparison with traditional TIMI (Thromolysis in Myocardial Infarction) score and transthoracic echocardiography (TTE) score in prognostic stratification of STEMI patients

METHOD AND MATERIALS

209 consecutive STEMI patients (mean age:61.4±11.4 year) reperfused by primary PCI underwent TTE and CMR three days after the index event. For each patient we measured: TIMI score, left ventricle ejection fraction (EFTTE), left ventricle end systolic volume (LVESVTTE) and number of myocardial segment with wall motion abnormalities (WMITTE) measured by TTE, left ventricle ejection fraction (EFCMR), left ventricle end systolic volume (LVESVCMR) and number of myocardial segment with wall motion abnormalities (WMICMR) measured by CMR, myocardial salvage index (MSI) and presence of microvascular obstruction (MVO). The primary clinical endpoint of study was the occurrence of major adverse cardiac events (MACE) defined as combined endpoint of hospitalization, acute coronary syndrome, implantable defibrillator and cardiac death.

RESULTS

The mean follow-up was 931±495 days.Patients experiencing MACE showed higher TIMI score($p<0.05$), LVESVTTE($p<0.01$),WMITTE ($p<0.01$),LVESVCMR($p<0.01$),WMICMR($p<0.01$),prevalence of MVO ($p<0.01$) and lower EFTTE($p<0.01$),EFCMR($p<0.01$) and MSI($p<0.01$).2 different models based on a binary score were created:a)Model 1 based on clinical parameters and TTE:TIMI<3=0 or >3=1; LVESVTTE <25ml/m2=0 or >25ml/m2=1; EFTTE>50%=0 or <50%=1;WMITTE<7=0 or >7=1;b) Model 2 based on CMR: LVESVCMR<55ml/m2=0 or >50ml/m2=1; EFCMR>50%=0 or <50%=1; WMICMR <7=0 or >7=1; MSI>0.47=0 or <0.47=1 ; MVO: absence=0 or presence=1. Clustering the study population for both model with a score threshold >2,model 2 provide a better prognostic stratification with a significant incremental prognostic value on the top of traditional outcome model (p:0.0001)

CONCLUSION

A multiparamtric approach with CMR including markers of myocardial damage provide incremental prognostic information in addition to traditional risk scores.

CLINICAL RELEVANCE/APPLICATION

A multiparametric approach with CMR provide incremental prognostic information in addition to traditional risk scores.

SSC02-05 Strain Analysis of Cardiac Sarcoidosis Based on Tagging Imaging Can Predict Focal Late Gadolinium Enhancement in MRI and FDG Accumulation in PET

Monday, Nov. 28 11:10AM - 11:20AM Room: S504AB

Participants
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PURPOSE

Focal cardiomyopathy is one of features of cardiac sarcoidosis (CS). FDG-PET and late gadolinium enhancement (LGE) in cardiac MR play an important role in evaluating this focal cardiomyopathy. In this study, we characterized focal cardiomyopathy in CS with segmented strain analysis based on MR tagging imaging, and compared with LGE in MR, and cardiac accumulation in FDG-PET.

METHOD AND MATERIALS

A total of 8 CS patients were retrospectively reviewed. They fulfilled the clinical diagnosis criteria of the CS and underwent 3T-MRI and FDG-PET within 2 months. We demarcated their hearts according to the 16-segment model by American Heart Association and evaluated their focal peak values of circumferential strain (Ecc) in systolic phase as the index of cardiac contractility, max value of Ecc rate as the index of diastolic function. Max Ecc rate was defined as the maximum gradient of a tangent to the Ecc curve in the diastolic phase. We also evaluated LGE, and FDG accumulation. LGE was defined as hyperenhanced lesions when signal intensity (SI) ≥ mean SI + 5 SD of normal myocardium. FDG accumulation was defined as lesions determined by two cardiovascular radiologists' consensus reading.Subsequently, we evaluated the mean value of peak Ecc and max Ecc rate among FDG (+)

segments and FDG (−) segments, LGE (+) and LGE (−) segments by Welch's t test.

RESULTS

In the 128 segments evaluated, peak Ecc and max Ecc rate in LGE (−) segments was better than in LGE (+) segments (-12.9% vs. -8.9%, p<.001, 42.0%/sec vs. 31.6%/sec, p<.001). The max Ecc rate in FDG (−) segments was also higher than in FDG (+) segments (40.2%/sec vs. 31.2%/sec, p<.001), while no significant difference was revealed in the peak Ecc between FDG (+) and FDG (−) segments (-11.7% vs. -10.3%, p=.18).

CONCLUSION

As an index of diastolic function, max Ecc rate calculated from strain analysis can predict focal FDG accumulation and LGE of CS. Further, a relationship of peak Ecc with LGE was identified, and attributed to systolic dysfunction.

CLINICAL RELEVANCE/APPLICATION

Focal cardiomyopathy due to cardiac sarcoidosis was effectively detected using strain analysis based on MR tagging imaging. This technique does not require any contrast agent or radiation exposure.

SSC02-06 Cardiac Remodeling and Changes in Blood Pressure Following Renal Denervation in Patients with Treatment-Resistant Hypertension

Monday, Nov. 28 11:20AM - 11:30AM Room: S504AB

Participants
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PURPOSE

In recent years, catheter-based renal denervation (RDN) has been investigated as a promising strategy in the treatment of resistant hypertension. The purpose of this study was to investigate the effect of RDN on blood pressure (BP) as well as cardiac mass and function via cardiac magnetic resonance imaging (CMR).

METHOD AND MATERIALS

RDN was performed on 15 patients with a history of resistant hypertension (Table 1). Office and ambulatory long term blood pressures were measured before and 12 months after RDN. For quantitative CMRI, an electrocardiographically triggered steady-state free precession (SSFP) cine sequence (TR/TE, 3.2/1.6ms; pixel-size, 1.7mm×1.7mm) was performed in short- and long-axis views previous to and 12 months after RDN (Fig. 1). Quantitative analysis included end-diastolic (EDV) and end-systolic volumes (ESV), stroke volume (SV), left ventricular ejection-fraction (EF) as well as left ventricular myocardial mass (LVMM). CMR data were analyzed by two independent observers using an in-house developed software (Heart Analysis Tool (HeAT)) (Fig. 2). Data are given as the mean of both observers. Statistical analysis was performed using GraphPad Prism 5 and Excel, Microsoft.

RESULTS

In patients with resistant hypertension, RDN let to a significant decrease of LVMM (165 ± 52 g vs 154 ± 51 g; p< 0.01) and LVMM indexed to body surface area (BSA) (80 ± 22 g/m2 vs 73 ± 21 g/m2; p< 0.01) within 12 months post-intervention (Fig. 3 and 5). EDV (161 ± 37 ml vs 166 ± 50 ml), EDV indexed to BSA (78 ± 15 ml/m2 vs 80 ± 21 ml/m2), ESV (69 ± 32 ml vs 70 ± 40 ml), ESV indexed to BSA (45 ± 8 ml/m2 vs 46 ± 13 ml/m2), SV (92 ± 20 ml vs 96 ± 30 ml) and EF (59 ± 11 % vs 60 ± 13 %) did not change on a significant level (Fig. 3). BP measurements revealed a significant decrease of the minimal diastolic BP in ambulatory long term measurements (53 ± 9 mmHg vs 49 ± 13 mmHg; p< 0.05). No additional significant changes of average, systolic or diastolic, office or ambulatory, diurnal or nocturnal BP measurements were detected (Fig. 4).

CONCLUSION

Despite a rather small effect on blood pressure, RDN lead to a decrease of left ventricular mass within 12 months after intervention.

CLINICAL RELEVANCE/APPLICATION

Our study indicates, that patients may benefit from RDN beyond reduction of the blood pressure.

SSC02-07 Diagnostic Accuracy of Coronary CT Angiography using Low Tube Voltage, Low Tube Current, Prospective ECG Triggering and Knowledge-based Model Reconstruction: Comparison with Invasive Coronary Angiography

Monday, Nov. 28 11:30AM - 11:40AM Room: S504AB

Participants
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PURPOSE

The aim of this study was to evaluate the diagnostic accuracy of coronary CT angiography (CCTA) using a low tube voltage, low

tube current, prospective electrocardiogram (ECG) triggering and iterative model reconstruction (IMR). Diagnostic accuracy was evaluated using invasive coronary angiography (ICA) as a reference standard.

METHOD AND MATERIALS

From January 2014 to February 2016, a total of 63 patients (Male:Female = 46:17, mean age = 61.8 ± 9.0 years, Body Mass Index (BMI) = 24.5 ± 2.6 kg/m2) with suspected coronary artery disease, who underwent CCTA and ICA, were retrospectively enrolled. CCTA was performed at a low tube voltage (80 kVp or 100 kVp), low tube current (100-200 mAs), and with prospective ECG triggering, followed by image reconstruction using IMR. Coronary artery disease (CAD) was defined as > 50% luminal narrowing and assessed using CCTA and ICA data. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy of CCTA were evaluated using ICA as the reference.

RESULTS

The mean radiation dose of CCTA was 1.07 ± 0.35 mSv. A total of 793 segments were enrolled. The mean attenuation and image noise of CCTA images were 468.1 ± 67.3 HU and 31.9 ± 8.6. There were no non-diagnostic segments. The per segment sensitivity, specificity, PPV, NPV and accuracy of CCTA were 85.9%, 96.1%, 80.0%, 97.4% and 94.5% respectively. The corresponding per vessel values were 93.3%, 94.3%, 87.5%, 97.1% and 94.0% respectively, and the per patient values were 100%, 83.3%, 93.8%, 100% and 95.2% respectively.

CONCLUSION

A low radiation dose CCTA protocol using a low tube voltage, low tube current, prospective ECG-triggering and IMR could be a useful strategy for diagnosing CAD as it reduces the radiation dose, while maintaining diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

CCTA, using an effective radiation dose of 1 mSv and IMR reconstruction, is an accurate, non-invasive, diagnostic method for CAD, and it might be applicable for CAD screening.

SSC02-09 Heart Rate Dependency in Cardiac T1 Mapping: An Analysis of the Modified Look-Locker Inversion Recovery (MOLLI) in a Phantom Model at Different Heart Rates

Monday, Nov. 28 11:50AM - 12:00PM Room: S504AB

Participants
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Armin M. Huber, MD, Munchen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recently T1 mappping was used for assessment of the myocardium under stress medication in order to detect ischemia without contrast agent. However, this has only been shown with a shortened modified Look-Locker inversion recovery (ShMOLLI) in contrast to a standard modified Look-Locker inversion recovery (MOLLI) sequence.Therefore, we sought to assess the heart rate independency of a MOLLI sequence with a modified read-out pattern to be more heart rate resistant.The aim of this study was to show that a MOLLI sequence could be eligible for a non contrast assessment of the myocardium under stress medication.

METHOD AND MATERIALS

The phantom studies were carried out at a 3.0 Tesla MRI system with multitransmission technology. Phantoms with different dilutions of gadopentetate dimeglumine were examined at different simulated heart rates (60, 70, 80, 90, 100 and 110 bmp) with a MOLLI sequence with a 5s-(3s)-3s read-out pattern in comparison to a 5b-(3b)-3b pattern.The dilutions resulted in samples with 220, 390, 550, 750, 890, 1100 and 1500 ms of T1 relaxation times. T1 relaxation times were measured three times for each sample.

RESULTS

All scans with the MOLLI 5b-(3b)-3b-sequence showed a significant inverse correlation of the measured relaxation time and the heart frequency for T1 phantoms with T1 relaxation times of 550 ms to 1500 ms ($p < 0.05$; mean slope: -4.1ms/beat per minute). For samples with a relaxation times of ≤ 390 ms the determined T1 time was independent of the heart rate ($p > 0.05$, mean difference: -0.01 ms) for the MOLLI 5b-(3b)-3b-sequence.However, no significant correlation of the measured T1 values and the heart rate was observed for the MOLLI 5s-(3s)-3s-sequence ($p > 0.15$; mean slope: 0.04 ms/beat per minute).

CONCLUSION

The already shortened MOLLI 5b-(3b)-3b showed a significant heart rate dependency while the MOLLI 5s-(3s)-3s-sequence did not.

CLINICAL RELEVANCE/APPLICATION

Therefore, MOLLI seems theoretically to be eligible for comparisons of values at different heart rates e.g. under stress medication or exercise.

SSC03

Science Session with Keynote: Chest (Nodule/Radiomics)

Monday, Nov. 28 10:30AM - 12:00PM Room: S404CD

CH CT MR

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

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Sub-Events

SSC03-01 Chest Keynote Speaker: Fleischner Society Nodule Guidelines Update

Monday, Nov. 28 10:30AM - 10:40AM Room: S404CD

Participants
Heber MacMahon, MD, Chicago, IL (*Presenter*) Consultant, Riverain Technologies, LLC; Stockholder, Hologic, Inc; Royalties, UCTech; Research support, Koninklijke Philips NV; Consultant, General Electric Company

SSC03-02 Diameter Measurement of the Solid Component in Sub-solid Nodules on CT: Effect of Window Setting and Reconstruction Image Plane on Prediction of Invasive Component of Lung Adenocarcinoma

Monday, Nov. 28 10:40AM - 10:50AM Room: S404CD

Awards
Student Travel Stipend Award

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PURPOSE

We aimed to assess the effect of window setting and reconstruction image plane in measuring the solid component within subsolid nodules (SSNs) and its predictive value on the size of invasive component.

METHOD AND MATERIALS

We searched the lung adenocarcinoma operation records at our institution from Feb 2012 to Oct 2015 and identified 252 nodules in 225 patients which manifested as SSNs on thin-section preoperative chest CT. For each nodule, all serial CT slices containing the nodule were reconstructed in axial, coronal and sagittal planes. Two radiologists independently measured the solid component with lung and mediastinal window settings in three reconstruction planes. On the representative CT image, long diameter was measured with lung window and both long and short diameters were measured in mediastinal window. The correlation between the CT and pathologic measurements and interobserver variability were assessed using intra-class correlation (ICC).

RESULTS

The size of invasive component showed good correlation with the long diameter of the solid component in lung window (ICC range, 0.71–0.76) and also with the average of long and short diameters in mediastinal window (ICC range, 0.63–0.68). The size of solid component on CT tended to be smaller than that of invasive component on all measurements. With regard to window setting, the difference between the size of solid component and invasive component was smaller in lung window (mean difference, 0.43–1.22 mm) than in mediastinal window (mean difference, 4.04–5.01 mm) on all image planes. In addition, the difference between the size of solid component and invasive component was smallest when the maximum diameter on three reconstruction plane was measured (mean difference, 0.43 mm [95% CI: -1.05, 0.18] with lung window). Interobserver agreement in CT measurements was excellent (ICC range, 0.85–0.92) either with lung or mediastinal window setting.

CONCLUSION

Measuring the solid component in lung window on the three (axial, coronal, and sagittal) reconstruction planes better predicts the size of invasive component than the method by the 2013 Fleischner Society's guideline.

CLINICAL RELEVANCE/APPLICATION

Measuring the solid component in lung window on the three reconstruction planes may help in determination of the extent of surgical resection by better predicting pre-invasive and minimally invasive adenocarcinomas.

SSC03-03 Solitary Pulmonary Nodule: Comparison of the Capability for Differentiating Malignant from Benign Nodules among Quantitatively Assessed Dynamic First-Pass CE-Perfusion ADCT and MR Indexes and FDG-PET/CT

Monday, Nov. 28 10:50AM - 11:00AM Room: S404CD

Participants
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PURPOSE

To compare the capability for differentiating malignant from benign nodules among quantitatively assessed dynamic first-pass contrast-enhanced (CE-) perfusion area-detector CT (ADCT) and magnetic resonance imaging (MRI) indexes and FDG-PET/CT.

METHOD AND MATERIALS

57 consecutive patients (38 male, 29 female; mean age 73 years) with 71 nodules underwent dynamic CE-perfusion ADCT and MRI, PET/CT, and microbacterial and/or pathological examinations. 71 nodules were classified into two groups based on the final diagnoses: malignant (n=45) and benign nodules (n=26). All dynamic CE-perfusion CT examinations were performed on a 320-detector row CT, and dynamic CE-perfusion MRI at a 3T system. All PET/CT examinations were performed by using standard technique on a PET/CT scanner. In each patient, total nodule perfusion (TNP) and nodule perfusions from pulmonary (NPP) and systemic (NPS) circulations calculated by dual-input maximum slope method from on dynamic ADCT and MRI data and SUVmax on PET/CT were assessed by ROI measurements. Then, all indexes were compared between malignant and benign nodules by Student's t-test. On each index, ROC analysis was performed, and feasible threshold value was determined. Finally, sensitivity, specificity and accuracy were compared each other by using McNemar's test.

RESULTS

All indexes had significant difference between malignant and benign nodules ($p<0.001$). Area under the curves (Azs) of TNPs of dynamic ADCT (Az=0.89) and MRI (Az=0.88) were significantly larger than that of NPSs on both methods (ADCT: Az=0.75, $p<0.05$; MRI: Az=0.81, $p<0.05$). When feasible threshold values adopted, accuracy of TNP on dynamic ADCT (87.3 [62/71] %) and MRI (87.3 [62/71] %) was significantly higher than that of NPSs (ADCT: 77.5 [55/71] %, $p=0.008$; MRI: 77.5 [55/71] %, $p=0.008$) and SUVmax (78.9 [56/71] %, $p=0.02$).

CONCLUSION

Quantitatively assessed dynamic first-pass CE-perfusion ADCT and MRI indexes have better potential than PET/CT for differentiaing malignant from benign nodules. In addition, both quantitative perfusion methods are considered as having same potential in this setting.

CLINICAL RELEVANCE/APPLICATION

Quantitatively assessed dynamic first-pass CE-perfusion ADCT and MRI indexes have better potential than PET/CT for differentiaing malignant from benign nodules. In addition, both quantitative perfusion methods are considered as having same potential in this setting.

SSC03-04 Ultra-short TE Imaging at 3T for the Morphological Characterization of Pulmonary Nodules

Monday, Nov. 28 11:00AM - 11:10AM Room: S404CD

Participants
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PURPOSE

Ultra-short echo time (UTE) magnetic resonance imaging (MRI) has been shown to deliver high-resolution images comparable to computed tomography (CT). Here we evaluate UTE's potential for precise lung nodule characterization at 3T.

METHOD AND MATERIALS

Fifty-one patients (mean age 68.7±10.8years) with 119 nodules/masses of 4-88mm (mean 17.4±16.3mm) underwent CT (1mm slice

thickness) and UTE (1mm3 isotropic resolution). Two chest radiologists assessed long axis, contrast-to-noise ratio (CNR), and detailed morphology (attenuation, margin, internal lucency) in consensus for CT, and for UTE in a blinded fashion. Sensitivity, specificity and inter-method agreement for morphological features were calculated with CT being the standard of reference.

RESULTS

Nine nodules (7.5%) were not visible on UTE, mostly due to very low CT attenuation. UTE tended to underestimate the long axis by 1.2±3.4mm compared to CT (p=0.359), with higher differences observed in part-solid (-2.6±5.1mm, p<0.05) and purely ground-glass (GGO) (-1.4±2.8 mm, n.s.) than in solid nodules (-0.7±2.6 mm). Mean CNR was 20.0±12.1 for CT and 36.1±21.5 for UTE (p<0.001). As in CT, CNR of part-solid (37.4±19.4) and GGO (13.9±8.6) was lower than of solid nodules (39.0±21.8) with UTE (p<0.05-0.001). Sensitivity and specificity of UTE for identifying part-solid attenuation were 57.7% and 97.6%, but were 90.9% and 98.0% for purely GGO attenuation (κ=0.71). Sensitivity and specificity for margin characteristics were: 70.6% and 93.2% for lobulation, 61.5% and 95.2% for spiculation, 87.0% and 93.8% for pleural tags, respectively (κ=0.64-0.81). Internal lucencies were correctly identified in 72.7% with 96.1% specificity (κ=0.73). Calcification was always not identified with UTE.

CONCLUSION

UTE showed high diagnostic properties for nodule size and morphology assessment, otherwise unprecedented by MRI. It should be developed further into a routine modality for nodule detection and lung cancer staging as part of comprehensive whole-body protocols.

CLINICAL RELEVANCE/APPLICATION

UTE of the chest may prove useful as a novel modality for lung cancer screening and staging, and pediatric oncology, reducing radiation burden in these populations due to repeat surveillance imaging.

SSC03-05 Quantitative CT Analysis of Pulmonary Pure Ground-Glass Nodule Predicts Histological Invasiveness

Monday, Nov. 28 11:10AM - 11:20AM Room: S404CD

Participants
Fan Li, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
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Shi Yuan Liu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether quantitative CT analysis enables predict histological invasiveness of pulmonary adenocarcinoma, appearing pure ground glass nodules (pGGNs).

METHOD AND MATERIALS

We retrospectively evaluated 110 pulmonary pure GGNs resected between June 2012 and October 2015, and pathologically classified them as pre-invasive lesions[included atypical adenomatous hyperplasia (AAH)and adenocarcinoma in situ (AIS);n =50],MIA (n=28), or invasive adenocarcinoma (n=32). Nodule size , the largest cross-sectional area , volume, mean CT value , mass, and CT attenuation values at the 0th,2th,5th, 25th, 50th,75th, 95th,98th and 100th percentile on histogram, and the slopes of CT attenuation values from 5th to 95th percentlie, 25th to 75th percentlie, 2th to 98th percentle ,0th to 100th percentle of the three groups were compared.A multivariate logistic regression analysis and Receiver operating curve (ROC) were performed to evaluate the differentiating performance in predicting histological invasiveness.

RESULTS

Of 110 pure GGNs, 22 were AAH, 28 were AIS, 28 were MIA, and 32 were invasive adenocarcinoma. The nodule size, the largest cross-sectional area , mass were significantly larger in the invasive adenocarcinoma group than in the pre-invasive and MIA groups.The 95th ,98th ,100th percentile, slope (2th to 98th),slope(25th to 75th),slope (0th to 100th) were significantly different from pre-invasive lesions and MIA or invasive adenocarcinoma. Logistic regression analysis showed that the nodule size (OR 1.21, 95% CI: 1.071 ~ 1.366, p <0.01) , the 100th percentile on CT number histogram (OR: 1.02, 95% CI: 1.009 ~ 1.032, p <0.001) and the slope (0th to 100th) (OR: 0.248, 95% CI:0.094 ~ 0.653, p <0.01) predicted the histological invasiveness independently. ROC curve analysis was performed based on the predicted probability of Logistic regression model, and the area under the curve was 0.824 (95% CI:0.745~0.903, p <0.001) .

CONCLUSION

Quantitative analysis of CT imaging can predict histological invasiveness of pGGNs, especially maximum diameter and 100th percentile on CT number histogram, which can instruct the long-term follow-up and selective surgical management.

CLINICAL RELEVANCE/APPLICATION

CT number histogram measurements of pure GGNs can reflect the heterogeneity of tumor and be useful for monitoring pure GGNs growth.

SSC03-06 CT Texture Analysis of Lung Cancer Nodule's Microenvironment: Initial Experience

Monday, Nov. 28 11:20AM - 11:30AM Room: S404CD

Participants
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PURPOSE

CT Texture analysis (CTTA) of lung cancer nodules has been identified as a potential imaging biomarker of malignancy. The purpose of this study was to determine if the microenvironment around such nodules is different from normal lung parenchyma and also a potential biomarker.

METHOD AND MATERIALS

A retrospective analysis of CT images from 53 lung cancer patients was performed. One lesion was delineated for each patient. CTTA was performed on the parenchyma surrounding a lesion and contralateral normal parenchyma. The regions of interest (ROIs) were: ROI1 was a 7mm region of parenchyma around the malignant nodule; ROI2, the reference containing normal parenchyma, was selected by mirroring ROI1 in the other lung. ROI3 and ROI4 were control regions measured at different levels in the lung containing the lesion and the contralateral lung to ensure that the observed difference did not represent differences between the lung's textures. 20 texture features including Haralick, Laws features and summary statistics were extracted for the 4 regions. A Support Vector Regressor model (libSVM) was trained on an independent population of pulmonary nodules and used to predict a malignancy score for each region of the current dataset. The Wilcoxon rank-sum test was used to compare the malignancy scores obtained for ROI1 vs. ROI2, and ROI3 vs. ROI4.

RESULTS

The mean scores for ROI1-4 were 0.236 (sd 0.210), 0.020 (sd 0.232), 0.056 (sd 0.289) and 0.063 (sd 0.252), respectively. There was a statistically significant difference between the malignancy scores for ROI1 and ROI2 (p-value = 3.41e-06). By comparison, we found no difference between control regions ROI3 and ROI4 (p-value = 0.77).

CONCLUSION

CTTA is able to identify texture changes in the microenvironment around a nodule. These parenchymal changes may be a biomarker of malignancy.

CLINICAL RELEVANCE/APPLICATION

Identifying early changes in the lung parenchyma may allow early diagnosis of malignant pulmonary lesions.

SSC03-07 Radiomic Features of the Perinodular Habitat on Non-contrast Lung CT Discriminates Adenocarcinoma from Granulomas

Monday, Nov. 28 11:30AM - 11:40AM Room: S404CD

Participants
Niha G. Beig, MS,BEng, Cleveland, OH (*Presenter*) Nothing to Disclose
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Anant Madabhushi, PhD, Piscataway, NJ (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

From a radiographic perspective, it is difficult to distinguish lung adenocarcinoma (AC) from granuloma (Gr). While these nodules can have similar appearances and both can show increased activity on PET CT evaluation, the vascular invasion and lymphangiogenesis in the perinodular habitat of AC is different from Gr. We seek to see if this biological difference can be captured by gradient based radiomic descriptors on non-contrast CT images. The challenges of a multi-site cohort are also addressed by separating the scans, based on CT reconstruction kernels (rK).

METHOD AND MATERIALS

Histology confirmed 69 non-contrast lung CT scans with 45 AC & 24 Gr cases were acquired from multiple Siemens CT scanners with different rK.Each patient had 2 rK CT scans. rK of B30f/s, B31f, B35f/s, B41f/s were grouped as 'smooth rK' & scans with a rK of B50f/s, B60f/s, B70f, B80f were grouped as 'sharp rK'. Regions of interest(ROI) were annotated by an expert reader. In the perinodular habitat, all 'air' pixels lesser than -900 Hounsfield units were removed before radiomic analysis. For each lesion, first order statistics were then derived from different radiomic descriptor families (example Haralick, Laws Energy, Histogram of oriented Gradient (HoG) and Gabor) resulting in a total 732 computerized 2D texture features.100 iterations of 3 fold cross validation were setup to evaluate the performance of features using Area Under the receiver-operating characteristic Curve (AUC) via Quadratic Discriminant Analysis (QDA) classifier.Most discriminative features were identified by using Feed Forward Feature Selection (FFFS) method.

RESULTS

From the smooth rK scans, top four features consisting of Gabor & Histogram of oriented Gradient (HoG), provided an AUC of 0.84±0.05 for distinguishing AC from Gr on CT.Smooth rK scans performed better than sharp rK (AUC=0.72±0.08), emphasizing that different CT acquisition pararmeters effect radiomic analysis.

CONCLUSION

The perinodular habitat has textural attributes that can differentiate AC from Gr. Radiomic descriptors such as Gabor and HoG may be capturing the higher lymphatic vessel density around AC. Independent validation on a larger cohort is required to authenticate the results.

CLINICAL RELEVANCE/APPLICATION

~ 30% of suspicious nodules undergoing biopsy for histologic confirmation are benign.Radiomic analysis of perinodular habitat can help reduce the number of unnecessary wedge resections for granulomas.

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/

Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator

SSC03-08 Evaluating Characteristics of Intrapulmonary Lymph Nodes Could Change Management of Pulmonary Nodules

Monday, Nov. 28 11:40AM - 11:50AM Room: S404CD

Participants
Matthew J. Stephens, MD, Denver, CO (*Presenter*) Nothing to Disclose
Byung-Hak Rho, MD, Namgu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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David A. Lynch, MBBCh, Denver, CO (*Abstract Co-Author*) Research support, Siemens AG Scientific Advisor, PAREXEL International Corporation Consultant, Boehringer Ingelheim GmbH Consultant, Gilead Sciences, Inc Consultant, F. Hoffmann-La Roche Ltd Consultant, Veracyte, Inc

PURPOSE

The purpose of this study was to evaluate pulmonary nodules in terms of intrapulmonary lymph node characteristics and extract features that in combination have high negative predictive value for excluding malignancy.

METHOD AND MATERIALS

Retrospective study evaluating 437 patients from the COPDGene® study who on initial CT scan had reported pulmonary nodule and either had documented lung cancer (n=81) or documented benign nodules at 5 year followup (n=356). Nodules were reviewed and characterized on initial CT scans by two independent readers using features previously shown to be associated with intrapulmonary lymph nodes. Multivariate analysis was used to extract features best suited to distinguish malignant nodules and benign nodules determined either from 5 year CT follow up or clinical history pertaining to cancer location in patients with known malignancy. Combination of pertinent features were then used to predict likelihood a nodule was a benign intrapulmonary lymph node and optimal cutoffs were determined to eliminate nodules likely to be intrapulmonary lymph nodes. Determined cutoffs were then applied to both LUNG-RADS and Fleischner Society guidelines to see potential impact on the same patient population.

RESULTS

Multivariate analysis showed that the presence of lymph node characteristics had strong negative predictive value for malignancy. Using optimized cutoffs (Sensitivity 97%, Specificity 38%, NPV 99%, PPV 13%), up to 51% of characterized pulmonary nodules could be excluded from further follow up without impacting management of patients with lung cancer. When management strategy for these patients was simulated based on LUNG-RADS or Fleischner criteria, inclusion of lymph node characteristics was found to result in a potential 5% reduction in CT utilization for LUNG-RADS and 37% for Fleischner criteria.

CONCLUSION

Excluding nodules which have high probability for being an intrapulmonary lymph node from further followup could have significant impact on CT utilization with little to no clinical impact on patient outcomes.

CLINICAL RELEVANCE/APPLICATION

Using lymph node characteristics in conjunction with LUNG-RADS and Fleischner Criteria guidelines might decrease CT utilization without having significant effect on patient outcomes.

SSC03-09 Novel Ultralow Dose (ULD) X-ray Evaluation of Lung Nodules Using Dual Energy and Digital Tomosynthesis Technologies

Monday, Nov. 28 11:50AM - 12:00PM Room: S404CD

Participants
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PURPOSE

Dual-energy (DE) x-ray could improve nodule detection by tissue discrimination. Digital tomosynthesis (DT) x-ray could improve nodule detection by spatial discrimination. The purpose of this study is to evaluate ULD DE and low-dose DT as alternatives to chest radiography (DR) and low dose CT (LDCT) for detection and characterization of lung nodules.

METHOD AND MATERIALS

Study 1 – Solid lung nodule: 4, 5, 6, 8 and 10mm spheres (100 HU) were placed in an anthropomorphic chest phantom and imaged with DR, DE and DT x-rays. DE x-rays were acquired with fixed and differential filtration. DT x-rays (DT100%) were acquired at a reference dose 8 times the exposure of a PA chest DR. DT30% and DT50% were also acquired. Imaging performance was evaluated

quantitatively and compared using detectability metrics (d') that were normalized by dose to provide dose efficiency metrics (d'norm).Study 2 – Ground Glass Nodule (GGN): GGN can represent inflammation, infection or low-grade adenocarcinoma. These pathologies can vary in the extent of tissue edema. The performance characteristics of chest DR, DE and DT for GGN were tested with A) ~2 cmcotton wool spheres varying in water content (simulated GGN) and B) 4, 5, 6, 8 and 10mm spheres (-800HU). A) and B) were placed into the anthropomorphic chest phantom and imaged using DR, DE, and DT followed by low dose CT (1mSv) using a wide volume CT: 320 x 0.5mm detector configuration, 135kV, 40mA, 0.5s GR. The CT images served as a reference standard.

RESULTS

To date:Study 1 – (d',d'norm) values were (1.2,0.7) and (1.3,1.1) for DE acquired with fixed and differential filtration. (d',d'norm) values were (11.8,7.8), (14.6,7.7) and (18.1,5.9) for DT30%, DT50% and DT100%. The values were normalized such that d'=d'norm=1 for DR.Study 2 – DT is superior to DR and DE in demonstrating GGN irrespective of water content.

CONCLUSION

DE and DT have superior detection performance per unit dose compared to DR. DT becomes anatomical noise limited (not dose limited) below DT50%. Differential filtration is a more dose-efficient technique for DE acquisition compared to fixed filtration.

CLINICAL RELEVANCE/APPLICATION

DE and DT x-ray have superior performance to DR, and comparable performance to LDCT for detection and characterization of lung nodules with significant reduction in radiation dose.

SSC04

Gastrointestinal (Pancreas Cancer)

Monday, Nov. 28 10:30AM - 12:00PM Room: E353A

CT GI MR OI

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

Participants

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Bhavik N. Patel, MD,MBA, Durham, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSC04-01 Colloid Carcinoma of The Pancreas: Differentiation From Conventional Ductal Adenocarcinoma Associated with Intraductal Papillary Mucinous Neoplasm

Monday, Nov. 28 10:30AM - 10:40AM Room: E353A

Participants
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Siva P. Raman, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ralph H. Hruban, Baltimore, MD (*Abstract Co-Author*) Royalties, Myriad Genetics, Inc
Elliot K. Fishman, MD, Baltimore, MD (*Abstract Co-Author*) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company;

PURPOSE

Colloid carcinoma (CC) is a distinct subtype of pancreatic cancer usually arising in association with intraductal papillary mucinous neoplasm (IPMN). CC has specific histopathological and molecular features, and has better prognosis than conventional ductal (tubular) adenocarcinoma (DA). The purpose of this study is to determine CT features of CC compared to DA arising in association with IPMN.

METHOD AND MATERIALS

Eighty-seven consecutive patients with pathological diagnosis of IPMN with invasive carcinoma (CC or DA) who had preoperative contrast enhanced CT were retrospectively evaluated. These included 30 patients with CC (20 male, 10 female, average age: 68.2±9.4) and 57 patients with DA (30 male, 27 female, average age: 71.1±10.6). Following CT features were reviewed by 2 radiologists. (1) main pancreatic duct (MPD) diameter, (2) diameter of the largest cystic mass, (3) and its location (Head/uncinate process vs. body/tail), (4) mural nodule, (5) calcifications in mass, (6) separate extraductal solid mass, (7) morphology of transition of MPD dilatation (abrupt transition vs. communicated with cystic mass), and (8) fistula to duodenum or common bile duct (CBD). These findings are compared between CC and DA.

RESULTS

MPD diameter was larger in CC compared to DA (14.0±10.0mm vs. 8.0±4.4mm; p=0.0002). The largest cystic mass was larger in CC than DA (4.8±3.4cm vs. 2.2±1.6cm, p<0.0001), and more likely located in the head/uncinate process of the pancreas in CC compared to DA (83% vs. 50%) and less likely located in the body/tail (17% vs. 50%) (p=0.0062). Mural nodule was more commonly seen in CC than DA (67% vs. 10%, p<0.0001). Calcifications were seen only in CC in 7 cases (23%, p=0.0001). Fistula to duodenum or CBD was observed or suspected in CC in 6 cases, but none in DA (p=0.0005). DA was more likely associated with separate extraductal solid mass compared to CC (70% vs. 23%, p<0.0001). In CC, dilated MPD tended to communicate with cystic mass (89%), whereas dilated MPD tended to abruptly terminate in DA (86%, p<0.0001).

CONCLUSION

Significant dilatation of MPD, large cystic mass with mural nodules, presence of calcifications, and fistula to duodenum and CBD are suggestive of CC in cases of IPMN.

CLINICAL RELEVANCE/APPLICATION

CCs have better prognosis than DAs, and have unique CT features including markedly dilated MPD, large cystic mass with mural modules, and are predisposed to calcifications and fistulous communication to duodenum or CBD.

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/

Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
Elliot K. Fishman, MD - 2016 Honored Educator

SSC04-02 DPC4 gene Status in Primary Pancreatic Ductal Adenocarcinoma: Relationship with CT Characteristics

Monday, Nov. 28 10:40AM - 10:50AM Room: E353A

Participants
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PURPOSE

Recent advances in pancreatic ductal adenocarcinoma biology have led to the discovery of recurrent genetic mutations in K-ras, p53, and DPC4 and the identification of the core signaling pathways for this disease. However, there have been no studies on the association between DPC4 gene status and the tumor growth patterns of pancreatic ductal adenocarcinoma on imaging modalities. We conducted our present study to To investigate the relationship between CT imaging findings and DPC4 gene status and determine the prognostic value of DPC4 gene status to predict overall survival in patients with pancreatic ductal adenocarcinoma.

METHOD AND MATERIALS

Between January and December 2011, we retrospectively analyzed 163 pancreatic ductal adenocarcinomas in 163 patients who had undergone surgical resection (mean age = 61.8 years; range = 35–81 years). We divided the study patients into 2 groups according to DPC4 gene status: DPC4-intact or DPC4-lost group. The qualitative CT findings were analyzed by two reviewers. The associations between the CT imaging findings and DPC4 gene status were evaluated using univariate anlaysis and multivariate logistic regression analysis. Overall survival was compared between the DPC4-intact and DPC4-lost group using Kaplan-Meier analysis and log-rank testing.

RESULTS

Between DPC4-intact group (n=75) and DPC4-lost group (n=88), three CT findings (i.e., tumor margin, peripancreatic infiltration, and background IPMN) were significantly different in univariate analysis. Of these, the presence of well-defined tumor margin was an independent and significant predictor of DPC4-intact gene mutation status (adjusted odd ratio = 2.06; p = 0.032) in multivariate analysis. The mean overall survival of the DPC4-intact group was significantly longer than the DPC4-lost group (30.0 months vs 22.0 months; p = 0.049).

CONCLUSION

The presence of well-defined tumor margins on CT is an independent predictor of intact DPC4 gene status, which is associated with better overall survival in patients with pancreatic ductal adenocarcinoma.

CLINICAL RELEVANCE/APPLICATION

The radiogenomic features of pancreatic ductal adenocarcinoma can make more tailored treatment plans, exploring the genetic and molecular biology of this tumor.

SSC04-03 Local Staging of Pancreatic Ductal Adenocarcinoma: Analysis of CT Report Adequacy and Impact of Second Opinion Assessment at a Tertiary Referral center

Monday, Nov. 28 10:50AM - 11:00AM Room: E353A

Participants
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Alison C. Harris, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Society of Abdominal Radiology and American Pancreatic Association consensus guidelines on reporting of staging CT for pancreatic ductal adenocarcinoma (PDA) recommend structured reporting to ensure complete assessment and accurate local staging. We assess adequacy of staging CT reports in this patient cohort for report completeness and adequacy in assessing local staging for potential resection, plus compare reported findings with second read evaluation of the CT studies.

METHOD AND MATERIALS

Patients with biopsy proven PDA that were discussed at pancreatic tumor rounds at a tertiary referral center over a six-month period were included. Staging CT reports and images were reviewed. Reports were assessed for completeness, employment of template reporting and local staging for potential resectability (resectable, borderline resectable, locally advanced) per above consensus guidelines. Images were also reviewed in a blinded fashion in consensus by two radiologists to assess for local stage, metastatic disease and potential for surgical resection.

RESULTS

101 staging CTs were reviewed (55% male, median age 67 years). 67% of studies were performed at outside hospitals. No report overtly utilized a report template. Lesion size, specific location, effects on pancreatic duct and effects on the biliary tree were provided in 89%, 96%, 87% and 82% of reports respectively. Specific reference to the superior mesenteric artery, celiac artery, hepatic artery, superior mesenteric vein and portal vein was absent in 45%, 53%, 59%, 38% and 53% respectively. Internal reports demonstrated complete correlation with the blinded second read with regard to local staging/potential resectability. 28% of external reports were unclear regarding vascular involvement and hence potential for resection. Second review resulted in upgrading of local stage in 36% of external reports, with the remaining 36% of external reports being concordant with second review with regard to potential resectability.

CONCLUSION

Template reporting is not utilized in the examined reports. Many reports remain incomplete, particularly regarding vascular involvement. Studies performed and reported outside of the tertiary referral center were unclear or underestimate local stage in

almost two thirds of cases.

CLINICAL RELEVANCE/APPLICATION

Accurate CT reporting of pancreatic ductal adenocarcinoma is essential in selecting patients that are potentially resectable.

SSC04-04 Additive Value of MRI with Diffusion-Weighted Imaging to MDCT for the Characterization of Focal Liver Lesions in Patients with Potentially Resectable Pancreatic Cancer

Monday, Nov. 28 11:00AM - 11:10AM Room: E353A

Participants
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Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Grant, Guerbet SA; Support, Siemens AG; Grant, Bayer AG; Grant, General Electric Company; Grant, STARmed Co, Ltd; Grant, RF Medical Co, Ltd; Grant, Toshiba Corporation; Grant, Samsung Medical Healthcare
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PURPOSE

To investigate the added value of magnetic resonance imaging(MRI) with diffusion weighted imaging(DWI) to preoperative staging MDCT for the characterization of focal liver lesion(FLL) in the staging work-up of patients with potentially resectable pancreatic ductal adenocarcinoma(PDAC)

METHOD AND MATERIALS

This retrospective study was approved by institutional review board; informed consent requirement was waived. We included 215 patients with pathologically proven PDACs who underwent pancreas protocol MDCT and MRI with DWI, with histologic or clinical reference standard confirmation of FLLs. Local resectability of PDACs were evaluated on MDCT (resectable, borderline resectable, unresectable) and characteristics of FLLs were scored as benign(including no FLL), indeterminate, or metastases on the MDCT set and combined MDCT and MRI with DWI set in separate sessions. Per-patient detection rate of hepatic metastasis unsuspected by MDCT and the additional diagnostic yield of MRI with DWI for FLLs were assessed.

RESULTS

Among 159 patients who were assessed to have a potentially resectable PDAC on MDCT(resectable, n=83; borderline resectable, n=76), 14 patients(8.81%, 14/159) were confirmed to have hepatic metastases and the other 145 as having benign-liver. Regarding FLLs, patients were classified as benign, indeterminate, or metastases in 128, 20, and 11 on MDCT and 142, 1, and 16 on the combined set. In MDCT-benign group(n=128), there were three hepatic metastases assessed as combined set-metastases (2.3%, 3/128). In MDCT-indeterminate(n=20), 10%(2/20) were scored as metastases and 90%(18/20) as benign on the combined set, which were finally confirmed. Among MDCT-metastasis(n=11), one case(1/11, 9.1%) was combined set-benign and confirmed as benign. The combined set yielded significantly less indeterminate FLLs(1 vs. 20, p=<.001) and showed significantly greater sensitivity for the diagnosis of hepatic metastases(100%, 14/14 vs. 64.3%, 9/14; P=.008) than the MDCT set.

CONCLUSION

In potentially resectable PDAC patients, addition of MRI with DWI to MDCT would provide a more confident diagnosis for FLLs and increase sensitivity for hepatic metastases than MDCT alone.

CLINICAL RELEVANCE/APPLICATION

The addition of MRI with DWI to MDCT would be useful in the characterization of focal liver lesions as either benign or metastases, especially for MDCT-indeterminate cases, thereby helping to determine operation candidates among patients with PDACs

SSC04-05 Evaluating Qualitative Differences Between Liver Metastasis and Microabscess in Bile Duct and Pancreas Carcinoma With Bile Duct Dilation in EOB-MRI

Monday, Nov. 28 11:10AM - 11:20AM Room: E353A

Participants
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Yu Kawashima, Chiba City, Japan (*Abstract Co-Author*) Nothing to Disclose
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Takashi Uno, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pancreas head carcinoma or bile duct carcinoma tend to complicate bile duct dilatation, cholangitis and liver microabscess, and it is often difficult to differentiate microabscess and metastasis. We evaluated the qualitative differences between metastasis and microabscess with bile duct dilatation due to bile duct carcinoma and pancreatic carcinoma in diffusion-weighted imaging (DWI), apparent diffusion coefficient (ADC) map and hepatobiliary phase (HBP) of Gd-EOB-DTPA magnetic resonance imaging (MRI).

METHOD AND MATERIALS

We retrospectively analyzed patients with bile duct dilatation due to carcinoma who had liver lesions which were difficult to differentiate microabscess or metastasis in preoperative dynamic CT and Gd-EOB-DTPA MRI. 31 patients were included (21 males, 10 females, mean age 66.7 years, range 46-87). Each nodule was diagnosed as metastasis or microabscess by pathological diagnosis or clinical follow-up for 1 year. Two radiologists retrospectively reviewed in consensus DWI, arterial phase and HBP of MRI. The signal intensity of the nodule on DWI, and ADC map, existence of A-P shunt around lesion, and wedge-shaped low signal intensity around lesion in HBP were evaluated. Pearson's chi-square test was performed in this study.

RESULTS

89 nodules (60 metastases and 29 microabscesses) were included. Metastases were more frequent in pancreas head carcinoma (86%) than in biliary duct carcinoma (58%). Metastases showed significantly lower signal intensity on ADC map ($p<0.01$). Signal intensity on DWI had no significant differences between metastases and microabscesses. Microabscesses had A-P shunt with higher frequency ($p<0.05$), and wedged-shaped low signal intensity around lesions in HBP with high frequency ($p<0.01$).

CONCLUSION

Signal intensity of ADC map, existence of A-P shunt, and wedged-shaped low signal intensity around lesion in HBP demonstrated a significant role in the differentiation of metastasis and microabscess with bile duct dilatation due to bile duct carcinoma and pancreatic carcinoma.

CLINICAL RELEVANCE/APPLICATION

Gd-EOB-DTPA MRI is useful for differentiating microabscess from metastasis.

SSC04-06 Preoperative Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography (FDG-PET/CT) Predicts Better Prognosis after Surgical Resection in Patients with Pancreatic Cancer

Monday, Nov. 28 11:20AM - 11:30AM Room: E353A

Participants
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Shintaro Ichikawa, MD, Chuo-Shi, Japan (*Abstract Co-Author*) Nothing to Disclose
Utaroh Motosugi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Onishi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the prognostic value of preoperative fluorine 18 fluorodeoxyglucose (FDG) positron emission tomography (PET)/computed tomography (CT) in patients with operable pancreatic cancer.

METHOD AND MATERIALS

We included 103 consecutive patients who had resectable pancreatic cancer and had undergone FDG-PET/CT before the surgery. The following factors were analyzed to determine the independent predictive factors for tumor recurrence after surgery: age, sex, blood glucose level, tumor marker level (carcinoembryonic antigen [CEA] and carbohydrate antigen 19-9 [CA19-9]), PET-related parameters (maximum standardized uptake value [SUVmax]), contrast-enhanced CT-related factors (tumor size, location, enhancement pattern, and T and N factors by TNM classification), and pathological findings (tumor differentiation and positive resection margin) were assessed using Cox proportional hazards regression analysis, which was used to assess disease-free survival (DFS). Kaplan-Meier analysis was used to compare the prognosis between the groups with high and low SUVmax.

RESULTS

The median follow-up period was 20 months. The findings of the univariate analyses revealed that SUVmax ($P = 0.0004$), tumor size ($P = 0.0002$), T factor ($P = 0.0102$), N factor ($P = 0.0049$), and CA19-9 levels ($P = 0.0059$) were significantly associated with DFS. Multiple variable analysis showed that SUVmax ($P = 0.0163$) and CA19-9 levels ($P = 0.0364$) were independent predictors of DFS. The results of Kaplan-Meier analysis revealed that patients with pancreatic cancer with low (<2.5) SUVmax had a significantly better prognosis than those with high SUVmax ($P = 0.0006$). Three years after the surgery, the DFS of patients with SUVmax < 2.5 ($n = 23$) and SUVmax ≥ 2.5 ($n = 80$) was 61.9% and 9.7%, respectively.

CONCLUSION

SUVmax has prognostic value to ascertain the DFS in patients with resectable pancreatic cancer. SUVmax < 2.5 is a predictor of better prognosis.

CLINICAL RELEVANCE/APPLICATION

SUVmax determined using preoperative FDG-PET/CT can be used as a biomarker for the prediction of higher DFS in patients with resectable pancreatic cancer.

SSC04-07 CT Texture Parameters are Promising Prognostic Biomarkers in Pancreatic Ductal Adenocarcinoma

Monday, Nov. 28 11:30AM - 11:40AM Room: E353A

Participants
Armin Eilaghi, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Farzad Khalvati, PhD,MSc, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Sameer Baig, MBBS, Toronto , ON (*Presenter*) Nothing to Disclose
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Masoom A. Haider, MD, Toronto, ON (*Abstract Co-Author*) Consultant, Bayer AG; ;

PURPOSE

Little has been published on the potential value of CT texture features in pancreatic ductal adenocarcinoma (PDAC). The purpose of this study was to assess whether CT-derived biomarkers of tumour heterogeneity are prognostic in patients undergoing surgery for PDAC.

METHOD AND MATERIALS

In this retrospective study, 30 consecutive patients, undergoing curative intent surgical resection for PDAC from 2009-2012 with a pre-operative contrast enhanced CT were identified from a surgical database. Whole pancreas gland and tumour regions were manually contoured using in house software (ProCanVAS). Five texture measures of regional heterogeneity namely uniformity, normalized entropy, dissimilarity, course irregularity, and structural deviation were calculated. Tumor size was also measured. Mann-Whitney rank sum test was used for comparing tumour and normal pancreas and Cox regression tests was used for assessing

association of texture features with disease specific survival (DSS).

RESULTS

Tumor tissue showed significantly lower Hounsfield intensity than normal pancreas ($p<0.001$) in all cases. Uniformity ($p<0.001$), normalized entropy ($p=0.007$), course irregularity ($p< 0.001$), and structural deviation ($p<0.001$) were significantly different in tumor regions compared to the rest of the pancreas. Univariate Cox regression analysis showed that tumor normalized entropy ($p=0.025$) and dissimilarity ($p=0.007$) were predictive of DSS. Tumor size was not associated with DSS ($p=0.100$).

CONCLUSION

PDAC texture features of normalized entropy and dissimilarity are promising prognostic imaging biomarkers of DSS for patients undergoing curative intent surgical resection.

CLINICAL RELEVANCE/APPLICATION

The application of CT texture features may guide treatment decisions such as the most appropriate use of neoadjuvant therapy in PDAC. Further validation with another independent PDAC resection dataset and analyses of the association of radiomic variables with genomic and transcriptomic subtypes is ongoing.

SSC04-08 CT Image Biomarker Analysis (Size, Density and Texture) to Predict response of Pancreatic Adenocarcinoma to Neoadjuvant Folfirinox Chemotherapy and ChemoRT

Monday, Nov. 28 11:40AM - 11:50AM Room: E353A

Awards
Student Travel Stipend Award

Participants
Kristine S. Burk, MD, Boston, MA (*Presenter*) Nothing to Disclose
Rodrigo Canellas, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Cristina Ferrone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company; Medical Advisory Board, Allena Pharmaceuticals, Inc

PURPOSE

The purpose of this study is to investigate the role of CT image biomarkers (size, HU and texture analysis) in predicting histologic response of pancreatic adenocarcinoma (PDAC) to neoadjuvant FOLFIRINOX (folinic acid, 5-FU, irinotecan, oxaliplatin) based chemotherapy and chemoRT.

METHOD AND MATERIALS

In this IRB approved retrospective study, 39 patients with PDAC treated with neoadjuvant FOLFIRINOX based chemotherapy +/- radiation were identified. Patient charts were reviewed for demographic information and histologic response at surgical pathology [histologic response (CAP grade 0-1 or Evans grade III-IV), no histologic response (CAP Grade 2-3 or Evans grade I-II)]. 35 were treated with combination chemoRT and 4 were treated with neoadjuvant chemotherapy alone. Pre-neoadjuvant treatment and post-neoadjuvant treatment/pre-surgery imaging studies were reviewed for tumor size, density (HU), and CT textural features analyzed with the CTTA TexRAD Ltd software. For CTTA, filtered and unfiltered images were assessed to quantify heterogeneity using a set of predefined histogram-based texture parameters. The Mann-Whitney U test and logistic regression were applied for statistical significance. ROC curves were used to identify accuracy of the predictive models.

RESULTS

19 patients achieved histologic response, and 20 were non-responders. Comparing pre-neoadjuvant therapy and post-neoadjuvant therapy/pre-surgery imaging studies, there was no statistically significant difference in % change in tumor size or % change in tumor density between histologic responders and non-responders. Independently, no texture parameter could predict histologic response. However, a model incorporating multiple texture parameters including: Mean, Entropy, SD and Skewness using a medium texture (filter SSF=3) was able to predict the likelihood of a patient to have histologic response $\chi2(4)= 16.871$, $p=.002$, with an associated ROC= 0.853 ($p<.001$).

CONCLUSION

CT texture analysis can be applied in PDAC to predict histologic response to neoadjuvant FOLFIRINOX-based chemotherapy and combination chemoRT. Tumor size and density measures are insensitive in predicting treatment response.

CLINICAL RELEVANCE/APPLICATION

CT texture analysis of pre-treatment CT scans can be used to predict histologic tumor response of pancreatic adenocarcinoma to neoadjuvant FOLFIRINOX-based chemotherapy and combination chemoRT.

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

SSC04-09 Validation of an Imaging-based Classification of Patients with Locally Advanced and Borderline Resectable Pancreatic Cancer

Monday, Nov. 28 11:50AM - 12:00PM Room: E353A

Participants
Ahmed M. Amer, MD, Houston, TX (*Presenter*) Nothing to Disclose
Yeonju Lee, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Shalini Moningi, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Gauri R. Varadhachary, MD, MBBS, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Matthew H. Katz, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Eric P. Tamm, MD, Houston, TX (*Abstract Co-Author*) Institutional Research Grant, General Electric Company
Jason Fleming, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Christopher H. Crane, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Eugene J. Koay, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We have identified a pre-therapy, multiphasic CT feature of pancreatic ductal adenocarcinoma (PDAC) that stratifies patients (pts) with localized and metastatic disease into groups with different molecular and pathological features, and clinical outcomes. This CT feature describes the gradient of enhancement (delta) across the parenchyma-tumor interface. Here we aimed to validate our imaging-based classification of high (HD) and low delta (LD) PDAC in pts with locally advanced pancreatic cancer (LAPC) and borderline resectable pancreatic cancer (BRPC). We also investigated the differential response to biological therapy in these groups

METHOD AND MATERIALS

The 1st cohort consisted of 100 pts (mean age 63.4 yrs, 38 f & 62 m, 50 LAPC & 50 BRPC) who underwent induction chemotherapy followed by standard dose chemoradiation (CRT) (50.4 Gy, 1.8 per fraction). A 2nd cohort consisted of 42 pts with LAPC who underwent concurrent bevacizumab plus capecitabine CRT (50.4 Gy, 1.8 per fraction; median age 62.5 yrs, 22 f & 20 m). Baseline pancreatic protocol CT scans were reviewed and volumetric delta measurements were calculated. We used the Cox proportional-hazards model for univariate and multivariate survival analyses

RESULTS

In the 1st cohort, the 2 year overall survival (OS) rate was shorter for the HD (25.6%) than for the LD group (59.2%; P =.005). Accounting for age, sex, stage, and surgery, delta classification was associated with OS (P = .001) and distant metastasis free survival (DMFS) (P =.007). Notably, in the 2nd cohort, delta classification was not associated with OS (P =.52) and DMFS (P =.45). On further exploration, pts with HD tumors treated with bevacizumab had better DMFS compared to HD tumors treated with standard CRT (HR, 0.48; 95%CI, 0.24 to .95; P =.03). Conversely, pts with LD tumors who received bevacizumab had worse OS compared to LD tumors treated with standard CRT (HR, 2.71; 95% CI, 1.16 to 6.33; P = .02)

CONCLUSION

Our results validate the prognostic utility of an imaging-based classification for PDAC. This classification may be useful in the selection of pts for anti-angiogenic therapy. Ongoing pathological analysis of microvessel density may provide more insight into differential responses

CLINICAL RELEVANCE/APPLICATION

Stratification of patients with PDAC based on delta score can be accomplished via standard of care CT scans. This imaging biomarker may be used for rational treatment selection in clinical trials

SSC05

Gastrointestinal (Dual-Energy CT)

Monday, Nov. 28 10:30AM - 12:00PM Room: E451A

CT GI

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

Participants
Benjamin M. Yeh, MD, San Francisco, CA (*Moderator*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;
Avinash R. Kambadakone, MD, Boston, MA (*Moderator*) Nothing to Disclose
Laura R. Carucci, MD, Midlothian, VA (*Moderator*) Nothing to Disclose

Sub-Events

SSC05-01 Dual Contrast Liver Imaging with Photon Counting CT: A New Approach for K-edge Imaging

Monday, Nov. 28 10:30AM - 10:40AM Room: E451A

Participants
Daniela Muenzel, MD, Munich, Germany (*Presenter*) Nothing to Disclose
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Roland Proksa, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
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Franz Pfeiffer, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter B. Noel, PhD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the feasibility of spectral photon-counting computed tomography (SPCCT) with K-edge depending material decomposition for dual contrast enhanced liver imaging.

METHOD AND MATERIALS

SPCCT was simulated with two different contrast agents (CA) at the time point where CA1 is in portal-venous contrast and CA2 is in arterial contrast phase. Material decomposition provided iodine and gadolinium maps which are calculated from the spectral information of SPCCT. Characteristic liver lesions (hemangioma, hepatocellular carcinoma, cyst, metastasis) have been inserted into the simulation.

RESULTS

With SPCCT and an optimized contrast injection protocol, it becomes feasible to provide contrast-enhanced images with arterial distribution of CA2 (gadolinium) and portal-venous phase of CA1 (iodine) in a single CT scan. The four inserted liver lesions were clearly visible, and the characteristic patterns of contrast enhancement was seen in arterial and portal-venous images.

CONCLUSION

Our results reveal the possibilities to improve liver diagnostics by employing the combination of dual contrast protocols with SPCCT imaging. In addition to the potential dose reduction motion artifacts in-between acquisitions are eliminated.

CLINICAL RELEVANCE/APPLICATION

Dual contrast PCCT allows for simultaneous visualization of arterial and portal venous contrast enhancement, with reduced radiation dose, in a single acquisition.

SSC05-02 The Separation of Simultaneously Administered Intravascular and Oral X-ray Contrast Agents Using Spectral CT: Pre-clinical Examples of Pseudo-cloaking with High-Z Materials

Monday, Nov. 28 10:40AM - 10:50AM Room: E451A

Participants
Todd C. Soesbe, PhD, Dallas, TX (*Presenter*) Nothing to Disclose
Matthew A. Lewis, PhD, Dallas, TX (*Abstract Co-Author*) Research collaboration, CMR Naviscan Corporation
Khaled A. Nasr, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Robert E. Lenkinski, PhD, Dallas, TX (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Consultant, Aspect Imaging;

PURPOSE

To show that the Spectral CT property of pseudo-cloaking (i.e., the masking or hiding of certain high-Z elements) can be used to differentiate iodine-based intravascular (IV) contrast agents from tungsten-based oral contrast agents when administered simultaneously. Unlike iodine and barium, the contrast-enhanced bowel wall and bowel lumen can be imaged independently using iodine and tungsten.

METHOD AND MATERIALS

Four female Fischer rats (n = 4) averaging 150 g mass were fasted for 24 hours. The rats were then given 4 mL of oral contrast based on either barium (12 mg Ba/mL, FDA approved BaSO4) or tungsten (20 mg W/mL). The tungsten contrast was from a tungsten carbide (WC) nanopowder colloidal suspension in methylcellulose. 30 minutes after oral contrast administration the rats

were given a 0.3 mL dose of Isovue-370 (iopamidol) via tail vein injection, euthanized with CO2 within 2 minutes after injection, then immediately imaged on a detection-based Spectral CT scanner (IQon, Philips Healthcare). The axial scans used 120 kVp with a 0.2 mm in-plane resolution. The spectrally derived images or SDIs (e.g., virtual non-contrast and iodine map) were analyzed using the thin-client Spectral Diagnostic Suite (SpDS, Philips Healthcare).

RESULTS

Both the IV (iodine) and oral (barium or tungsten) contrast agents appear in the conventional images as highly attenuating materials. The IV contrast is most noticeable in the kidneys (nephrographic/late phase) and the oral contrast is most noticeable in the stomach and small intestine. In the virtual non-contrast (VNC) images both the iodine and the barium are removed, but the tungsten is not affected. Conversely, in the iodine maps both the iodine and barium appear while the tungsten disappears (i.e., is pseudo-cloaked). We obtained similar results with phantoms on the Siemens dual-source scanners (SOMATOM Flash and Force).

CONCLUSION

Certain high-Z elements appear pseudo-cloaked in Spectral CT iodine maps, meaning they have negative pixel values and can be differentiated from iodine. This K-edge based phenomena includes ytterbium (Z=70) through platinum (Z=78) and provides a rich palette for the potential development of future Spectral CT contrast agents.

CLINICAL RELEVANCE/APPLICATION

Unlike barium, tungsten-based oral contrast agents can be differentiated from iodine, and provide complete segmentation between the bowel wall and lumen (useful for bowel ischemia and Crohn's disease).

SSC05-03 Which Dual Energy CT Virtual Monochromatic keV Reconstruction is best to Simulate Typical kVp Settings at Standard CT?

Monday, Nov. 28 10:50AM - 11:00AM Room: E451A

Participants
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Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;

PURPOSE

To determine which virtual monochromatic (VMC) keV reconstruction of a rapid kV switching dual energy CT (rsDECT) scan gives the closest CT numbers (HU) to standard kVp settings.

METHOD AND MATERIALS

We euthanized 10 rabbits 5 minutes after intravenous injection of 600 mg iodine/kg intravenous iohexol, then rapidly serially imaged them on a rsDECT scanner with dual energy technique and again at single energy with 80, 100, 120, and 140 kVp tube potentials. Axial 1.25 mm images were then viewed on an Advantage Windows workstation to place 10 regions of interest (ROIs) on each of the following tissues: fat, muscle, vertebral body bone, liver, and aorta. ROIs were copied to all image sets to record the CT number (HU) at each kVp (2000 ROIs), and for each kVp we then recorded the VMC keV that gave the closest matching HU value. After determining the overall closest matching VMC keV for each kVp setting, ROIs were then obtained from each tissue at each kVp and the corresponding "best" VMC keV.

RESULTS

For fat, muscle, bone, liver, and aorta, the keV that provided the closest HU values to 80 kVp images were 56, 55, 56, 54 and 56, respectively; for 100 kVp, the keV were 62, 60, 62, 60, and 61; for 120 kVp the keV were 67, 65, 67, 65, and 65; and for 140 kVp the keV were 70, 70, 72, 69, and 70, respectively. Overall, the closest matches for 80, 100, 120, and 140 kVp CT numbers were 55, 61, 66, and 70 keV, respectively. At these closest keVs, CT number standard deviations of 2.7, 2.5, 1.7, 18, and 11 HU for fat, muscle, bone, liver, and aorta, respectively, were seen compared to the corresponding kVp HU value.

CONCLUSION

For rsDECT, VMC reconstructions at 55, 61, 66, and 70 keV most closely approximate 80, 100, 120, or 140 kVp single energy CT images, respectively, across a range of tissues in an intravenous contrast-enhanced body CT scan. Nevertheless, standard deviations of up to 2.7 and 18 HU difference may be seen for soft tissues and bone, respectively, between a given kVp setting and its corresponding keV reconstruction.

CLINICAL RELEVANCE/APPLICATION

Our data provides the necessary bridge to allow rsDECT to provide quantitative comparisons between rsDECT and prior single kVp CT scans, and may allow rsDECT access to previously established conventional CT thresholds for the diagnosis various disease entities.

SSC05-04 Determining the Origin of Periampullary Carcinoma Using Spectral Curves in Dual-energy Spectral CT Imaging

Monday, Nov. 28 11:00AM - 11:10AM Room: E451A

Participants
Chenglong Ren, Shanxi, China (*Presenter*) Nothing to Disclose
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Rongqiang Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Xirong Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Qi Yang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Fabao Gao, MD, PhD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the value of using the spectral curve in dual-energy Spectral CT imaging for differentiating periampullary cancers originated from distal cholangiocarcinoma (DCA), duodenal adenocarcinoma (DA) and pancreatic adenocarcinoma (PA).

METHOD AND MATERIALS

In total, 55 patients with obstructive jaundice were imaged in the portal venous phase using dual-energy Spectral CT imaging mode with fast kVp switching. These patients were confirmed by surgical operation to have periampullary cancers that were originated from distal cholangiocarcinoma (DCA, n=14), duodenal adenocarcinomas (DA, n=17) and pancreatic adenocarcinomas (PA, n=24). Virtual monochromatic images with energies from 40keV to 140keV were generated and analyzed on an Advanced Workstation 4.6. A circular region of interest (ROI) was place at the center of the lesion on the portal phase images to measure the CT value, avoiding the dilated common bile duct. To ensure the consistency, all measurements were performed 3 times in consecutive slices to calculate the average values. The ROI measurements were propagated to all energy levels to generate the spectral HU curve: CT number as function of energy. The spectral HU curve slopes were calculated using the CT values from 40 to 80 keV: slope = [CTnumber (40keV) - CTnumber (80kev)]/40. The slopes for lesions of different origins were compared using the one-way ANOVA test ($p<0.05$ was considered to have significant difference).

RESULTS

The slopes of the spectral curves were 3.54±0.89 for distal cholangiocarcinomas, 1.52±0.62 for duodenal adenocarcinomas and 1.04±0.67 for pancreatic adenocarcinomas in portal phase. There were significant differences in the slope of the spectral HU curves of periampullary lesions between any two groups ($p<0.05$): DCA vs DA ($P < 0.001$) ; DCA vs PA ($P < 0.001$) ; DA vs PA ($P = 0.04$) .

CONCLUSION

The slopes of the spectral HU curve in Spectral CT imaging are different for periampullary carcinoma originated from DCA, DA or PA. Quantitative analysis of the spectral HU curve in Spectral CT in the portal venous phase may be used to determine the origins of periampullary carcinoma.

CLINICAL RELEVANCE/APPLICATION

For the obstructive jaundice patients, spectral CT imaging was a promising method to differentiate the origin of periampullary carcinoma.

SSC05-05 The Study of Quantitation of Hepatic Iron Deposition with Dual-energy CT on a Rabbit Model

Monday, Nov. 28 11:10AM - 11:20AM Room: E451A

Participants
Tao Li, nanning, China (*Abstract Co-Author*) Nothing to Disclose
Bingfeng Lu, Nanning, China (*Presenter*) Nothing to Disclose

PURPOSE

To explore the feasibility and accuracy of liver iron quantification with virtual iron concentration(VIC)imaging based on dual energy CT(DECT)

METHOD AND MATERIALS

Ninety-six rabbits were randomly divided into liver iron overload experiment group, validation group, iron overload and fatty liver experiment group, validation group. All rabbits underwent intramuscular injection of iron dextran 15 mg / kg from 1 to 16 week;the last two groups were fed with high fat diet additionally. DECT and MR were used for all rabbits. Liver iron concentration (LIC), liver fat concentration (LFC) , HE and Prussian blue staining were examed.

RESULTS

CT numbers of 80kVp, 120kVp, 140kVp, VIC imaging and R2* in liver iron overload group positively linearly correlated with LIC(r =0.900, 0.837, 0.719, 0.895 and 0.935, respectively); linear regression equation for LIC calculated from VIC was y=0.31x-0.48(F=129.7, P<0.01). CT numbers of VIC in the validation group were substituted into the equation to predicte LIC. Mean difference between predicted LIC and actual LIC was 0.21 mg/g. CT numbers of 80kVp, 120kVp, 140kVp, VIC imaging and R2* in the iron overload and fatty liver group positively linearly correlated with LIC(r = -0.376, -0.531, -0.618, 0.924 and 0.942, respectively); linear regression equation for LIC calculated from VIC was y=0.30x+0.23(F=265.4, P<0.001). Mean difference between predicted LIC and actual LIC was 0.19 mg/g. The difference of slope and intercept of two equations has no statistical significance(F=0.020, P>0.05;F=0.203, P>0.05).Therefore, the data of two experiment groups were merged for ROC analysis. At a LIC threshold of 3.2 mg/g, the corresponding optimal threshold of VIC was 13.7 HU, and diagnostic sensitivity, specificity and AUC were 80.43%, 100% and 0.961. At a LIC threshold of 7.0 mg/g, the optimal threshold of VIC was 22.0 HU, and diagnostic sensitivity, specificity and AUC were 95.65%, 90.24% and 0.968.

CONCLUSION

Virtual iron concentration imaging on DECT shows potential ability to accurately quantify liver iron accumulation in the iron overload rabbit model, without being affected by fatty liver.

CLINICAL RELEVANCE/APPLICATION

DECT is using for non-invasive quantitation of hepatic iron deposition

SSC05-06 Can Non-enhanced Dual-energy Spectral CT Scans Be Used to Differentiate Small Liver Cysts from Small Metastatic Tumors?

Monday, Nov. 28 11:20AM - 11:30AM Room: E451A

Participants
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Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

Chenglong Ren, Shanxi, China (*Abstract Co-Author*) Nothing to Disclose
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Jing Chen, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
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Yongjun Jia, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Tian Xin, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the clinical value of the non-enhanced dual-energy spectral CT scans in differentiating small hepatic cysts from small metastatic tumors.

METHOD AND MATERIALS

43 patients with small liver lesions (27 cases with liver cysts; 16 cases with metastases) who underwent the non-enhanced spectral CT scans were included. In total, there were 104 lesions (≤1.5cm), including 71 small liver cysts and 33 small liver metastases, were identified. The gemstone spectral imaging (GSI) Viewer software on the AW4.6 workstation was used to measure the CT number on the 40 keV virtual monochromatic images and the water concentration on the water (fat) material decomposition images. The curve slope for the spectral curve and the effective-Z values of lesions were also calculated. The above parameters for the two types of lesions were analyzed using independent sample t test, and ROC curve analysis was used to evaluate the diagnostic efficiency.

RESULTS

The CT values at 40 keV, water concentration, curve slope and Effective-Z for liver cyst were -14.77±18.24HU, 897.51±118.68g/L,-1.14±0.47 and 7.24±0.19, respectively; while the corresponding values for small metastases were 15.39±24.87HU, 1101.53±129.11g/L, -0.33±0.46 and7.43±0.18, respectively. The differences for these parameters between the two lesion types were statistically significant (all $p<0.05$). The sensitivity and specificity for differentiating small liver cyst from small metastasis with the CT number of images at 40keV was 75.8% and 76.1.1%, respectively. These values were improved to 84.8% and 95.8%, respectively using water concentration in the lesions.

CONCLUSION

The parameters obtained in the non-enhanced dual-energy spectral CT scans demonstrated appreciable clinical values for differentiating small liver cysts from small metastases, with the water concentration on the water and fat-based material decomposition images providing the highest diagnostic performance.

CLINICAL RELEVANCE/APPLICATION

The non-enhanced dual-energy spectral CT scans may be used to differentiating small liver cysts from small metastases with high diagnostic performance.

SSC05-07 Clinical Value of Spectral CT Imaging in Preoparative Evaluation on Histo-Differentiation of Rectal Adenocarcinoma

Monday, Nov. 28 11:30AM - 11:40AM Room: E451A

Participants
Chuan-bin Wang, Hefei, China (*Presenter*) Nothing to Disclose
Fei Gao, Hefei, China (*Abstract Co-Author*) Nothing to Disclose
Dong Jiangning, Hefei, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To discuss the value of the spectral CT parameters in the preoperative evaluation on histo-differentiation of rectal adenocarcinoma.

METHOD AND MATERIALS

Totally 90 patients with rectal adenocarcinoma confirmed by pathology underwent dual-phase enhanced spectral CT scan. Monochromatic images with energy levels from 40 to 140 keV was generated and the slope Kvalues were computed. And Iodine concentrations were derived from iodine-based material-decomposition CT images and normalized to the iodine concentration in the aorta(NIC). According to the results of pathology, the 90 patients were divided into poorly, moderately and well differentiated adenocarcinoma groups. Using the ROC curve to evaluate the differentiation diagnosis efficiency of NIC and slope K in rectal adenocarcinoma respectively.

RESULTS

The cases in well differentiated adenocarcinoma, moderately differentiated adenocarcinoma and poorly differentiated adenocarcinoma were 22, 50 and 18, respectively. The iodine concentration, NIC and slope K value were statistically difference both in the arterial and venous phase ($P<0.05$). According to the ROC curve, the diagnostic value of NIC was close to the slope K, in the arterial phase. The sensitivity and specificity of slope K were 77% and 79%, respectively, which were similar to that of NIC(76% and 74%, respectively). In the venous phase, slope K was associated with higher sensitivity(86%) compared to that of NIC(77%), but similar specificity(72% vs 70%).

CONCLUSION

The spectral CT can provide a new imaging method for evaluating the histo-differentiation of rectal adenocarcinoma in preoperative.

CLINICAL RELEVANCE/APPLICATION

The spectral CT can provide a new imaging method for evaluating the histo-differentiation of rectal adenocarcinoma in preoperative.

SSC05-08 Prototype Detection-based Spectral CT Scanner Derived Virtual Non-Contrast Attenuation Values Compare Favorably to Attenuation Values on Unenhanced Images

Monday, Nov. 28 11:40AM - 11:50AM Room: E451A

Participants
Lakshmi Ananthakrishnan, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Richard W. Ahn, MD, PhD, Dallas, TX (*Abstract Co-Author*) Co-founder, ViXa LLC; Stockholder, Vixa LLC
Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Abstract Co-Author*) Institutional Research Grant, Koninklijke Philips NV; Speaker, Koninklijke Philips NV
Negin Rassouli, MD, Cleveland, OH (*Abstract Co-Author*) Institutional Grant support, Koninklijke Philips NV
Yin Xi, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Suhny Abbara, MD, Dallas, TX (*Abstract Co-Author*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG
Todd C. Soesbe, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Matthew A. Lewis, PhD, Dallas, TX (*Abstract Co-Author*) Research collaboration, CMR Naviscan Corporation
John R. Leyendecker, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Robert E. Lenkinski, PhD, Dallas, TX (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Consultant, Aspect Imaging;

PURPOSE

A prototype detection-based spectral CT scanner allows generation of virtual non-contrast (VNC) images from contrast enhanced acquisitions, but it is unknown if the resulting HU correspond to those on unenhanced images. We aim to correlate the HU resulting from detection-based spectral CT VNC to those from unenhanced images.

METHOD AND MATERIALS

This multi-institutional prospective study is IRB approved. 84 pairs of unenhanced and virtual non contrast (VNC) datasets were reconstructed in patients scanned on a prototype detection-based spectral CT scanner (IQon, Philips Healthcare). Regions of interest (ROI) were drawn on identical locations of unenhanced and VNC images in the liver, spleen, renal cortex, abdominal aorta, right psoas muscle, and subcutaneous fat, and HU values were recorded. Descriptive statistics for mean HU per ROI were calculated for different positions and phases. Equivalence testing was performed to determine if unenhanced and VNC HU were "equivalent", defined as <5/10/15 HU difference. Interobserver variability was determined.

RESULTS

1476 ROIs were evaluated. The mean attenuation difference between unenhanced and VNC was less than 15 HU in 92.7%, less than 10 HU in 75.2%, and less than 5 HU in 44.4% of all measurements. When using a threshold of 10 HU difference, equivalence testing demonstrated the unenhanced and VNC HU values to be equivalent in most tissues except fat. When divided by organ, difference in unenhanced and VNC was less than 10 HU in 81.7% of liver, 85.4% of psoas, and 81.8% of renal cortex measurements. HU in subcutaneous fat was overestimated by approximately 10 HU on all phases.

CONCLUSION

VNC data derived from contrast enhanced acquisitions on a prototype detection-based spectral CT scanner provide HU values similar to unenhanced scans in most tissues except fat. Further study is needed to determine if attenuation thresholds currently used clinically for common pathology should be adjusted for spectral derived VNC images, particularly when fat/lipid is likely to be present.

CLINICAL RELEVANCE/APPLICATION

Reconstructed VNC images on a prototype detection-based spectral CT scanner have the potential to allow retrospective characterization of incidental findings.

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/

Suhny Abbara, MD - 2014 Honored Educator
Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator

SSC05-09 Comparison of Single-source Split-filter Dual-energy Abdominal CT with Single-energy Abdominal CT using Automatic Tube Voltage Modulation: Assessment of Image Quality and Radiation Dose

Monday, Nov. 28 11:50AM - 12:00PM Room: E451A

Participants
Andre Euler, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose
Markus M. Obmann, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Zsolt Szucs-Farkas, MD, PhD, Berne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Bram Stieltjes, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
David J. Winkel, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Caroline Zaehringer, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Anna L. Falkowski, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Sebastian T. Schindera, MD, Basel, Switzerland (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Ulrich GmbH & Co KG; Research Grant, Bayer AG; Speakers Bureau, Bayer AG

PURPOSE

To assess the radiation dose and image quality of single-source split-filter dual-energy abdominal CT compared with single-energy CT using automatic tube voltage modulation (ATVM).

METHOD AND MATERIALS

In a retrospective study, 200 portal-venous phase abdominal CT scans were reviewed which were acquired on a single-source CT scanner (SOMATOM AS+, Siemens) either with single-energy mode with ATVM (CarekV, Siemens) and 130 ref. mAs or with dual-energy split-filter technology (TwinBeam, Siemens) at AuSn120 kVp and 420 ref. mAs. CT numbers (HU) were obtained in varying organs. Image noise and contrast-to-noise ratio (CNR) for parenchymal and vascular structures were assessed. Subjective image quality was evaluated by three radiologists independently. Radiation dose was estimated by size-specific dose estimate (SSDE). Descriptive statistics and Mann-Whitney-U-test were used.

RESULTS

The two patient groups showed no significant difference in water equivalent diameter (29.2 cm vs. 29.0 cm, respectively; P=0.79). In the single-energy group, ATVM selected 100 kVp in 78 patients and 120 kVp in 22 patients. Image noise was 18% lower with dual-energy compared with single-energy (8.4 HU vs. 10.2 HU, respectively; P<.0001). Parenchymal CNR was significantly higher with dual-energy (24.9 vs 22.0, respectively; P=.007), whereas vascular CNR was significantly lower with dual-energy compared with single-energy (3.5 vs 5.2, respectively; P<.0001). Subjective image noise was graded superior and image contrast inferior in the dual-energy group (P<.0001). However, there was no significant difference in diagnostic confidence between the two groups (P=.78). SSDE was 11% lower using dual-energy technique (12.6 mGy vs. 11.2 mGy, respectively; P=.02).

CONCLUSION

Single-source dual-energy CT with split-filter technology enables abdominal dual-energy scans at significantly lower image noise and radiation dose compared with ATVM without impairing subjective diagnostic confidence.

CLINICAL RELEVANCE/APPLICATION

Dual-energy CT with split-filter technology has the potential to add information such as material decomposition without additional radiation penalty compared with single-energy CT with ATVM.

SSC06

Genitourinary (Renal and Adrenal Imaging)

Monday, Nov. 28 10:30AM - 12:00PM Room: N228

CT GU MR OI

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

Participants
Steven C. Eberhardt, MD, Albuquerque, NM (*Moderator*) Nothing to Disclose
Matthew S. Davenport, MD, Cincinnati, OH (*Moderator*) Royalties, Wolters Kluwer nv; ;

Sub-Events

SSC06-01 A Cyst or not a Cyst: Density Evaluation of Homogeneous Renal Lesions on a Routine Contrast CT

Monday, Nov. 28 10:30AM - 10:40AM Room: N228

Participants
Steffen Huber, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Mike Spektor, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Nnenaya Agochukwu, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Gary M. Israel, MD, Madison, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare Hounsfield units (HU) of renal cysts and of homogenous renal cell carcinoma (RCC) and identify if there is a minimum Hounsfield unit that can be used as a cut off value to classify a mass as benign or malignant on a single post contrast phase CT.

METHOD AND MATERIALS

A waiver from the Institutional Review Board was obtained for this retrospective study. 123 patients with pathologically proven diagnosis of RCC and a post contrast CT scan prior to intervention were included. Two radiologists categorized the RCCs into either homogenous or heterogenous, measured average, max and minimum HU of the lesions on post contrast CT scans. The maximum and minimum HU measurements of the lesion were obtained by placing an ROI in the densest and least dense region anywhere in the lesion. Simple cysts were identified and average HU recorded. Nonparametric tests were used for the non-normal distributed data. Inter reader agreement was tested with Cohen's kappa test.

RESULTS

There were 116 heterogenous RCCs, 13 homogenous RCCs and 24 cysts. None of the homogenous RCCs had an average HU of less than 42 and no region measured less than 32 HU units within homogenous RCCs. HU are reported as mean, standard deviation (SD) and rang.The homogenous and heterogenous RCCs had the following HU: mean 76 (SD 23) 42–116 / 79 (SD 37) 21-243; maximum HU within a lesion 82 (SD 24) 45-120 / 118 (SD 42) 52-282; minimum HU within a lesion 66 (SD) 32-113 / 35 (SD 24) 4-131 (figure 1). Mean HU of renal cysts 14 (SD 8) 3-31. All findings were statistical significant with P values of 0.001 or less.Both readers categorized the RCC into homogenous and heterogenous identically.

CONCLUSION

Out of 129 RCCs none of the 13 homogenous RCCs had HU less than 32 on post contrast CT scans.

CLINICAL RELEVANCE/APPLICATION

Incidental hyperdense renal lesions are common and difficult to differentiate from homogenous RCCs on post contrast CT's. No homogenous RCCs had a minimum HU less than 32 or a mean HU of less than 42.

SSC06-02 Dual Energy CT for Evaluation of Polycystic Kidneys: A Multi Reader Study

Monday, Nov. 28 10:40AM - 10:50AM Room: N228

Awards
Trainee Research Prize - Resident

Participants
Sha-har Admoni, MD, Boston, MA (*Presenter*) Nothing to Disclose
Jeremy R. Wortman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Urvi P. Fulwadhva, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Aaron D. Sodickson, MD, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, Siemens AG; Consultant, Bayer AG

PURPOSE

Assessment of polycystic kidneys on CT can be a challenging diagnostic task due to the need to compare multiple lesions between non-contrast and post-contrast image series. Iodine overlay images from dual energy CT (DECT) display iodine content in color, perfectly registered over the corresponding virtual noncontrast (VNC) images. The purpose of this study was to perform a multi reader comparison of DECT iodine overlay images with traditional enhanced and unenhanced CT images in the evaluation of polycystic kidneys with respect to lesion detection, reading time, and diagnostic confidence.

METHOD AND MATERIALS

DECT scans from 26 patients with polycystic kidneys (defined as >10 cysts in either kidney) were evaluated retrospectively. Simulated renal mass protocol (RMP) CT scans were created using VNC and nephrographic phase mixed images through the kidneys. Two radiologists independently evaluated either the simulated RMP CT or a DECT iodine overlay series to evaluate for the presence

of enhancing lesions. Kidney evaluation reading times were recorded, as well as Likert scale diagnostic confidence ratings for the presence or absence of an enhancing lesion. Differences in the number of detected lesions and in reading time were assessed with a t-test, and differences in diagnostic confidence ratings with a chi-square test.

RESULTS

26 patients (15 male, 11 female, mean age 63) with polycystic kidneys were included. Readers detected an average of 0.8 enhancing lesions per patient on DECT and 0.7 on RMP ($p = 0.81$). Average reading time was 75 secs for DECT and 140 secs for RMP ($p < 0.0001$). Readers rated highest diagnostic confidence in 62% of DECT and 12% of RMP ($p = 0.0002$).

CONCLUSION

DECT is a valuable tool for the assessment of enhancing renal lesions in polycystic kidneys, a task that can be challenging and time consuming with traditional enhanced and unenhanced CT images. Use of iodine overlay images enables decreased reading times and greater diagnostic confidence compared with renal mass protocol CT, without a significant difference in the number of lesions detected.

CLINICAL RELEVANCE/APPLICATION

Iodine overlay images from dual energy CT decrease reading time and improve diagnostic confidence compared with traditional renal mass protocol CT in the evaluation of patients with polycystic kidneys.

Honored Educators

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Aaron D. Sodickson, MD, PhD - 2014 Honored Educator

SSC06-04 MDCT Perfusion Imaging of Solid Renal Masses using a 320-Detector Unit: Is It a New Tool to Distinct Benign from Malignant Lesions?

Monday, Nov. 28 11:00AM - 11:10AM Room: N228

Participants
Catherine Roy, MD, Strasbourg, France (*Presenter*) Nothing to Disclose
Mickael Ohana, MD, MSc, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Guillaume Alemann, MD, MS, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Aissam Labani, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Amina Jelidi, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Herve Lang Sr, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether CT perfusion quantitative parameters may help to differentiate benign from malignant renal solid lesions.

METHOD AND MATERIALS

We prospectively evaluated 78 solid renal masses (55 malignant; 23 benign :15 angiomyolipoma, 8 oncocytoma) with MDCT including as part of our examination a renal perfusion using a 320-slice dynamic volume CT unit (Aquilion One, Toshiba Medical Systems) including the whole kidney without table movement.The perfusion protocol included 24 volumes with a total acquisition time until 90sec, a rotation time of 0.5sec, 0.5ml/kg of a highly concentrated contrast medium (Iomeprol 400 mg iodine/ml) with a flow rate of 5-6ml/sec pushed by 50 ml of saline serum. Perfusion parameters were calculated after a non-rigid motion automatic correction, using the Patlak model with the dedicated software of our CT unit.Mean values of quantitative parameters as arterial flow (AF), blood volume (BV) and clearance (Cl) were recorded from ROI located in the tissular part of the renal mass. Correlations were done with pathological data obtained either by US guided biopsy (6), surgical removal of the masses (62 masses) or follow up (10 masses).

RESULTS

Radiation dose was 7-10mSv (mean 8.3). Lesions ranged from 2.2 to 6.5cm in diameter.Concerning AF, our results were 285+27, 67+18 and 223 + 29 ml/100g/min for clear cell, papillary renal carcinomas and benign masses, respectively. For BV and Cl, our results were: 49+13, 48+ 11 ml/100g ($p = 0.37$) and 15+6, 29 +10 ml/100g/min ($p < 0.01$) for malignant and benign lesions, respectively. Cl was significantly higher in benign lesions than in malignant masses. AF value was significantly higher in clear cell RCC than in papillary renal carcinoma and BV did not show any difference.In the ROC analysis, the best Cl cut-off value for differentiating malignant from benign masses was 13.5 ml/100g/min (sensitivity : 76% ; specificity : 95% - AUC : 87.2).Concerning the tumoral grade of malignant lesions, there was no statistically significant difference between parameters.

CONCLUSION

Among CT perfusion parameters, the clearance value seems to be an interesting and efficient parameter to orientate towards benignancy. Renal perfusion is feasible in clinical practice with a reasonable radiation dose.

CLINICAL RELEVANCE/APPLICATION

Clearance value could discriminate between benign and malignant renal solid lesion. Renal perfusion is feasible in clinical practice.

SSC06-05 Can MR Differentiate Subtypes of Renal Cell Carcinoma and Distinguish Subtypes from Oncocytoma or Angiomyolipoma:Multiparametric Feature Analysis

Monday, Nov. 28 11:10AM - 11:20AM Room: N228

Participants
Carolina Parada Villavicencio, MD, Chicago , IL (*Presenter*) Nothing to Disclose

Camila L. Vendrami, Santo Andre, Brazil (*Abstract Co-Author*) Nothing to Disclose
Vanessa Lewis, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Robert McCarthy, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Daniel T. Oberlin, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
David D. Casalino, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Frank H. Miller, MD, Chicago, IL (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

To develop a model based on MRI feature to predict the subtypes of renal cell carcinoma (RCC) and distinguish from oncocytoma and angiomyolipoma (AML).

METHOD AND MATERIALS

We included 241 renal masses that had partial nephrectomy or nephrectomy from January 2010 to September 2015. Features evaluated include T1- and T2-weighted signal intensity, signal loss on chemical shift and frequency selective images, India Ink artifact on opposed phase images, and dynamic enhancement features. Other findings include necrosis, cystic component and hemorrhage. In addition, apparent diffusion coefficients (ADC) from diffusion-weighted imaging (DWI) were evaluated. The association of MRI features among the pathological categories was evaluated using chi-squared and Mann-Whitney test. Variables with $P < 0.1$ among pathological category groups were entered into a multinominal logistic regression analysis. Goodness of fit was assessed by Pearson chi-squared and likelihood test of model coefficients. The predictive ability of the model was determined by constructing a classification table.

RESULTS

Renal pathology included: RCC clear cell (n=122), RCC papillary (n=55), RCC chromophobe (n=13), oncocytoma (n=19), AML (n=15), unclassified (n=17). All imaging characteristics except location and lesion size were significantly different among pathology groups. 205 masses contained all imaging features and were included in the multinominal logistic regression model. MRI features that were statistically significant to predict and discriminate RCC clear cell (predictive value 89.8%) were T2 appearance (homogeneous vs. heterogeneous), T2 signal intensity and ADC. For RCC papillary, (predictive value 88.1%) DWI and T2 signal intensity were significant and for AML, (predictive value 92.9%) DWI and avid early enhancement. RCC chromophobe and oncocytoma had the lowest statistically predicted value with 46.2% and 21.4%. The model correctly classified 79.5% of all diagnosis (Table).

CONCLUSION

MRI features for discriminating RCC were statistically significant for subtypes clear cell and papillary, as well as AML. However differentiation of RCC chromophobe and oncocytoma still remains challenging with MRI.

CLINICAL RELEVANCE/APPLICATION

Preoperative assessment and characterization of suspicious renal lesions using multiparametric MRI could help determine surgical management and guide therapy and surveillance imaging.

Honored Educators

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Frank H. Miller, MD - 2012 Honored Educator
Frank H. Miller, MD - 2014 Honored Educator

SSC06-06 Quantitative Volumetric Histogram Analysis of Diffusion-Weighted Magnetic Resonance Imaging: An Initial Experience of Solid Renal Cell Carcinoma with Different Prognosis

Monday, Nov. 28 11:20AM - 11:30AM Room: N228

Participants
anqin li, Wuhan, China (*Presenter*) Nothing to Disclose
haojie li, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Dao Y. Hu, MD, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Zhen Li, MD, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to determine whether quantitative volumetric histogram analysis on diffusion-weighted MRI (DWI) is helpful for distinguishing clear cell RCC (ccRCC) from papillary RCC (pRCC) and chromophobe RCC (chRCC) which having different prognosis.

METHOD AND MATERIALS

A total of 51 patients with solid renal tumors who underwent surgery and had histopathology available were included in this retrospectively study. These patients were divided into two group: Group A (better prognosis, 18 with pRCC and 13 with chRCC) and Group B (worse prognosis, 20 with ccRCC). In addition to routine renal MRI and DWI (b=0, 800s/mm2) were performed on a 3-T system (Discovery 750, GE Medical System, Milwaukee, Wis, USA). Quantitative volumetric tumor regions of interest (ROIs) were drawn on all slices of the ADC maps to obtain histogram parameters, including ADCmean, ADCmedian, ADC10%, ADC25%, ADC75%, ADC90%, entropy, skewness and kurtosis. Multiple receiver operating characteristic (ROC) curves analysis was used to determine and compare the diagnostic value of each significant parameter.

RESULTS

Group B had significantly higher ADCmean, ADCmedian, ADC10%, ADC25%, ADC75%, and ADC90% values compared to Group A ($P=0.003$, $P=0.003$, $P=0.003$, $P=0.002$, $P=0.008$, $P=0.014$, respectively). The majority ADC value of Group B was concentrated on the left of the histogram but Group A was concentrated on the right of the histogram (skewness= -0.16 ± 0.54, 0.40 ± 0.64, respectively, $P=0.002$). There were no significant difference was found on kurtosis and entropy ($P=0.110$, $P=0.620$, respectively).

During ROC curves analysis, compared with Group A and Group B, the ADC10% value generated the highest AUC for differentiating these two groups (AUC, 0.753; Sensitivity, 65%; Specificity, 84%; cut-off value, 0.839×10-3 mm2/s), while the ADCmean value generated more higher AUC for differentiating these two groups (AUC, 0.731; Sensitivity, 50%; Specificity, 93%; cut-off value, 1.430×10-3 mm2/s).

CONCLUSION

Quantitative volumetric histogram analysis on DWI showed a significant shift towards skewness and higher ADCmean, ADCmedian, ADC10%, ADC25%, ADC75%, and ADC90% in better prognosis patients with pRCC and chRCC compared with worse prognosis with ccRCC.

CLINICAL RELEVANCE/APPLICATION

Volumetric tumor ADC histogram parameters can be used as a quantitative tool to distinguish three subtypes renal cell carcinomas which having different prognosis.

SSC06-07 Diagnostic Accuracy of Virtual Non-contrast Enhanced Dual-energy CT for Diagnosis of Lipid-rich Adrenal Adenoma: A Systematic Review and Meta-analysis

Monday, Nov. 28 11:30AM - 11:40AM Room: N228

Participants
Michael J. Connolly, BSC, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
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Mohamed A. El-Khodary, FRCPC,FRCR, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Trevor McGrath, BSc, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Nicola Schieda, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

PURPOSE

To use systematic review and meta-analysis to determine the diagnostic accuracy of dual-energy (DE) virtual non-contrast enhanced computed tomography (vNECT) for the diagnosis of lipid rich adrenal adenomas; the comparator test is non-contrast enhanced CT (NECT).

METHOD AND MATERIALS

Search of multiple databases was performed on Oct. 23, 2015 for eligible studies. Inclusion criteria were: adrenal lesion imaged with contrast-enhanced DE CT with vNECT series generated with Hounsfield Unit (HU) attenuation values and acceptable reference standard. Inclusion and data extraction were performed independently by two reviewers with disagreements resolved by consensus. Risk of bias was assessed using QUADAS-2. Summary estimates of diagnostic accuracy were generated using the bivariate random effects model and subgroup analyses were done to evaluate for sources of heterogeneity.

RESULTS

Five studies (170 patients and 192 adrenal lesions) were included. The pooled sensitivity and specificity for lipid rich adenomas on vNECT imaging series were 0.75 (95% CI: 0.53, 0.89) and 0.96 (95% CI: 0.88, 0.99). For the same studies and patients, the pooled sensitivity and specificity for lipid rich adenomas on the comparator test (NECT) were 0.97 (95% CI: 0.91, 0.99) and 0.97 (95% CI: 0.91, 0.99). There was a consistent trend towards higher HU values on vNECT series and differences in vNECT HU values depending on the timing of contrast enhanced DE CT. Moderate risk of bias was identified in the areas of index test (3/5 studies) and reference standard (5/5 studies)- primarily from lack of clear reporting.

CONCLUSION

vNECT images generated from dual-energy CT demonstrated comparable specificity with decreased sensitivity compared to NECT for the diagnosis of lipid rich adenomas. The reason for this may be because vNECT overestimated HU when compared to NECT. Additional potential reasons include timing of vNECT relative to contrast injection as well as issues related to the quality of included studies.

CLINICAL RELEVANCE/APPLICATION

Diagnosis of lipid-rich adenomas using vNECT shows similar specificity but diminished sensitivity when compared with NECT.

SSC06-08 Adrenal Gland Iron Deposition: A Heretofore Ignored MRI Finding

Monday, Nov. 28 11:40AM - 11:50AM Room: N228

Participants
Michele Perillo, MD,FRCPC, Montreal, QC (*Presenter*) Nothing to Disclose
Anuradha S. Shenoy-Bhangle, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jennifer Nimhuircheartaigh, MBBCh, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Koenraad J. Mortele, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hemosiderosis is a commonly encountered MRI finding but, to our knowledge, adrenal gland iron deposition on MRI has yet to be reported. We aim to (1) evaluate the prevalence of adrenal hemosiderosis; and (2) to correlate the presence of adrenal hemosiderosis with the overall pattern of organ involvement and degree of serum iron overload.

METHOD AND MATERIALS

A search of our abdominal MRI reports database from January 2002 to February 2016 yielded 155 exams that contained the term "hemosiderosis". Exclusion of studies (n=103) performed on a 3T magnet, those that lacked in-and out-of-phase T1 images, and those that did not have a serum ferritin level within 60 days of the study resulted in a final cohort of 52 cases. Each MRI study was reviewed for evidence of adrenal, liver, spleen, and bone marrow iron deposition and correlated with serum ferritin levels. Iron overload was considered mild, moderate, and severe when ferritin levels were less than 1000 ng/mL, between 1000-2000 ng/mL, and over 2000 ng/mL, respectively. Hepato-splenic iron deposition was also assessed using average ratios of liver, spleen, and

paraspinal muscle ROI on in-phase GRE sequences.

RESULTS

19 (37%) of 52 cases had evidence of adrenal gland iron deposition. Of those, 18 (95%) had hepatic involvement, 18 (95%) had splenic involvement, and 14 (74%) had marrow involvement. None had solitary adrenal gland involvement. 6 of 19 (32%) had mild iron overload, 5 of 19 cases (26%) had moderate iron overload, and 8 of 19 cases (42%) had severe iron overload based on ferritin levels (p=0.94). Average liver-to-paraspinal muscle ROI ratios were 0.61 and 1.03 in cases with and without adrenal involvement (p=0.027), respectively. Average spleen-to-paraspinal muscle ROI ratios were 0.55 and 0.74 in cases with and without adrenal involvement (p> 0.05), respectively.

CONCLUSION

Adrenal gland involvement in hemosiderosis is not negligible. It typically occurs in combination with other visceral organ involvement, and more commonly seen in patients with severe hepatic involvement . Serum ferritin levels and presence of adrenal gland involvement appear unrelated.

CLINICAL RELEVANCE/APPLICATION

Radiologists should be aware of possible adrenal gland involvement in cases of hemosiderosis, specifically in cases where the spleen, liver, and/or bone marrow are involved.

SSC06-09 Can CT Textural Analysis Differentiate between Lipid-poor Adrenal Adenomas and other Solid Adrenal Lesions? A Preliminary Study

Monday, Nov. 28 11:50AM - 12:00PM Room: N228

Participants
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Presenter*) Nothing to Disclose
Rodrigo Canellas, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
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Colin J. McCarthy, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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Michael A. Blake, MBBCh, Boston, MA (*Abstract Co-Author*) Editor with royalties, Springer Science+Business Media Deutschland GmbH

PURPOSE

To retrospectively evaluate the diagnostic performance of texture analysis for the discrimination of lipid-poor adenomas from other solid adrenal lesions.

METHOD AND MATERIALS

We identified 22 patients who underwent adrenal washout protocol CT prior to a CT-guided adrenal biopsy between 2006 and 2014. Final diagnosis was based on pathology or stability on imaging for at least one year. Two patients were excluded due to incomplete follow-up. CT textural analysis (CTTA) was assessed using a commercially available research software program (TexRAD) that applies a filtration-histogram technique for characterizing tumor heterogeneity. Filtration step selectively filters and extracts texture features at different anatomical scales varying from 2mm (fine features) to 6mm (coarse features). Receiver operating characteristics (ROC) was performed to assess sensitivity and specificity for differentiating between the benign and malignant adrenal lesions.

RESULTS

Of the 20 adrenal lesions analyzed, 10 (50%) were biopsy-proven metastases and 10 (50%) were adenomas. None of the lesions measured less than 10 HU on the non-contrast study to suggest they were a lipid-rich adenoma. Both the unfiltered mean image intensity and mean positive pixels (mpp) were significantly lower in the adenomas compared to the metastases ($p < 0.006$, and $p < 0.003$ respectively). Using a mpp threshold of 29, CTTA identified adenomas with a sensitivity of 70% and a specificity of 90% (AUC=0.9). Adrenal washout protocol CT had a sensitivity of 40% and a specificity of 90%. Combining the two techniques, if lesions were not characterized as an adenoma on washout protocol CT, then using a mmp threshold of 29 resulted in an overall sensitivity of 90% and specificity of 90%.

CONCLUSION

Our preliminary results show that CTTA might be a useful quantitative method to help differentiate lipid-poor adenomas from metastases.

CLINICAL RELEVANCE/APPLICATION

The increasing use of CT has led to more-frequent identification of adrenal lesions. The ability to differentiate adenomas from malignant lesions with CTTA may reduce the need for further imaging or tissue sampling.

SSC07

Science Session with Keynote: Health Service, Policy and Research (Evidence-based Medicine/Guidelines/Outcomes)

Monday, Nov. 28 10:30AM - 12:00PM Room: S102D

HP

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

Participants
Janie M. Lee, MD, Bellevue, WA (*Moderator*) Research Grant, General Electric Company
Fabian Bamberg, MD, MPH, Tuebingen, Germany (*Moderator*) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Research Grant, Siemens AG;

Sub-Events

SSC07-01 Active Surveillance versus Initial Nephron-Sparing Treatment for Small Renal Tumors: A Decision Analysis

Monday, Nov. 28 10:30AM - 10:40AM Room: S102D

Participants
Stella Kang, MD,MSc, New York, NY (*Presenter*) Nothing to Disclose
William C. Huang, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Scott Braithwaite, MD,MSc, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Pari Pandharipande, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The standard of care for small renal tumors is partial nephrectomy (PN), but consequent renal function decline is associated with worsened overall survival in patients with baseline chronic kidney disease (CKD). We compared the life expectancy (LE) of biopsy and imaging-based active surveillance (AS) with nephron-sparing treatments of PN or percutaneous ablation.

METHOD AND MATERIALS

A state-transition microsimulation model was used to project LE in hypothetical patients with mild or moderate CKD diagnosed with small renal tumors. Tested strategies were: 1) uniform PN; 2) selective PN, favoring ablation for stage 2 or 3a CKD and complex tumor anatomy, or stage 3b CKD and any tumor anatomy; 3) biopsy-based treatment (ablation of most cancers); and 4) imaging AS. The model incorporated tumor anatomic complexity scoring predictive of post-surgical renal functional loss, renal functional decline, mortality rates by CKD stage, comorbidities, benign and malignant lesions, and risk of cancer progression with and without initial treatment. Patients were susceptible to all-cause, surgical, and cancer-specific mortality. Our primary model outcome was LE. Sensitivity analysis was performed to test the stability of results with variability of parameters.

RESULTS

In 65-year-old men with stage 2 or 3 CKD and at least moderate tumor anatomic complexity, biopsy-based treatment had the highest LE relative to other strategies. For example, in stage 3a CKD biopsy LE was +2.2 years, +0.47 years compared to uniform PN and selective PN, respectively. Biopsy favorability was driven by treatment of fewer benign tumors, and sparing of some patients worsened CKD and mortality risks associated with PN. In frail patients with Charlson comorbidity index of at least 1 and stage 3 CKD, AS was less effective than biopsy-based treatment (-0.40 years) but superior to PN (+0.50 years). Results were most sensitive to rates of renal function decline and related mortality.

CONCLUSION

Biopsy of small renal tumors with ablation for cancers is likely the most effective management strategy in patients with stage 2 or 3 CKD and at least moderately complex tumor anatomy. In CKD stage 3 patients, preference likely strongly affects the decision for imaging AS instead of biopsy.

CLINICAL RELEVANCE/APPLICATION

CKD stage and tumor anatomy guide personalized treatment selection for small renal tumors; biopsy-based treatment is likely the most effective option in most tumor and CKD categories.

SSC07-02 Variations in National Benchmarks of CT Dose Metrics for Different Protocols within A Body Part: Analysis of the ACR Dose Index Registry

Monday, Nov. 28 10:40AM - 10:50AM Room: S102D

Participants
Amirhossein Mozafarykhamseh, MD, boston, MA (*Presenter*) Nothing to Disclose
Atul Padole, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Debapriya Sengupta, MBBS,MPH, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Judy Burleson, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD, Boston, MA (*Abstract Co-Author*) Technical support, Siemens AG; Technical support, Medical Vision
Mythreyi Bhargavan-Chatfield, PhD, Reston, VA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the variation in national benchmark radiation dose metrics associated with different CT protocols with in a body region using the ACR Dose Index Registry (DIR)

METHOD AND MATERIALS

Using Radiology PlayBook identification (RPID) numbers, we assessed CT dose metrics (CT dose index volume (CTDIvol); dose length product (DLP); and size-specific dose estimates (SSDE for chest and abdomen only)) for 969591CT studies in ACR DIR from 2011-2015 (10% sample). Data were stratified according to body regions (head (n=332,137), chest (n= 171,641) and abdomen (n= 271,287), individual protocols per body region and year of CT study 2011-15. The CT protocols were, head n =6 (routine head, temporal bone, neck, sinuses, face) chest n=6 (low dose chest, pulmonary angiography, high resolution chest, routine chest, cardiac CT angiography, calcium scoring), abdomen, n=4 (routine abdomen pelvis, multiphase renal, kidney stone, multiphase liver). For each subgroup, we determined the 50th (median) and 75th quartiles for CTDIvol (mGy), SSDE (mGy) and DLP (mGy.cm)

RESULTS

The median and 75th quartiles of CTDIvol (mGy) for all protocols of chest (11, 17), abdomen (13, 19) and head (49, 58) were significantly different ($p<0.0001$). Accordingly, median and 75th quartiles of DLP for chest (393, 694), abdomen (655, 962) and Head (780, 950) were also significantly different ($p<0.0001$). The median and 75th quartiles of SSDE for chest (13, 19) and abdomen (15, 21) were significantly different ($p<0.0001$). There has been significant reduction in radiation CTDIvols across different CT protocols from 2011 to 2015 ($p<0.0001$) with highest dose reduction in chest region (19.4%) and lowest in head region (9.6%). Highest and lowest CTDIvol values for different protocols in each body regions were: chest (low dose chest: 3.1 and cardiac CT angiography: 15); abdomen (kidney stone: 12 and multiphase liver: 14), Head (neck CT: 15 and. routine head CT: 51)

CONCLUSION

Amongst body protocols, chest CT is associated with lowest CTDI, DLP and SSDE, while, head CT had the highest dose metrics. The head region also had the lowest decrease in CTDIvol from 2011-2015

CLINICAL RELEVANCE/APPLICATION

Comparing the national dose indices can give a better understanding to every facility to see where its position regarding dose reduction and help optimizing dose management strategies

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/

Subba R. Digumarthy, MD - 2013 Honored Educator

SSC07-03 Do Primary Care Physicians Follow Their Own Specialty Society's Guidelines Regarding Mammography Screening? An Analysis of Nationally Representative Data

Monday, Nov. 28 10:50AM - 11:00AM Room: S102D

Awards
Student Travel Stipend Award

Participants
Linda E. Chen, MD, Seattle, WA (*Presenter*) Nothing to Disclose
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Joann G. Elmore, MD, MPH, Seattle, WA (*Abstract Co-Author*) Editor, UpToDate, Inc
Habib Rahbar, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, General Electric Company
Savannah C. Partridge, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether family physicians, internal medicine physicians, and obstetricians/gynecologists (Ob/Gyn) adhered to their specialty society's recommendations for mammography screening in response to the 2009 U.S. Preventive Services Task Force (USPSTF) revised recommendations (only the last group continued to support annual screening starting at age 40).

METHOD AND MATERIALS

All office-based preventive service visits for women ≥ 40 years old from the National Ambulatory Medical Care Survey (NAMCS) for years 2007-2012 were included. Visits involving patients with breast-related symptoms or history of cancer were excluded. Binomial regression analyses were performed to identify changes over time in the mammography referral rate per 1,000 visits by physician specialties. Data were stratified by age and, in multivariate analyses, adjusted for patient- and office-level covariates. All analyses were weighted to account for the multi-stage probability sampling design of NAMCS.

RESULTS

Based on sampling weights, our analysis represented an average of 35,947,290 preventive medicine visits per year from 2007 to 2012. Overall, between 2007-2008 and 2011-2012, mammography referral rate decreased after the 2009 USPSTF revised recommendations (285 to 215 per 1,000 visits, -25.0% adjusted change, $p=0.006$). The largest decrease in mammography referral rate was among family physicians (230 to 128 per 1,000 visits, -49.0% adjusted change, $p<0.001$), especially for women ≥ 75 years old (161 to 47 per 1,000 visits, -77.9% adjusted change, $p=0.006$). This was followed by internal medicine visits (135 to 79 per 1,000 visits, -45.8%, adjusted change, $p=0.038$). No statistically significant changes were noted in mammography referral rates among obstetricians/gynecologists over time (476 to 419 per 1,000 visits, -14.4% adjusted change, $p=0.23$).

CONCLUSION

Mammography referral rates decreased after the 2009 USPSTF revised recommendations. However, larger declines were seen

among family and internal medicine physicians compared to obstetricians/gynecologists, commensurate with differences in their respective societal recommendations.

CLINICAL RELEVANCE/APPLICATION

Specialty society recommendations influence referral practices for screening mammography. Radiologists should engage with societies to advocate benefits of mammography and greater screening use.

SSC07-04 Mammography as a Lens to Patient Engagement: Associations between Demographic and Medical Factors and Participation in Screening Mammography

Monday, Nov. 28 11:00AM - 11:10AM Room: S102D

Participants
Vishala Mishra, MBBS, Boston, MA (*Presenter*) Nothing to Disclose
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Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
H. Benjamin Harvey, MD, JD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To use compliance with mammographic screening as a surrogate to understand potential demographic and medical factors affecting patient engagement.

METHOD AND MATERIALS

HIPAA-compliant and IRB approved. Women age 50 to 64 who obtained SM in 2005 were followed for 10 years after the index SM to determine compliance. Compliance was rated as low (≤3 SMs over the study period), medium (4-7 SMs) or high (≥8 SMs). High and low compliance groups were compared based on demographic and medical factors, with sub-analysis of a high-cost patient subset. Odds ratios (OR; lower indicating poorer compliance) with 95% confidence intervals (CI), t-tests, and multivariate logistic regression were performed (significance $p<0.05$ before Bonferroni correction).

RESULTS

10,166 patients met inclusion criteria: 60.7% demonstrated high compliance, 30.7% moderate compliance, and 8.6% low compliance. Demographic factors associated with low compliance were younger age ($p=0.0001$), non-English speaking (OR 0.7, CI 0.5-0.9, $p=0.008$), active smoking (OR 0.4, CI 0.4-0.5, $p<0.0001$), unmarried (OR 0.7, CI 0.6-0.8, $p<0.0001$), and less primary care contact (OR 0.5, CI 0.4-0.6, $p=0.0001$), with active smoking and less primary care contact persistent in the high-cost patient subset. Medical factors associated with low compliance were domestic violence (OR 0.1, CI 0.0-0.7, $p=0.005$), congestive heart failure (OR 0.4, CI 0.3-0.6, $p=0.0003$), chronic obstructive pulmonary disorder (OR 0.3, CI 0.2-0.5, $p<0.0001$), depression (OR 0.5, CI 0.4-0.6, $p<0.0001$) and drug abuse (OR 0.3, CI 0.1-0.6, $p<0.0001$) amongst others, with generalized pain (OR 0.3, CI 0.17-0.54, $p<0.0001$) and posttraumatic stress disorder (OR 0.4, CI 0.2-0.7, $p=0.0008$) unique to the high-cost patient subset. Immunization (OR 2.5, CI 2.1-3.0, $p<0.0001$), annual physical (ORs 4.6, CI 1.1-18.7, $p<0.001$) and bisphosphonate use (OR 3.6, CI 1.7-7.6, $p<0.0001$) were among the factors associated with high compliance.

CONCLUSION

A variety of demographic and medical factors are strongly associated with participation in screening mammography, potentially informing system-wide patient engagement efforts.

CLINICAL RELEVANCE/APPLICATION

Patient engagement is central to success in value-based care. Radiology can deliver value to health systems by harnessing screening data to inform patient engagement and care optimization efforts.

SSC07-05 Having a PCP is the Strongest Predictor of Successful Follow-up of Inner-City Patients Enrolled in a Randomized, Controlled Cardiovascular Imaging Trial

Monday, Nov. 28 11:10AM - 11:20AM Room: S102D

Participants
Samuel Friedman, Bronx, NY (*Presenter*) Nothing to Disclose
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Linda B. Haramati, MD, MS, Bronx, NY (*Abstract Co-Author*) Spouse, Board Member, Bio Protect Ltd; Spouse, Board Member, OrthoSpace Ltd; Spouse, Board Member, Kryon Systems Ltd
Jeffrey M. Levsky, MD, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ethnic minorities, women, and those of low socioeconomic status are widely under-represented in clinical trials. This has led to new emphasis by funding organizations to support urban clinical trials, which are more representative of the patient mix encountered in 21st century U.S. medical practice. Few studies explore factors associated with successful follow-up in these historically difficult to reach patients. To identify patient characteristics and methods of contact that predict successful contact for follow-up in an urban, predominantly ethnic minority, female-majority, poor population to help devise strategies to improve retention.

METHOD AND MATERIALS

We retrospectively reviewed records from a prospective randomized controlled trial of 400 hospitalized chest pain patients that received either coronary CT angiography or radionuclide myocardial perfusion imaging in order to determine which characteristics were associated with successful telephone follow-up at one year after enrollment. We assessed demographic variables, medical history, and social factors using bivariate analyses. A multivariate analysis was performed using variables from the bivariate analysis with $p\leq0.2$.

RESULTS

The overall successful one-year follow-up rate was 95%(381/400). Study participants who completed follow-up were significantly more likely to have a primary care physician (PCP) [88%(337/381) versus 68%(13/19)], speak English natively [52%(199/381) versus 26%(5/19)], have a higher Charlson comorbidity index score, and be female [64.0%(244/381) versus 42.1%(8/19)]. Having a PCP and native English language remained significant at multivariate analysis. Socioeconomic status score, quantity of contact information and insurance status were not significantly associated with successful follow-up.

CONCLUSION

Patients engaged with the healthcare system by having a PCP are significantly more likely to achieve follow-up. Successful follow-up is associated with native English speaking.

CLINICAL RELEVANCE/APPLICATION

In running clinical trials it is vital to assess whether participants have a primary care physician - a strong predictor of successful follow-up. This informs resource allocation to optimize protocols.

SSC07-06 Impact of Evidence Based Feedback on MRI Lumbar Spine Orders Place the Day of an Outpatient Primary Care Visit for Lower Back Pain

Monday, Nov. 28 11:20AM - 11:30AM Room: S102D

Participants
Hanna M. Zafar, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Ivan Ip, MD, MPH, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose
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Angela M. Mills, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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Ramin Khorasani, MD, Boston, MA (*Abstract Co-Author*) Consultant, Medicalis Corp

PURPOSE

To evaluate the impact of evidence based feedback on lumbar spine MRI (MRLS) orders placed the day of an outpatient primary care visit for lower back pain (LBP).

METHOD AND MATERIALS

After a 7 month baseline observation period, we randomized 114 outpatient primary care providers over 12 months to receive either periodic report cards (group A) or real-time clinical decision support (CDS) at the time of MRLS order entry (Group B) on adherence to the American College of Physicians / American Pain Society Joint Practice LBP Guidelines (Intervention 1). Subsequently, all providers received both forms of feedback over 11 months (Intervention 2). Outpatient visits for LBP were identified through International Classification of Diseases 9th Revision (ICD-9) codes and Medicare fee-for-service patients were excluded. Our primary outcome measure was the proportion of MRLS orders the day of LBP visit. To account for delayed orders, we also analyzed MRLS orders placed 30 days after LBP visit. Differences between baseline and intervention were assessed using Pearson Chi Squared analysis.

RESULTS

A total of 172,999 primary care outpatient visits were included over the study period. Despite randomization, there were significant differences in the proportion of MRLS orders the day of LBP visit between Group A (5.0%, 70 /1,392) and Group B (3.2%, 42 /1,321) (p=.026) suggesting randomization was not effective; therefore pooled baseline and Intervention 2 data for both groups was evaluated. Although the proportion of outpatient primary care LBP visits increased between baseline (2,713/42,654, 6.4%) and intervention 2 (4,446/64,003 (7.0%) (p=.0005), the proportion of MRLS orders the day of LBP visit decreased between baseline (112/2,713, 4.1%) and intervention 2 (137/4,446 (3.1%) (p=.028)(Figure 1); this represented an absolute reduction of 1% and relative reduction of 24% ([4.1-3.1]/4.1x100 = 24%); . There was no difference in the proportion of MRLS orders placed 30 days after the initial outpatient LBP visit.

CONCLUSION

Evidence based feedback can decrease outpatient MRLS orders the day of primary care LBP visit and does not result in delayed MRLS orders.

CLINICAL RELEVANCE/APPLICATION

Despite an increase in outpatient primary care LBP visits, evidence based feedback through periodic report cards and CDS can substantially decrease MRLS orders placed the day of LBP visits.

SSC07-07 Utilization of Pre-operative Imaging for Colon Cancer: A Population-based Study

Monday, Nov. 28 11:30AM - 11:40AM Room: S102D

Participants
Matthew D. McInnes, MD, FRCPC, Ottawa, ON (*Presenter*) Nothing to Disclose
Shelly Wei, Kingston, ON (*Abstract Co-Author*) Nothing to Disclose
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Christopher M. Booth, MD, FRCPC, Kingston, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the use of pre-operative imaging for colon cancer and to identify factors associated with utilization in routine clinical

practice.

METHOD AND MATERIALS

This population-based, retrospective cohort study used the Ontario Cancer registry to identify a random sample of 25% of all colon cancer patients treated with surgery in the province of Ontario, Canada from 2002-2008. Pre-operative imaging of the chest, abdomen and pelvis was identified from physician billing records. Modified poisson regression was used to analyze factors associated with practice patterns.

RESULTS

Of the 7,249 included patients, 71% of had pre-operative chest imaging (CT=13%, CXR=67%) and 77% had abdominal imaging (CT=63%, US=33%, MR=0.5%). Higher rates of imaging in the 2006-2008 cohort when compared with 2002-2004 were identified for: any abdomen imaging (86% vs. 68%; p<0.001); CT abdomen (78% vs. 47%; p<0.001); any chest imaging (79% vs. 62%; p<0.001); CT chest (20% vs. 6%; p<0.001). Variables associated with use of any chest imaging include: age (RR 1.17-1.18 ≥50 vs <50 years, p<0.001); co-morbidity (RR 1.07-1.08 for moderate vs. none, p<0.001); surgeon volume (RR 0.95 for low vs high volume providers, p=0.013); geographic region (regional variability RR 0.90-1.11, p<0.001); and study period (RR 1.28 for 2006-2008 vs 2002-2004, p<0.001). There was no association with gender, hospital volume or socioeconomic status.Variables associated with use of any abdomen imaging included: hospital volume (RR 0.92 low vs high volume providers, p<0.001); geographic region (regional variability RR 0.77-1.09, p<0.001); and study period (RR 1.25 for 2006-2008 vs 2002-2004, p<0.001). There was no association with age, gender, comorbidity, socioeconomic status, or surgeon volume.

CONCLUSION

In clinical practice, use of pre-operative imaging increased over time and was associated with age, comorbidity, geographic region, and provider volume.

CLINICAL RELEVANCE/APPLICATION

While pre-operative chest, abdomen and pelvis imaging to stage colon cancer is considered standard of care, there is considerable variation in routine practice. This variation may reflect opportunities for quality improvement.

SSC07-08 Colorectal Liver Metastases: A Systematic Review and Met-Analysis of the Diagnostic Performance of MultiDetector CT, Gadoxetate Disodium-Enhanced MRI, and PET/CT

Monday, Nov. 28 11:40AM - 11:50AM Room: S102D

Participants
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So Yeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ja Yeon Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, DONGKOOK Pharmaceutical Co, Ltd
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Seung Soo Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Moon-Gyu Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To perform a systematic review and meta-analysis of the test performance of multidetector CT, gadoxetate disodium-enhanced MRI, and PET/CT for the diagnosis of colorectal liver metastasis (CRLM) and to identify the factors influencing this performance.

METHOD AND MATERIALS

A systematic search of PubMed MEDLINE and EMBASE was done to identify research studies that investigated the diagnostic performance of multidetector CT, gadoxetate disodium-enhanced MRI, and PET/CT for CRLM from November 2004 to January 2016. Study quality was assessed using QUADAS-2. According to the types of the imaging tests, the threshold effect and study heterogeneity were analyzed and the meta-analytic summary sensitivity and specificity were estimated. Meta-regression analysis was done to further explore study heterogeneity.

RESULTS

Of the 803 articles screened, we found 41 studies in 27 articles reporting imaging diagnosis of CRLM (17 studies for CT, 11 studies for MRI, 13 studies for PET/CT). The meta-analytic summary sensitivity of CT, MRI, and PET/CT were 80.4% (95% CI, 73.7, 85.6%), 92.5% (87.3, 95.6%), and 74.1% (62.1, 83.3%), respectively. The summary specificity of CT, MRI, and PET/CT were 77.8% (95% CI, 61.9, 88.3%), 87.1% (76.2, 93.4%) and 93.9% (83.9, 97.8%), respectively. There was no threshold effect in any of the imaging tests. All of the three imaging tests demonstrated substantial study heterogeneities both in the sensitivity and specificity (I2=90.9%, 92.6% for CT; I2=90.1%, 84.0% for MRI; I2=94.8%, 93.4% for PET/CT). The types of the reference standard (pathology only vs. combined use with follow-up images) were significant factors for study heterogeneity in all of the three imaging tests (P≤0.05). Neoadjuvant chemotherapy significantly decreased the sensitivity of CT (P=0.02) and MRI (P<0.01). The sensitivity in CT was significantly higher in studies from eastern countries than in those from western countries (P=0.02).

CONCLUSION

Despite the heterogeneous performances among the studies, gadoxetate disodium-enhanced MRI showed the highest sensitivity and PET/CT showed the highest specificity for diagnosing CRLM.

CLINICAL RELEVANCE/APPLICATION

Gadoxetic disodium-enhanced MRI and PET/CT should be considered as an additional imaging modality to CT when we evaluate patients with suspicious colorectal liver metastasis.

SSC07-09 Healthy Service, Policy and Research Keynote Speaker: Translating Evidence Into Best Practices

Monday, Nov. 28 11:50AM - 12:00PM Room: S102D

Participants

Janie M. Lee, MD, Bellevue, WA (*Presenter*) Research Grant, General Electric Company

SSC08

Informatics (Image Processing and Analysis)

Monday, Nov. 28 10:30AM - 12:00PM Room: S402AB

MR IN

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

Participants
Asim F. Choudhri, MD, Memphis, TN (*Moderator*) Nothing to Disclose
Srini Tridandapani, MD, PhD, Atlanta, GA (*Moderator*) Co-founder, CameRad Technologies, LLC
Gary J. Wendt, MD, MBA, Middleton, WI (*Moderator*) Medical Advisory Board, McKesson Corporation; Medical Advisory Board, HealthMyne, Inc; Stockholder, HealthMyne, Inc; Co-founder, WITS(MD), LLC; ;

Sub-Events

SSC08-01 Radiogenomic Analysis of The Cancer Genome Atlas (TCGA)/The Cancer Imaging Archive (TCIA) Head and Neck Squamous Cell Cancer (HNSCC) Cohort: Correlations between Genomic Features and Quantitative Imaging Features

Monday, Nov. 28 10:30AM - 10:40AM Room: S402AB

Awards
Student Travel Stipend Award

Participants
Aasheesh Kanwar, Houston, TX (*Presenter*) Nothing to Disclose
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Jay Messer, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Andrew Wong, BS, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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Laurence E. Court, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Yuan Ji, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Clifton D. Fuller, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Radiogenomics is the study of the association between genomic features and imaging phenotypes, aiming to enhance the molecular drivers for image phenotypes of biological samples. With publicly available data from TCGA and TCIA on the same set of tumor samples, we assessed pathway-specific alterations as potential correlates of radiomics features in matched cases from TCGA/TCIA HNSCC database(s).

METHOD AND MATERIALS

Segmented gross tumor volumes from pretreatment CT scans in DICOM-RT format were processed in IBEX, yielding 360 radiomic features characterizing different tumor image phenotypes. TCGA genomic data of the same tumors including whole-genome gene expressions, copy number variations (CNV), DNA methylations, miRNA expressions, somatic mutations, and expressions of cancer-related proteins, were processed using TCGA-Assembler. We used regression analysis and gene set enrichment methods to identify individual genomic features and genetic pathways that are associated with tumor radiomic features, adjusting for known prognostic variables such as patient age, smoking status, tumor stage and subsite.

RESULTS

A total of 126 patient samples was analyzed. Most samples were AJCC stage IV (n=83) with tumors of the oral cavity (n=67), larynx (n=35), and oropharynx (n=20). Mean age was 59.8 (SD=11.35) and most were current (n=51) or former smokers (n=44). We identified 20, 154, 3, 438, 8641, and 814 statistically significant (Benjamini-Hochberg-adjusted p-value ≤ 0.05) associations involving miRNA expressions, mutated genes, protein expressions, promoter region DNA methylations, transcriptional activities and CNVs of genetic pathways, respectively. Clinically relevant pathway associations have been identified, including the positive association between the expression level of ERK2 (a kinase important for cell proliferation and differentiation) and tumor size. All significant associations have been collected into a database for open-access querying/dissemination.

CONCLUSION

We identified a cohort of statistically significant associations between various genomic features and multiple kinds of radiomic phenotypes for HNSCC. These findings not only confirm known pathways, but may develop new knowledge about the genomic underpinnings of tumor imaging phenotypes.

CLINICAL RELEVANCE/APPLICATION

Quantitative analysis of standard-of-care images may inform upon tumor genomic status and identify pathway-depdendent features for risk/therapy stratification.

SSC08-02 Quantitative MR Imaging Biomarkers to Assess Early Response of Breast Cancers to Neoadjuvant

Chemotherapy (NACT)

Monday, Nov. 28 10:40AM - 10:50AM Room: S402AB

Participants
Ruth H. Bonini, MD, PhD, Campo Grande, Brazil (*Presenter*) Nothing to Disclose
Eva C. Gombos, MD, Boston, MA (*Abstract Co-Author*) Royalties, Reed Elsevier
Sona A. Chikarmane, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Vivek Narayan, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Judy Garber, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jayender Jagadeesan, PHD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Initial results show correlation with multiple MR heterogeneity metrics to PR. The imaging biomarkers may be helpful to predict the NACT response in breast cancer patients after first cycle of NACT, early in the course of treatment, before usual size measurements would indicate response.

Background

To assess tumor response after the first cycle of neoadjuvant chemotherapy (NACT) using imaging biomarkers that quantify the tumor heterogeneity on MRI and further correlate these metrics to pathological response (PR).

Evaluation

45 biopsy proven breast cancers were evaluated using MRI on baseline and first post-NACT and compared with the PR (complete or significant PR [pCR] = tumor loss > 90% vs partial or no PR [non-pCR]). The average time between baseline and first post-NACT MRI was 30 days. The first post-NACT MRI was done 8-14 days after the first cycle of treatment. A breast-imaging radiologist segmented the cancer on pre-contrast and first post-contrast images of baseline and first post-NACT MRI in the 3D Slicer software. 57 metrics that quantify the shape, morphology, distribution statistics, geometry and texture were obtained for each cancer using the HeterogeneityCAD module in 3D Slicer. Statistical correlation of the PR was performed with the % change in metrics evaluated from baseline and first post-NACT cycle MRI using Mann-Whitney test.

Discussion

Percentage change in 26/57 metrics on pre-contrast and 28/57 metrics on post-contrast MRI showed significant difference between the pCR and non-pCR groups ($p<0.05$). Mean representative metrics for non-pCR on post-contrast MRI (as %): Energy: 22.9, Entropy: 33.2, Variance: 5.4, Uniformity: 26.6, Auto correlation: 42.0, Dissimilarity: 44.6. Mean of Metrics for PCR (as %): Energy: 44.1, Entropy: 55.2, Variance: 25.0, Uniformity: 45.7, Auto correlation: 68.9, Dissimilarity: 69.0. Standard morphological metrics such as volume, surface area, maximum 3D diameter and compactness do not show significant differences between the pCR and non-pCR groups.

SSC08-03 Transport-Based Morphometry on Structural MRI Enables Reliable Differentiation of 16p11.2 Duplication and Deletion Carriers

Monday, Nov. 28 10:50AM - 11:00AM Room: S402AB

Awards
Trainee Research Prize - Medical Student

Participants
Shinjini Kundu, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Julia Owen, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
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Timothy Roberts, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Randy L. Buckner, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Srikantan S. Nagarajan, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Elliott H. Sherr, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Pratik Mukherjee, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company Medical Adivisory Board, General Electric Company
Gustavo Rohde, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Copy number variants (CNVs) in the 16p11.2 chromosomal locus (BP4-BP5) are associated with several neurodevelopmental disorders. This study aims to determine whether 16p11.2 deletion and duplication carriers can be differentiated based on structural MRI of the brain using Transport-Based Morphometry (TBM), and if so, whether regional white matter morphological changes that enable differentiation shed light on the underlying neurobiology of 16p11.2 CNVs.

METHOD AND MATERIALS

T1-weighted imaging was performed on 235 subjects (51 deletion carriers, 53 duplication carriers, 131 control subjects), including adults and children of both genders (4 – 63 years, mean age 22.4 ± 14.7; M:F ratio = 1.35). Deletion and duplication carriers had a range of neurodevelopmental diagnoses. Statistical Parametric Mapping (SPM12) was used to coregister and segment the white matter. Subsequently, TBM was applied to generate transport maps characterizing individual spatial tissue distribution compared to a common template image. Principal components analysis (PCA) was then applied for dimensionality reduction, and classification was performed using penalized linear discriminant analysis (PLDA) combined with a k-nearest neighbor (KNN) classifier (k = 15). Test accuracy was evaluated using leave-one-subject out cross-validation.

RESULTS

TBM enabled 100% test accuracy in predicting group membership (duplication, deletion, control) using white matter (100% sensitivity/specificity, Cohen's kappa = 1) and 95.7% using gray matter appearance alone (sensitivity = 96.1%, specificity = 98.9%, Cohen's kappa = 0.928). We identified a characteristic increase in white matter density (deletion carriers>controls>duplication carriers) in the following regions: occipital, splenium of corpus callosum, frontoparietal, inferior frontal, superior vermis of

cerebellum, cerebellar hemispheric. Conversely, a decrease in the inferior temporal (duplication carrier>controls>deletion carriers) white matter was also observed.

CONCLUSION

TBM enables robust prediction of 16p11.2 CNVs using T1-weighted images alone. Furthermore, for the first time, characteristic white matter morphology differences that enable sensitive classification were visualized.

CLINICAL RELEVANCE/APPLICATION

TBM reveals structural changes in white matter caused by 16p11.2 CNVs, associated with many neurodevelopmental disorders, yielding new insight and potential biomarkers to monitor disease and treatment.

SSC08-04 A Novel Bi-Input Convolutional Neural Network for Deconvolution-Free Estimation of Stroke MR Perfusion Parameters

Monday, Nov. 28 11:00AM - 11:10AM Room: S402AB

Participants
King Chung Ho, MSc, los angeles, CA (*Presenter*) Nothing to Disclose
Fabien Scalzo, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Karthik V. Sarma, BSc, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Suzie M. El-Saden, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
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Corey W. Arnold, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Perfusion magnetic resonance (MR) images are often used in conjunction with diffusion weighted images during the assessment of acute ischemic stroke to distinguish between the likely salvageable tissue and infarcted core. Methods such as singular value decomposition have been developed to approximate perfusion parameters from these images. However, studies have shown that existing deconvolution algorithms can introduce distortions that influence the measurements. In this work, we present a novel bi-input convolutional neural network (bi-CNN) to approximate perfusion parameters without deconvolution. We applied the trained bi-CNN to approximate cerebral blood volume (CBV).

METHOD AND MATERIALS

MR perfusion data was collected retrospectively for a set of 11 patients who had acute ischemic stroke. The ground truth perfusion maps (i.e., CBV) and arterial input functions (AIFs) were generated from ASIST-Japan perfusion mismatch analyzer, with the resulting CBV values ranging between 0-201 ml/100g. A set of 87,600 training patches with associated AIFs and CBVs were randomly sampled from the source perfusion data. Each patch had a size of 3 x 3 x 70 (width x height x time), and the center of the patch was the voxel of interest for estimation.Our bi-CNN is a 5-layer model with two parts: 1) two separate 3D convolutional and nonlinear layers for the training patch and its AIF, and 2) three fully-connected layers that combine the output of the first part to produce an estimated CBV. The model was trained with batch gradient descent, with a momentum of 0.9.

RESULTS

A leave-one-brain-out validation was performed to estimate voxel-wise CBV values. The bi-CNN achieved an average mean squared error (MSE) of 3.799 ml/100g +/-3.715. CBV deficits (< 2.5 ml/100g) could be identified from the bi-CNN estimated maps.

CONCLUSION

Our patch-based bi-CNN model is capable of estimating CBV in stroke patients. The model can be potentially extended to other disease domains, such as perfusion analysis in cancer. Future work includes experimenting on a larger dataset and estimating other important perfusion parameters, such as time-to-maximum (Tmax).

CLINICAL RELEVANCE/APPLICATION

Convolutional neural networks can be trained to approximate stroke MR perfusion parameters (e.g., CBV) and are a potential alternative method for automated quantification of perfusion abnormalities.

SSC08-05 Radiomic Response Assessment for Recurrent Glioblastoma Treated with Bevacizumab in the Brain Trial

Monday, Nov. 28 11:10AM - 11:20AM Room: S402AB

Participants
Patrick Grossmann, Boston, MA (*Presenter*) Nothing to Disclose
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Raymond Y. Huang, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hugo Aerts, PhD, Boston, MA (*Abstract Co-Author*) Stockholder, Genospace LLC

PURPOSE

To develop radiomic biomarkers for non-invasive response assessment of Bevacizumab (Avastin; Genentech) treatment in recurrent

glioblastoma multiforme (GBM).

METHOD AND MATERIALS

We analyzed prospectively acquired data from the BRAIN trial. For 167 patients, we extracted 71 radiomic features each from normalized post-contrast T1-weighted and fluid attenuation inversion recovery (FLAIR) sequences at baseline (pre-treatment) and at first follow-up (six weeks post-treatment). For every imaging modality at baseline, we selected 10 comprehensive features using an unsupervised feature selection approach that did not take clinical outcomes into account to limit overfitting. We investigated these features in terms of prognostic value for overall survival (OS), progression-free survival (PFS), as well as early (<3 month) and late (>9 month) progression.

RESULTS

T1 and FLAIR features showed only low pairwise correlation at baseline (mean positive and negative Pearson correlation of 0.3 and -0.13) indicating complementary effects of imaging modalities at the radiomic level. Features derived from T1 scans generally showed higher prognostic performances as compared to FLAIR (Fig. 1). A T1 derived textural-heterogeneity feature (gray-level non-uniformity) stratified patients into early and late progressors significantly at baseline (AUC 0.67, p=4.8x10-4); Kaplan-Meier analysis of this feature for OS showed moderate prognostic value at baseline (HR=1.8, p=7.2x10-4) and follow-up (HR=2, p=4x10-4). A multivariate Cox-regression model of supervised selected features stratified early and late progressors significantly at follow-up T1 scans in independent validation data (HR=2.8, p=5.8x10-4) after correcting for age, sex, and Karnofsky performance status.

CONCLUSION

For the first time, our study allows the definition of radiomic response phenotypes of Bevacizumab treatment in recurrent GBM by leveraging high-quality prospective trial data. Importantly, our data suggests the increased benefit of measuring radiomic patient profiles longitudinally after treatment has been initiated to monitor progression and resistance for immediate intervention and treatment adaptation.

CLINICAL RELEVANCE/APPLICATION

Through to the development of non-invasive imaging biomarkers predicting the effect of Bevacizumab treatment for patients with recurrent GBM, our study contributes to the promotion of precision medicine in oncology.

SSC08-06 Radiogenomics Mapping of Non-small Cell Lung Cancer Shows Strong Correlations between Semantic Image Features and Metagenes

Monday, Nov. 28 11:20AM - 11:30AM Room: S402AB

Participants
Mu Zhou, PhD, Mountain View, CA (*Presenter*) Nothing to Disclose
Sandy Napel, PhD, Stanford, CA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc; Scientific Advisor, RADLogics, Inc
Sebastian Echegaray, MS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Ann N. Leung, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Olivier Gevaert, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To present a radiogenomic map linking RNA sequencing data with semantic image features for patients with non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

Under IRB approval, we studied 113 patients with NSCLC who had preoperative CT scans and tumor tissue collected between 04/07/2008 and 09/15/2014 at two medical centers. A thoracic radiologist annotated the CT of each tumor with 89 semantic image features using a template with a controlled vocabulary, reflecting radiologic features in tumor shape, margin, and texture as well as background lung characteristics. Next, total RNA was extracted from these tissue samples and converted into a library for paired-end RNA sequencing on Illumina Hiseq. The RNA sequencing data were clustered into 56 high quality metagenes and filtered for metagene homogeneity in five external, public gene expression cohorts totaling 1227 NSCLC patients. We updated a radiogenomics map between metagenes and semantic image features by using Pearson correlation metric with the False Discovery Rate (FDR). In addition, we established the prognostic relationship of metagenes using Cox proportional hazards modeling in five external cohorts.

RESULTS

We identified the top ten metagenes with the highest cluster homogeneity in consensus from five external cohorts. The defined metagenes are highly coexpressed genes to capture important biological processes including hypoxia, cell cycles, and immune response. Correlating metagenes and semantic features, we found 34 significant associations (P<0.05 and FDR<0.01). Ground glass opacity (P=0.005 and FDR<0.001) and nodule attenuation (P=0.008 and FDR=0.003) are strongly correlated with the metagene 19 that defines EGFR pathway. In addition, semantic features capturing presence of centrilobular emphysema (P=0.03) and emphysema severity (P=0.015) are both found to be significantly associated with survival outcomes of patients with NSCLC.

CONCLUSION

We built a radiogenomics map linking ten high-level metagenes capturing canonical pathways of NSCLC to observable imaging characteristics providing a strong association with survival.

CLINICAL RELEVANCE/APPLICATION

Semantic image features capturing tumor phenotypic characteristics can be used to non-invasively associate with molecular properties of NSCLC with prognostic implications.

SSC08-07 Effect of Input Parameters on the Use of Convolutional Neural Networks in Distinguishing Between Malignant and Benign Breast Lesions Across Two Breast Imaging Modalities

Monday, Nov. 28 11:30AM - 11:40AM Room: S402AB

Participants
Benjamin Q. Huynh, Chicago, IL (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate the effect of image formats on the use of deep convolutional neural networks (CNNs) in the task of distinguishing between benign and malignant lesions on FFDM and breast ultrasound images

METHOD AND MATERIALS

Datasets included 1125 breast lesions [2393 regions of interest (ROIs)] on breast ultrasound and 219 breast lesions [607 ROIs] on full-field digital mammography (FFDM). Ultrasound ROIs were categorized as benign solid, benign cystic, or malignant; FFDM ROIs as either benign or malignant. Output from image ROIs subjected to pre-trained CNNs were classified in the diagnostic task using support vector machines (SVM). In order to fit the image size requirements of the pre-trained CNN, ultrasound ROIs were resized by various different scaling and padding methods, with classification performance being assessed for the different padding options. Performance levels of the deep learning were also compared to that obtained using 'traditional' CADx human-designed features. Five-fold cross validation (by lesion) was used to assess performance in the task of distinguishing between benign and malignant breast lesions, with area under the ROC curve (AUC) as the index of performance.

RESULTS

Mirror-padding resulted in the best performance (AUC=0.90 (Std Error=0.01)) compared to zero-padding (AUC=0.79 (SE=0.02)) and average-padding (AUC=0.81 (SE=0.01)). Also, extracted CNN features demonstrated rotational invariance despite the view-based asymmetry of ultrasound ROIs. The pre-trained CNN methods yielded similar diagnostic performance levels as compared to the conventional CADx methods (AUC = 0.90 vs 0.90 (SE = 0.01) for ultrasound; AUC = 0.81 vs 0.80 (SE = 0.01) for FFDM).

CONCLUSION

Deep learning demonstrated, across two breast imaging modalities, similar performance levels as compared to CADx in the diagnostic task. However, optimal choice of input ROIs in the CNN structure appears crucial in assuring high performance.

CLINICAL RELEVANCE/APPLICATION

Deep learning techniques show extreme promise in computer-aided diagnosis, however, performance levels are dependent on the type of pre-processing.

SSC08-08 Development of a Novel Bayesian Network Interface for Radiology Diagnosis Support and Education

Monday, Nov. 28 11:40AM - 11:50AM Room: S402AB

Participants
Po-Hao Chen, MD, MBA, Philadelphia, PA (*Presenter*) Nothing to Disclose
Suyash Mohan, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, NovoCure Ltd; Grant, Galileo CDS, Inc
Tessa S. Cook, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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R. Nick Bryan, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Stockholder, Galileo CDS, Inc; Officer, Galileo CDS, Inc
Emmanuel J. Botzolakis, MD,PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

A prototype web-based interface (ARIES) was developed that streamlines interaction of radiologists with BNs. With further development and validation, we anticipate this could provide Radiology diagnosis and educational support.

Background

Bayesian networks (BNs) are forms of artificial intelligence that have shown promise for Radiology diagnosis support. Taking as input imaging and clinical key features (KFs) extracted by radiologists, BNs can output probability-ranked differential diagnoses (DDx) and suggest further imaging or testing to constrain the DDx. Moreover, because BNs illustrate probabilistic relationships between KFs and DDx, they offer a unique approach to Radiology education that emphasizes "bottom-up" diagnostic reasoning (i.e., DDx given KFs), as opposed to more traditional "top-down" approaches (i.e., KFs given DDx).

Evaluation

To translate BNs into clinical and educational practice, we developed ARIES (Adaptive Radiology Interpretation and Education System), an open-source, web-based interface that allows Radiologists to interact with expert-developed BNs representing various imaging domains (e.g., Neuroradiology). ARIES utilizes a commercially available BN backend (Netica, Vancouver, Canada) wrapped in a Java server, and was created using JavaScript, JQuery, and HighCharts. ARIES was developed in close collaboration with practicing radiologists, intended for use alongside a traditional PACS workstation.

Discussion

In Clinical Mode, ARIES displays buttons corresponding to relevant KFs. As KFs are selected, two sets of probability-ranked DDx are continuously updated ("radiographic DDx," based on imaging KFs alone, and "clinical DDx," using both disease prevalence and clinical KFs). Embedded sensitivity analysis highlights the next most discriminating KFs after each selection. In Education Mode, trainees are prompted to review clinically proven cases from an internal teaching file. After entering KFs and providing a DDx, automated feedback is provided comparing agreement between trainee- and expert-extracted KFs, and between trainee- and BN-generated

DDx. ARIES also offers machine learning functionality, updating BN probability tables in real-time as cases are submitted to the interface.

SSC08-09 Multiparametric Magnetic Resonance Imaging of the Prostate with Computer Aided Detection as the First Reader: Effect on Experienced Observer Performance

Monday, Nov. 28 11:50AM - 12:00PM Room: S402AB

Participants
Valentina Giannini, PhD, Candiolo, Italy (*Presenter*) Nothing to Disclose
Simone Mazzetti, PhD, Candiolo, Italy (*Abstract Co-Author*) Nothing to Disclose
Federica Arabia, Candiolo, Italy (*Abstract Co-Author*) Nothing to Disclose
Salvatore Pedalino, Candiolo, Italy (*Abstract Co-Author*) Nothing to Disclose
Filippo Russo, MD, Candiolo, Italy (*Abstract Co-Author*) Nothing to Disclose
Daniele Regge, MD, Torino, Italy (*Abstract Co-Author*) Speakers Bureau, General Electric Company

PURPOSE

To assess if the detection of prostate cancer (PCa) at multiparametric Magnetic Resonance Imaging (mp-MRI) is improved when Computer aided detection (CAD) is adopted as the first reader (FR-CAD) by the experienced radiologists. Secondary aims of this study are to assess if CAD reduces reading time and interobserver variability.

METHOD AND MATERIALS

3 experienced radiologists searched for PCa in 89 mp-MRI studies. First, radiologists reported the examinations by using the FR-CAD paradigm. In this case, they were asked to analyze the probability map of the CAD superimposed to the T2w, and to confirm those CAD marks that they consider to be PCa. After 6 weeks, cases were re-ordered randomly and readers reported them without the support of the CAD system (unassisted reading), by scrolling all MR sequences (i.e. T2w, DW and DCE). Lesion size, PIRADS (only in the unassisted reading), a five-point confidence score and interpretation time was recorded for both reading modalities. Per-patient and per-lesion sensitivity, and specificity were computed for both procedures and compared using the McNemar test. Inter-observer agreement between reviewers was evaluated using Fleiss Kappa statistics.

RESULTS

The dataset comprised 35 patients having at least 1 clinically significant tumor (39 lesions) and 54 negative patients (at least 1 year follow up). Mean per-patient sensitivity of FR-CAD and unassisted reading did not differ significantly when considering lesion of all size and GS (81% vs 88%, p=0.105), while with the FR-CAD sensitivity increased significantly for patient having a GS>6 (81% vs 91%, p=0.046) and a maximum lesion diameter≥10 mm (80% vs 95%, p = 0.006). Specificity increased not significantly when using the FR-CAD (75.3% vs 78.4%, p = 0.25). The average reading time strongly decreased with the FR-CAD (220 s vs 60 s, p<0.0001). The inter-reader agreement also increased in the FR-CAD paradigm for both per-patient (0.55 vs 0.60) and per-lesion (0.46 vs 0.55) analysis.

CONCLUSION

This preliminary study shows that FR-CAD can (I) improve sensitivity in detecting PCa with GS>6 and lesion diameter ≥ 10 mm, (II) increase inter-reader agreement and (III) reduce reading time.

CLINICAL RELEVANCE/APPLICATION

FR-CAD for prostate cancer may be an attractive reading strategy into the routine clinical environment, especially if mp-MRI prostate imaging will be introduced to select patients candidate to biopsy.

SSC09

Musculoskeletal (Bone Intervention)

Monday, Nov. 28 10:30AM - 12:00PM Room: E450A

MK IR SQ

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

Participants
Jean-Denis Laredo, MD, Paris, France (*Moderator*) Research Consultant, Cardinal Health, Inc Research Consultant, Laurane Medical Research Consultant, F. Hoffman-La Roche Ltd Research Grant, SERVIER
Kambiz Motamedi, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSC09-01 Magnetic Resonance guided Focused Ultrasound (MRgFUS) for totally Non-Invasive Treatment of Non-vertebral Osteoid Osteoma: A Prospective Two-Center Study

Monday, Nov. 28 10:30AM - 10:40AM Room: E450A

Participants
Alessandro Napoli, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Fabrizio Boni, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Carola Palla, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Scipione, Terracina, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Alberto Bazzocchi, MD, Bologna, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate mid- to long-term efficacy of MRgFUS in the treatment of accessible symptomatic osteoid osteomas

METHOD AND MATERIALS

Patients were eligible if they had clinical and imaging diagnosis of Osteoid Osteoma. Lesions located in vertebral body were excluded; recurrences after RFA or surgery were included. Patients received focal therapy using MRgFUS (InSightec), delivered toward the nidus. Primary endpoints were pain relief assessed using questionnaires on Visual Analog Pain Score (VAS) and daily intake of Non-steroidal drugs (NSAIDs); secondary endpoints were need for further intervention and bone changes analyzed at imaging (CT and dynamic CE-MRI; Gd-BOPTA, Bracco). Patient's follow-up, including clinical and imaging examinations, was established at 1 and 12 months

RESULTS

36 patients (female 8; male, 28; mean age 26) were recruited for MRgFUS treatment; all patients completed the procedure without adverse events immediately after treatment or at follow-up. A mean number of 6 ± 1.5 sonications with mean energy of 991 ± 452 J was necessary to complete the treatment. Three patients underwent treatment as rescue (2 post-RFA, 1 post surgery). Complete clinical response was found in 32/36 (88.8%) patients (pain score=0 and NSAIDs discontinuation). There was a statistically significant difference (p=0.001) between baseline (7 ± 2) and follow-up values (0 ± 2) for pain severity, according to VAS. Two patients (5.1%) reported pain recurrence requiring both RFA and other two experienced pain decrease >2 points in the scale but did not reach 0, being classified as partial responders without requiring further interventions. Imaging evaluation with CE-MRI demonstrated marked reduction of nidus perfusion in all complete responders

CONCLUSION

MRgFUS can be effectively adopted for the treatment of Osteoid Osteoma. This application is totally non-invasive with robust pain relief

CLINICAL RELEVANCE/APPLICATION

MRgFUS can be performed safely with high rate of success for the noninvasive treatment of Osteoid Osteoma

SSC09-02 Painful Bone Metastases Palliation through MR-Guided Focused Ultrasound: Clinical Response Evaluation

Monday, Nov. 28 10:40AM - 10:50AM Room: E450A

Participants
Fabrizio Boni, Rome, Italy (*Presenter*) Nothing to Disclose
Cristina Marrocchio, rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Vincenzo Noce, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Fabrizio Andrani, Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Napoli, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate MRgFUS treatment efficacy in patients with painful bone metastases non responding to pain-killer drugs and radiation therapy.

METHOD AND MATERIALS

Our study included 44 patients (14 female and 30 males; mean age 61,4 ± 9,5) suffering from metastatic bone disease. All patients

were considered non responders to conventional therapies (radiation, analgesic drugs) and were preliminary analyzed by contrast-enhanced MR imaging and pain scale assessment (Quality of Life Questionnaire-BM22 and VAS scale). We treated 52 non-vertebral skeletal metastases with MRgFUS (ExAblate 2100, InSightec). Follow-up evaluation comprehended MR scan and pain scale scoring at 3 and 6 months after treatment.

RESULTS

MRgFUS ablation was performed without adverse events. 26 out of 44 patients (60%) experienced a complete clinical response and suspended any other therapy. 13/44 patients (31%) reported an incomplete response (more than 2 points decrease in VAS pain scale). 5/44 patients (9%) have been classified as non-responders (less than 2 points decrease in VAS pain scale). Statistically significant differences between baseline, 3-month and 6-month follow-up have been demonstrated, in terms of VAS scale, analgesic drugs intake and pain interference on quality of life (QLQ- BM22).

CONCLUSION

MRgFUS treatment of bone metastases is effective and safe in pain palliation of selected patients.

CLINICAL RELEVANCE/APPLICATION

MRgFUS could be routinely introduced in treatment options for painful bone metastases non responding to conventional treatment.

SSC09-03 Radiological Percutaneous Osteosynthesis and Cementoplasty for Osteolytic Metastases

Monday, Nov. 28 10:50AM - 11:00AM Room: E450A

Participants
Erti Mavrovi, Lyon, France (*Presenter*) Nothing to Disclose
Anne-Charlotte Kalenderian, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Charles Mastier, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Hedi Beji, Vienne, France (*Abstract Co-Author*) Nothing to Disclose
Gualter Vaz, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Marie T. Cuinet, MD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Philippe Thiesse, MD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Frank Pilleul, MD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Bertrand Richioud, Lyon, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Radiological percutaneous osteosynthesis and cementoplasty (RPOC) is a recent technique for interventional radiologists. It is a minimally invasive procedure and could be an alternative of surgery in patients with metastatic disease. We report our experience in the field of oncology.

METHOD AND MATERIALS

We retrospectively reviewed all cases of RPOC performed in our hospital in patients suffering from osteolytic metastases with or to prevent pathological fracture. An impending pathological fracture was defined by a Mirels' score > 8.

After institutional review board the patients were not candidates for surgery due to poor performans status, refusal or on-going chemotherapy. RPOC was performed with cannulated screws under computed tomography and scopic guidance with a CT-Navigation device.We retrospectively analyzed occurrence of post-procedural fractures, reduction in pain, technical feasibility, duration in the operating room, early complications and duration of hospitalization.

RESULTS

Between September 2013 and November 2015 RPOC was performed in 30 patients (10 women, 20 men, mean age of 59 y ± 11). The technical success was 96,7% with screwing a failed iliopubic branch too fragile. The average duration of the procedure was 92 minutes ± 19. All patients got up and walked on the day after the surgery. The average duration of hospital stay was 4 days ± 3 (range, 2-10).Twenty patients had RPOC for impending malignant pathological fracture, 14 of the proximal femur and 6 of the acetabulum roof. The average Mirels' score was 9.8 ± 1.1 (range, 8-12).For the proximal femur, no fracture occurred, with a median follow-up of 242 days (range, 11-600).For the acetabulum roof, 2 pathological fractures occurred (fracture rate=33,3%, mean follow-up of 245 days).Ten patients had RPOC for 10 painful pathologic fractures.For symptomatic patients (n = 17), visual analog scale (VAS) decreased from 6.8 ± 1.2 (range, 5-9) before treatment, to 2.3 ± 1.1 (range, 1-4) one month later.

CONCLUSION

Radiological Percutaneous Osteosynthesis and Cementoplasty for osteolytic metastasis is a safe and feasible technique.For fragile patients that are not candidates for surgical stabilization, RPOC can be a good alternative in pain relief of pathologic fractures or consolidation of lytic metastasis with a high fracture risk.

CLINICAL RELEVANCE/APPLICATION

Alternative at surgical stabilization for fragile metastatic patients

SSC09-04 Safety and Results of Image-Guided Vertebroplasty with Elastomeric Polymer Material (Elastoplasty)

Monday, Nov. 28 11:00AM - 11:10AM Room: E450A

Participants
Giovanni Mauri, MD, Milan, Italy (*Presenter*) Consultant, Esaote SpA
Gianluca M. Varano, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Della Vigna, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Guido Bonomo, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Franco Orsi, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Giovanni Carlo Anselmetti, MD, Torino, Italy (*Abstract Co-Author*) Research Consultant, Medtronic plc

PURPOSE

To use an elastomeric polymer material rather than traditional polymethymethacrylate ("PMMA") or acrylic bone cement in vertebroplasty could theoretically lower the number of secondary fractures. Primary endpoint of the present study was to assess safety of image-guided vertebroplasty using a novel silicone based elastomeric polymer material (elastoplasty). Secondary endpoint was the effectiveness in pain relief.

METHOD AND MATERIALS

19 patients (13 females, mean age 72±10 y) underwent elastoplasty between 2010 and 2016. 14 patients had osteoporotic fractures, 2 patients traumatic fractures, 1 patient a painful myeloma localization, and 1 patient a painful vertebral angioma. 15 patients were using a brace and all were consuming drugs for pain relief. A total of 33 vertebrae were treated (range L1-T6). Patients were treated under local anesthesia and fluoroscopic guidance, using transpedicular approach and 2-6 ml of silicone based elastomeric polymer material (VK100) was injected by an interventional radiologist with more than 20 years' experience in vertebroplasty. Chest x-ray was performed after the procedure in order to detect pulmonary embolism. Immediate and late complications, if any, were recorded, and VAS and Oswestry before and after the procedure evaluated.

RESULTS

It was always possible to complete the procedure. In 6/19 (31.5%) asymptomatic leakage of the material was observed. Minimal asymptomatic pulmonary embolism was seen in 4/19 (21%) patients, with no alteration of the saturation parameters. After two days no evidence of pulmonary emboli existed. In 18/19 (94%) patients had a recovery from pain symptoms. One patient with painful angioma did not experienced any change in symptoms. VAS and Oswestry scores were significantly reduced after the procedure, from 7.9±1.1 to 0.7±1.4 ($p<0.001$) and from 79.6±12% to 9.9±14% ($p<0.001$) respectively. 14/15 (93%) of the patients no longer required a brace after the procedure ($p<0.001$) and 16/19 (84%) completely stopped using any drugs for pain relief after treatment ($p<0.001$). At a mean follow-up of 2.1±2.4 years, no new treatment for symptomatic vertebral fractures were needed.

CONCLUSION

Image-guided elastoplasty is a safe and effective procedure when performed by experienced operator.

CLINICAL RELEVANCE/APPLICATION

elastopasty is a novel procedure that can be safely performed by experienced operators, and holds the potential of lowering the number of secondary fractures.

SSC09-05 Percutaneous Vertebroplasty in Tumoral Spinal Fractures with Posterior Vertebral Wall Involvement: Feasibility and Safety

Monday, Nov. 28 11:10AM - 11:20AM Room: E450A

Participants
Diego S. Palominos Pose, MD, Nice, France (*Presenter*) Nothing to Disclose
Nicolas Amoretti, MD, Nice, France (*Abstract Co-Author*) Nothing to Disclose
Amelie Pellegrin, Nice, France (*Abstract Co-Author*) Nothing to Disclose
Olivier Andreani, Nice, France (*Abstract Co-Author*) Nothing to Disclose
Marie-Eve Amoretti, Nice, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the technical feasibility and safety of CT and fluoroscopy guided percutaneous vertebroplasty in the treatment of tumoral vertebral fractures with epidural involvement.

METHOD AND MATERIALS

Institutional review board approval and informed consent were obtained for this study. Sixty-three consecutive adult patients (35 women, 28 men; mean age +/- standard deviation: 69 years +/- 14) with tumoral spinal fractures that compromised the posterior vertebral column with epidural involvement were prospectively treated by means of percutaneous vertebroplasty with CT and fluoroscopy guidance. Only local anesthesia was used during these procedures. Postoperative outcome was assessed using the Kostuik index.

RESULTS

Sixty-three vertebroplasties were performed on thirty-four thoracic (54%), twenty-six lumbar (41%), and three (5%) cervical vertebrae. The etiologies of the fractures were metastasis in twenty-eight (44%), myeloma in twenty-five (40%) and hemangioma in ten (16%). Almost all fractures (94%) were consolidated after vertebroplasty (score of Kostuik <3) ($p < 0.001$). No major complications were reported in our series of cases.

CONCLUSION

This study suggests that tumoral spinal fractures with posterior vertebral wall involvement can be successfully and safely treated by CT and fluoroscopy-guided percutaneous vertebroplasty.

CLINICAL RELEVANCE/APPLICATION

Percutaneous vertebroplasty in tumoral fractures with posterior vertebral wall involvement is feasible, efficient and safe. Its use by the physicians in charge is recommended to benefit the patient.

SSC09-06 Nomogram for Predicting Intradiscal Cement Leakage Following Percutaneous Vertebroplasty in Patients with Osteoporosis Vertebral Compression Fractures

Monday, Nov. 28 11:20AM - 11:30AM Room: E450A

Awards
Trainee Research Prize - Medical Student

Participants
Binyan Zhong, MD, PhD, Nanjing, China (*Presenter*) Nothing to Disclose

Gao-Jun Teng, MD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We aim to establish an effective and novel nomogram for intradiscal cement leakage (ICL) following percutaneous vertebroplasty (PVP) in patients with osteoporosis vertebral compression fractures (OVCFs).

METHOD AND MATERIALS

Patients with OVCFs who underwent their first PVP in our department between January 2007 and December 2013 were included in this study. Univariate and multivariate analysis were used to predict the independent risk factors. The Nomogram was then created based on the identified independent risk factors.

RESULTS

A total of 241 patients and 330 vertebrae were included. The mean age of the patients was 73.5 (SD 7.9) years old, and the mean number of treated vertebrae was 1.4 per person. ICL was observed in 93 (28.2%) of the treated vertebrae. Greater fracture severity (P=0.016), cortical disruption of the endplate (P<0.0001), absence of Kummell's disease (P=0.010), and higher CT values (P=0.050) are the independent risk factors for ICL.

CONCLUSION

Greater fracture severity, cortical disruption of the endplate, absence of Kummell's disease, and higher CT values are the independent risk factors for ICL. The novel nomogram gives accurate prediction of ICL.

CLINICAL RELEVANCE/APPLICATION

This predictive nomogram can guide physicians do something to prevent ICL

SSC09-07 CT-guided Percutaneous Pedicle Screw Fixation Followed by Cementoplasty in the Treatment of Metastatic Spinal Disease

Monday, Nov. 28 11:30AM - 11:40AM Room: E450A

Participants
Claudio Pusceddu, MD, Cagliari, Italy (*Presenter*) Nothing to Disclose
Nicola Ballicu, MD, Cagliari, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Melis, Cagliari, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

evaluate the feasibility and effectiveness of CT-guided percutaneous screw fixation plus cementoplasty (PSFPC) in patients with painful vertebral metastases with fractures or to prevent pathological fracture.

METHOD AND MATERIALS

Twenty patients (7 men and 13 women, median age 52 years) with 24 vertebral metastases (7 NSCLC, 7 multiple myeloma, 6 breast carcinoma) underwent CT–guided PSFPC. The procedure was performed in a single vertebra in 16 patients and in two vertebrae in 4 patients. The vertebral approach was unilateral with a single screw in thirteen patients and bilateral with two screws in the remaining 7. We analyzed the feasibility and complications of the procedure, the decrease in pain using a visual analogue scale (VAS) and the functional outcome assessed according to the evolution of their walking ability.

RESULTS

There were no complications related to infections or incorrect positioning of the screws or leakage of cement. VAS score decreased from 7.4 (range, 4- 9) to 1.2 (range, 0-3). All patients were able to walk within 6 hours after the procedure and have improved their walking capacity at six months. No new bone fracture occurred during a median follow up of 10 months.

CONCLUSION

our results suggest that PSFPC is a safe and effective procedure which allows us to stabilize the fracture and prevent pathological fractures with a significant pain relief and good recovery of walking ability. PSFPC seems to be a promising alternative for patients who are not candidates for surgery. Further studies are required to confirm this preliminary experience.

CLINICAL RELEVANCE/APPLICATION

These results may introduce a new method of palliative treatment in patients with painful vetebral metastatic lesion with fracture or at high risk of fracture.

SSC09-08 Percutaneous Image-Guided Spinal Biopsy: Factors Affecting the Higher Diagnostic Yield

Monday, Nov. 28 11:40AM - 11:50AM Room: E450A

Participants
So Yeon Yang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Won Kwon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Su Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

The objectives of this study were to determine the accuracy of percutaneous image-guided spinal biopsy of osseous spinal lesions in patients with known or suspected underlying malignancy in reference to the imaging appearance of the biopsied lesion and to analyze factors affecting the higher biopsy yield.

METHOD AND MATERIALS

We retrospectively reviewed 247 consecutive percutaneous spinal biopsies. Size (< 2 cm and ≥ 2 cm), location (C-, T-, L-spine, and sacrum), and CT density (osteoblastic, osteolytic, mixed, and isodense) of the lesion, guiding modality (CT and fluoroscopy),

years of biopsy attending experience (< 2 years and ≥ 2 years), number of approach (one and ≥ 2), pathologic report of the biopsy, and final diagnosis of the lesion were recorded. A biopsy was considered as diagnostic if it provided a confident pathologic result or non-diagnostic if the pathology could not suggest a specific diagnosis. All variables were compared using Pearson's chi square test or Fisher's exact test.

RESULTS

In all, 197 of 247 (79.8%) biopsies were diagnostic. On multivariate analysis, size, CT density, and final diagnosis of the lesion were statistically significant factors on affecting biopsy yield. Biopsy in larger lesions (≥ 2 cm) showed significantly higher diagnostic yield than smaller lesion (p = 0.006). The osteolytic lesions had highest diagnostic rate (87.6%), followed by mixed (84.4%), osteoblastic (66.7%) and isodense lesions (61.1%). There was statistically significant difference in the diagnostic biopsy rates of osteolytic versus osteoblastic lesions (p=0.004) and of osteolytic versus isodense lesions (p=0.031). Metastasis had highest diagnostic rate (97.2%), followed by primary malignancy (84.2%) and benign lesion (39.4%) with statistical significance.

CONCLUSION

In the percutaneous image-guided biopsy for the spinal lesion, size, CT density, and final diagnosis of the lesion can affect the higher biopsy yield. Osteolytic lesions have higher diagnostic biopsy rate than osteoblastic or isodense lesions. Metastatic lesions have highest diagnostic biopsy rate followed by primary malignant and benign lesions.

CLINICAL RELEVANCE/APPLICATION

Percutaneous biopsies for osteolytic or mixed spinal lesions have a higher diagnostic yield than for osteoblastic or isodense lesions.

SSC09-09 Short and Long Term Effects of In Vivo Periarticular Osseous Ablation on Porcine Articular Cartilage: Comparison between Cryoablation and Radiofrequency Ablation

Monday, Nov. 28 11:50AM - 12:00PM Room: E450A

Awards
Student Travel Stipend Award

Participants
Ji Y. Buethe, MD, Cleveland, OH (*Presenter*) Research Grant, Galil Medical Ltd
Craig Lance, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Christos Kosmas, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Ali Gholamrezanezhad, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Fadi Abdul-Karim, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Yaxia Zhang, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Mark R. Robbin, MD, Cleveland Hts, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We aim to compare the short- and long-term effects of cryoablation (Cryo) versus radiofrequency ablation (RFA) on nontarget articular cartilage tissue during CT-guided periarticular bone ablation in an in vivo porcine model.

METHOD AND MATERIALS

Following Institutional Animal Care and Use Committe approval, 3 juvenile female miniature pigs underwent a 2-arm study using the animals as their own control. Pigs #1 and #2 underwent CT-guided periarticular bone ablations (pig#1-Cryo; pig#2-RFA) at 4 different sites each, and all limbs (including 1 control site) were removed from both pigs immediately following the procedures. Pig #3 underwent periarticular bone Cryo or RFA at 3 different sites each, and all limbs (including 1 control site) were removed 7 weeks following the procedure. For all ablations, an 11-gauge coaxial introducer was percutaneously advanced into the target epiphyseal site followed by placement of single RFA or Cryo probe 1cm from the articular surface under general anesthesia. RFA was performed for a total of 6 minutes at a target temperature of 90 degrees Celsius using 17G cooled-tip electrodes. Cryo was performed using 17G probes for two 10-5-minute freeze-thaw cycles. All bone and articular cartilage specimens were examined histologically with H&E staining.

RESULTS

In vivo Cryo and RFA both resulted in acute osteonecrosis at the ablation sites without associated histologic articular cartilage disruption immediately following the procedure. Cryo and RFA resulted in focal osteonecrosis and inflammatory reaction with bone remodeling at the ablation sites without associated histological cartilage disruption 7 weeks following the percutaneous ablation therapy.

CONCLUSION

In vivo Cryo and RFA of periarticular bone in a porcine model did not result in short- or long-term histological articular cartilage disruption. These findings suggest that both Cryo and RFA may not cause significant damage to the adjacent articular cartilage tissue during percutaneous periarticular osseous ablation therapies.

CLINICAL RELEVANCE/APPLICATION

Nontarget articular cartilage disruption is a potential risk associated with periarticular thermal bone ablation, and there is paucity of data on the long-term effects.

SSC10

Nuclear Medicine (Gastrointestinal Imaging)

Monday, Nov. 28 10:30AM - 12:00PM Room: S505AB

GI CT NM

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

FDA Discussions may include off-label uses.

Participants
Amir H. Khandani, MD, Chapel Hill, NC (*Moderator*) Consultant, Progenics Pharmaceuticals, Inc; Consultant, WorldCare International, Inc
Don C. Yoo, MD, E Greenwich, RI (*Moderator*) Consultant, Endocyte, Inc

Sub-Events

SSC10-01 Heterodimer of Tissue Factor and CD105 F9ab)s for Preclinical PET Imaging of Pancreatic Cancer

Monday, Nov. 28 10:30AM - 10:40AM Room: S505AB

Awards
Student Travel Stipend Award

Participants
Dawei Jiang, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Haiming Luo, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Christopher England, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Hector Valdovinos, MS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Robert J. Nickles, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pancreatic adenocarcinoma is currently causing great health concern and treated with limited outcomes. Thus, the development of non-invasive imaging tracers with high specificity for pancreatic cancer is crucial to improving the accuracy of diagnosis as well as the monitoring of therapy.

METHOD AND MATERIALS

A bi-specific heterodimer was synthesized by conjugating an anti-tissue factor (TF) Fab (ALT-836-Fab) with an anti-CD105 Fab (TRC105-Fab), via the biorthogonal "click" reaction between tetrazine (Tz) and trans-cyclooctene (TCO). The heterodimer was labeled with 64Cu for positron emission tomography (PET) imaging of nude mice bearing BXPC-3 xenograft and orthotopic pancreatic tumors.

RESULTS

PET imaging of BXPC-3 (TF/CD105+/+) xenograft tumors with 64Cu-labeled heterodimer displayed significantly enhanced tumor uptake (28.8 ± 3.2 %ID/g) at 30 h post-injection (p.i.), while compared with each of their single Fab tracers (12.5 ± 1.4 %ID/g for anti-TF Fab and 7.1 ± 2.6 %ID/g for anti-CD105 Fab). Also, the activity-concentration ratio in term of tumor/muscle ratio is 75.2 ± 9.4 at 30 h p.i., which could allow effective visualization of tumors. Furthermore, 64Cu-NOTA-heterodimer enabled sensitive detection of orthotopic pancreatic tumor lesions with an uptake of 17.1 ± 4.9 %ID/g and tumor/muscle ratio of 72.3 ± 46.7 at 30 h p.i.

CONCLUSION

Dual-targeting of TF and CD105 with heterodimer F(ab)s offered a broad-spectral strategy and efficient method to improve the imaging of pancreatic tumors or other possible cancers. We hope this approach could help with the diagnosis, monitor, and therapy of pancreatic malignancies.

CLINICAL RELEVANCE/APPLICATION

Dual-targeting of TF and CD105 with heterodimer F(ab)s offered a broad-spectral strategy and efficient method to improve the imaging of pancreatic tumors. We hope this approach could help with the diagnosis, monitor, and therapy of pancreatic malignancies.

SSC10-02 Evaluation of a Fast 68Ga-DOTATOC PET/MRI Protocol for Whole-Body Staging of Neuroendocrine Tumors: A comparison with 68Ga-DOTATOC PET/CT

Monday, Nov. 28 10:40AM - 10:50AM Room: S505AB

Participants
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Cornelius Deuschl, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Karsten J. Beiderwellen, MD, Essen, Germany (*Abstract Co-Author*) Speaker, Siemens AG; Speaker, Bracco Group
Thorsten D. Poeppel, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG

PURPOSE

To compare the diagnostic performance of a fast 68Ga-DOTA-Phe1-Tyr3-octreotide (68Ga-DOTATOC) positron emission

tomography/magnetic resonance imaging (PET/MRI) protocol with 68Ga-DOTATOC PET/computed tomography (PET/CT) in whole-body staging of neuroendocrine tumors (NETs).

METHOD AND MATERIALS

30 patients with histologically proven NET underwent 68Ga-DOTATOC PET/CT and subsequently a 68Ga-DOTATOC PET/MRI in a single injection protocol. For PET/MRI, a fast and comprehensive sequence protocol was applied. Each PET/MRI and PET/CT was independently evaluated by two readers concerning lesion count, lesion localization, lesion nature (benign/indeterminate/malignant), and lesion conspicuity (4-point Likert scale). The reference standard was based on histopathology and/or follow-up imaging. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of PET/MRI and PET/CT were compared using McNemar's chi2 test. Wilcoxon tests assessed differences in SUVmax and lesion conspicuity. Correlation analysis of SUVmax was performed using Pearson's correlation coefficient (r). Interobserver agreement on lesion nature was calculated using Cohen's kappa (k).

RESULTS

25 patients had at least one malignant NET lesion. 68Ga-DOTATOC PET/MRI and 68Ga-DOTATOC PET/CT each correctly identified 96% of these patients. On a per-lesion basis the sensitivity, specificity, PPV, NPV, and diagnostic accuracy of 68Ga-DOTATOC PET/MRI was 90.0%, 100%, 100%, 80%, and 92.9%, respectively. Corresponding values for 68Ga-DOTATOC PET/CT were 86.6%, 98.2%, 99.2%, 74.0%, and 89.8%. The differences between both modalities in terms of diagnostic performance were not statistically significant ($p=0.38$). Moreover, SUVmax was strongly correlated ($r=0.86$; $p<0.001$) and did not differ significantly ($p=0.35$). Lesion conspicuity was better with 68Ga-DOTATOC PET/MRI ($p<0.01$). Interobserver agreement on lesion nature was substantial with 68Ga-DOTATOC PET/CT ($k=0.87$; $p<0.001$) and with 68Ga-DOTATOC PET/MRI ($k=0.90$; $p<0.001$).

CONCLUSION

68Ga-DOTATOC PET/MRI provides an equivalently high diagnostic performance in whole-body staging of NETs as compared with 68Ga-DOTATOC PET/CT.

CLINICAL RELEVANCE/APPLICATION

Bearing in mind the lower radiation exposure and improved scan duration 68Ga-DOTATOC PET/MRI applying a fast imaging protocol seems to be a viable alternative to 68Ga-DOTATOC PET/CT for whole-body staging of NETs.

SSC10-03 Prediction of Posthepatectomy Liver Failure Proposed by The International Study Group of Liver Surgery Using Residual Liver Function Estimation with 99mTc-GSA Scintigraphy

Monday, Nov. 28 10:50AM - 11:00AM Room: S505AB

Participants
Youichi Mizutani, Miyazaki, Japan (*Presenter*) Nothing to Disclose
Shigeki Nagamachi, MD, PhD, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Tamasa Terada, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Mei Shimomura, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Youhei Hattori, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Masatsugu Kawano, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshinori Hirai, MD, PhD, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The International Study Group of Liver Surgery (ISGLS) proposed a definition and grading system based on the severity of posthepatectomy liver failure (PHLF). We aimed to evaluate the usefulness of residual liver function estimation with Tc-99m-galactosyl human serum albumin (99mTc-GSA) for the prediction of PHLF proposed by ISGLS (PHLF-ISGLS).

METHOD AND MATERIALS

136 patients scheduled hepatectomy for liver tumors underwent 99mTc-GSA scintigraphy. From the acquired image data, maximal removal rate of GSA(GSA R-max)was calculated using multi-compartmental analysis. We also calculated the GSA R-max in the predicted residual liver (GSA-RL). Residual liver volume was calculated by conventional CT. PHLF-ISGLS was defined by an increased PT-INR (≧1.2) and concomitant hyperbilirubinemia (≧1.2mg/dl) on postoperative day 5. In PHLF and non-PHLF groups, we compared the following parameters: age, gender, ICG R15, albumin, bilirubin, hyaluronic acid, type4 collagen, Child-Pugh classification, Residual liver volume, residual liver percentage, GSA R-max and GSA-RL. Univariate and multivariate logistic analyses were used for the statistical assessment.

RESULTS

Of 136 patients, 17 met the criteria of PHLF-ISGLS. With regard to age, albumin, Child-Pugh classification, residual liver volume, residual liver percentage, GSA R-max and GSA-RL, there were statistically significant differences between PHLF and non-PHLF groups. Multivariate analysis revealed that GSA-RL and residual liver volume were significant independent predictors of PHLF ($P = 0.004$ and $P = 0.038$, respectively). The odd ratio was 149423 for GSA-RL and 1.003 for residual liver volume.

CONCLUSION

GSA-RL calculated by 99mTc-GSA scintigraphy was the most useful independent predictor of PHLF-ISGLS.

CLINICAL RELEVANCE/APPLICATION

In patients scheduled hepatectomy for liver tumors, GSA-RL is useful for the prediction of residual liver function.

SSC10-04 Added Value of SPECT-CT to Standard Dynamic Imaging in Abdominal Emergencies

Monday, Nov. 28 11:00AM - 11:10AM Room: S505AB

Participants
Elham Safaie, MD, Stony Brook, NY (*Presenter*) Nothing to Disclose
Kavitha Yaddanapudi, DMRD, MBBS, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

George C. Angelos, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Robert Matthews, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the added value of SPECT-CT acquisition to traditional nuclear medicine blood flow and dynamic images in gastrointestinal (GI) and genitourinary (GU) emergencies.

METHOD AND MATERIALS

We retrospectively evaluated 23 consecutive abdominal emergency studies wit SPECT CT between July 2013-March 2016. Studies included RBC bleeding, hepatobiliary scan, Meckel's study, and DTPA renal scan. All patients had initial dynamic imaging followed by SPECT-CT. Six patients with equivocal bleeding studies had SPECT-CT obtained to localize bleeding. Of these one study was performed to confirm a suspect Meckel's diverticulum. There were 14 hepatobiliary studies for bile leak evaluation (n=9), biliary atresia (n=3), and cholecystitis (n=2). One SPECT-CT was performed for determining urinary leak in a renal transplant patient.

RESULTS

All 23 patients had inconclusive standard dynamic studies. SPECT/CT was performed at the end of dynamic imaging being helpful in 95.6 % of the studies. We were able to accurately identify the regional anatomy and source of GI bleed in all 6 cases using SPECT-CT with 2 large bowel and 4 small bowel. One study the patient had both small bowel and peritoneal bleed at surgery. Three of these patients had multiple prior inconclusive dynamic studies before SPECT-CT. Meckel's diverticulum study remained inconclusive after SPECT-CT. In the 14 hepatobiliary studies, SPECT-CT localized 9 biliary leaks, confirmed biliary atresia in 3, and excluded cholecystitis in 2 by identifying the gall bladder. For the renal transplant patient, SPECT/CT was able to identify precise localization of urinary leak. The average added scan time ranged between 20-30 minutes.

CONCLUSION

Our findings demonstrated that adding SPECT-CT to standard GI and GU dynamic imaging supplements conventional imaging in equivocal patients for anatomic localization and subsequent intervention. In RBC studies, accurate anatomical localization of small bowel versus large bowel bleeding significantly alters patient management. The added scan time is reasonable even in emergency setting.

CLINICAL RELEVANCE/APPLICATION

SPECT-CT added to traditional dynamic imaging emergency studies can lead to accurate diagnosis in a reasonable time frame.

SSC10-05 A Novel Technique to Measure Strength of Abnormality on GI Bleeding Scans: Development, Initial Implementation, and Correlation with Conventional Angiography

Monday, Nov. 28 11:10AM - 11:20AM Room: S505AB

Participants
Rami Farhat, DO, Secaucus, NJ (*Presenter*) Nothing to Disclose
Travis French, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Esther E. Coronel, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Dov Bechhofer, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Anca Kranz, 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

PURPOSE

To develop a tool to measure the relative strength of bleeding on nuclear medicine GI bleeding scans, correlate this with conventional angiographic findings, and determine the predictive value of this tool.

METHOD AND MATERIALS

A single institution nuclear medicine database query of GI bleeding scans performed between January 1, 2013 and December 31, 2015 was performed. The reports from all studies were reviewed, and the imaging from all positive studies was reviewed. A novel technique was developed and utilized to analyze the scans, which allowed for calculation of percent increase of activity in the region of interest/ROI (area of positive bleeding) while also calculating activity in ROI in the aorta and liver (controls). Interventional radiology database was then queried to determine which patients with positive findings on scintigraphy underwent angiography, and which cases had positive angiographic findings. Data analysis was performed by two radiology attendings and two residents, to determine median percent increases in ROI in patients with positive scintigraphy and positive angiography, versus those who had positive scintigraphy and negative angiography.

RESULTS

Out of 194 nuclear medicine GI bleeding scans performed during the study period, 71 were positive for active lower GI hemorrhage. Out of these cases, 37 patients were then sent for conventional angiography. Nine patients had positive angiographic findings of active contrast extravasation that correlated with the site of bleeding on scintigraphy. The median ROI percent increase for patients with positive scintigraphy and positive angiography was 50%, while for patients with positive scintigraphy but negative angiography it was 26.8%. Data analysis suggests that a positive bleeding scan with ROI percent increase of less than 20% has predictive value that conventional angiography will be negative.

CONCLUSION

Utilizing software to determine percent increase in activity within the region of interest of active GI bleeding on scintigraphy can have predictive value in determining which patients likely will not benefit from diagnostic conventional angiography.

CLINICAL RELEVANCE/APPLICATION

Positive GI bleeding nuclear medicine scans that have percent increase in radiotracer uptake of less than 20% have predictive value in that these patients are unlikely to have positive findings on angiography, thus cannot be embolized.

SSC10-06 A Simple Ratiometric Method Allows Discriminating Benign From Malignant In-111 Pentetreotide

(OctreoScan) Uptake in the Pancreatic Head

Monday, Nov. 28 11:20AM - 11:30AM Room: S505AB

Awards
Student Travel Stipend Award

Participants
Jamal J. Derakhshan, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Michael D. Farwell, MD, MA, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

High-throughput immunohistochemistry has shown large variation in expression of somatostatin receptors in the normal human pancreas. Recent gallium-labeled PET studies have shown a high prevalence of "pathologic" octreotide uptake, which is usually benign. The costs and morbidity of mistaken Whipple procedures are inordinate. The study was conducted to determine the prevalence of In-111 pentetreotide (OctreoScan) uptake in SPECT scans of the pancreas and determine whether a simple ratiometric method could differentiate benign from malignant uptake.

METHOD AND MATERIALS

A retrospective review of all In-111 pentetreotide studies performed at a large academic medical center was performed over 1 year time interval. The uptake of octreotide (abdominal SPECT 4 hrs and chest 24 hrs post injection of 222 MBq) was visually graded as absent, mild or definite. In the cases of uptake, a ratio between the maximal uptake in the pancreas versus mean in the liver was obtained. A two-sided Student's T-test was performed between uptake in patients with and without known pancreatic head masses. The sensitivity and specificity of a threshold was determined.

RESULTS

There were a total of 359 pentetreotide studies interpreted. 147 studies were excluded, most since they did not include the pancreatic head. 138 patients were included (ages 22-94). No pancreatic head uptake was observed in 79% of studies (168/212). 12 (6%) studies had faint visual uptake while 32 (15%) had definite uptake. 11 studies were performed in 7 patients with known pancreatic masses, all of which demonstrated definite uptake. The average uptake ratio in known masses was 7.5±6.2 and 0.9±0.3 in patients without a known mass (p=0.005). Using a threshold ratio of 1.8, 100% sensitivity and specificity was achieved for determining the presence of a pancreatic head mass.

CONCLUSION

Pentetreotide uptake in the pancreatic head is common (21% of studies) and usually benign (75% of cases with uptake). All patients with known pancreatic head mass had definite uptake visually. Using a lesion to liver ratio of ≥ 1.8, 100% accuracy was obtained for determining the presence of a pancreatic head mass.

CLINICAL RELEVANCE/APPLICATION

A simple ratiometric method can differentiate malignant and benign pancreatic head pentetreotide uptake, alleviating unnecessary work-up and surgeries of patients with visual pancreatic head uptake.

SSC10-08 Prognostic Value of F-18 Fluorodeoxyglucose Positron Emissiontomography/computed Tomography in Patients with Barcelona Clinic Liver Cancer Stages C Hepatocellular Carcinomas: A Multicenter Retrospective Cohort Study

Monday, Nov. 28 11:40AM - 11:50AM Room: S505AB

Participants
Jin Kyoung Oh, Incheon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sae Jung Na, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong Won Lee, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong An Chung, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Mijin Yun, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung-Hyup Hyun, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Il Ki Hong, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We evaluated the prognostic value of pretreatment F-18 flurodeoxyglucose positron emission tomography/computed tomography (F-18 FDG PET/CT) in Barcelona Clinic Liver Cancer (BCLC) stage C hepatocellular carcinoma (HCC) patients according to distant metastasis.

METHOD AND MATERIALS

A total of 293 patients with BCLC stage C HCC between 2009 and 2010 who underwent staging F-18 FDG PET/CT before treatments were retrospectively enrolled from 7 university hospitals. Tumor-to-normal liver standardized uptake value ratio (TNR) of the primary tumor was measured by pretreatment F-18 FDG PET/CT. TLR and clinical variables were analyzed with respect to overall survival (OS).

RESULTS

In BCLC stage C HCC patients, higher TLR was associated with extrahepatic metastasis (p=0.023). On multivariate analysis, Child-Pugh classification, PIVKA- II, and TLR were independent prognostic factors in no distant metastasis group (p<0.05). In contrast, TLR was the only independent prognostic factor in metastasis group (<0.001). Patients with high F-18 FDG uptake (TLR≥ 3.5) showed significantly worse prognosis than those with low F-18 FDG uptake (p<0.05).

CONCLUSION

BCLC stage C is a heterogeneous group with different prognostic factors according to distant metastasis. TLR is an independent prognostic factor regardless of distant metastasis.

CLINICAL RELEVANCE/APPLICATION

F-18 FDG PET/CT can predict survival of patients with Barcelona Clinic Liver Cancer stages C hepatocellular carcinomas

SSC10-09 18F-FDG PET-CT in Detection of Malignancy in Cases Paraneoplastic Syndrome

Monday, Nov. 28 11:50AM - 12:00PM Room: S505AB

Participants
Khushboo Gupta, MD, Mumbai, India (*Presenter*) Nothing to Disclose
Rahul B. Jadhav, MD, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Paraneoplastic syndrome (PNS) is a group of rare disorders that are caused by altered immune system response to a neoplasm (mostly neurological). In such cases early identification of underlying malignancy is targeted to arrest the immune mediated neurological manifestation and install early treatment. With advent of 18F-FDG PET-CT, the detection efficiency of primary malignant lesions have improved. We therefore studied the role of FDG PET-CT in investigation of PNS.

METHOD AND MATERIALS

44 patients (19 females and 25 males) with suspected PNS underwent FDG PET-CT scan at our institution. Scan was performed 1 hr after administration of 10 mCi of 18F-FDG along with 16 slice CECT. Based on the scan results, biopsy was performed in cases with suspected lesions, while other cases were followed up clinically.

RESULTS

FDG PET-CT scan was positive for metabolically active lesions in 36/44 patients. Suspicious malignant lesions were noted in 12/36 patients. Biopsy was performed and primary malignancy was detected in 8/12 patients (commonest was SCLC, followed by lymphoma). Infective etiology was indicated in 16/36 patients, of which 11 patients were biopsied; results revealed granulomatous disease in 9 patients and reactive nodes in 2 patients. In other 3/36 patients, PET-CT demonstrated reactive nodes. Remaining 5/36 patients were equivocal for malignancy and/or infection, biopsy of 2 of these 5 patients revealed infective etiology. Overall no biopsy was performed in 19/44 cases, which were followed up clinically (for 410 to 518 days). No malignancy was found in this group in due course.

CONCLUSION

In present study, FDG PET-CT detected primary malignancy in 22.2% cases. In other suspected cases of paraneoplastic syndromes it showed a high efficiency in ruling out the possibility of malignancy.

CLINICAL RELEVANCE/APPLICATION

PET/CT scan has proven its efficiency over other imaging modalities in detection of primary malignancies. Hence its use is justified in ruling out malignancies in suspected cases of paraneoplastic syndromes.

SSC11

Neuroradiology (Advances in Brain Imaging)

Monday, Nov. 28 10:30AM - 12:00PM Room: N226

NR MR

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

Participants
Max Wintermark, MD, Lausanne, Switzerland (*Moderator*) Advisory Board, General Electric Company;
Laurie A. Loevner, MD, Gladwyne, PA (*Moderator*) Nothing to Disclose

Sub-Events

SSC11-01 Predicting Response of Low-Grade Gliomas to Therapy from MR Images using Convolutional Neural Networks

Monday, Nov. 28 10:30AM - 10:40AM Room: N226

Awards
Student Travel Stipend Award

Participants
Zeynettin Akkus, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Issa Ali, BS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jay P. Agrawal, MD, East Meadow, NY (*Abstract Co-Author*) Nothing to Disclose
Jiri Sedlar, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD, Rochester, MN (*Abstract Co-Author*) Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC; Stockholder, FlowSigma

PURPOSE

Previous studies have shown that 1p/19q codeletion is a strong prognostic molecular marker for positive tumor response to chemotherapy and radiotherapy in low-grade gliomas (LGGs). Therefore, predicting 1p/19q status is crucial for effective treatment planning of LGGs. Presently, determining 1p/19q status requires surgical biopsy followed by histopathological analysis. We provide an alternative, noninvasive method to predict the 1p/19q status of LGGs from MR images using convolutional neural networks (CNNs).

METHOD AND MATERIALS

First, we registered postcontrast T1 (T1C) images to T2 images. Next, we segmented tumors from 3 consecutive 2D slices that contained the largest amount of tumor and centered each in a standard bounding box (125x175 pixels) to maintain consistency. A binary morphological dilation was applied to include tumor boundaries. The dataset was then divided into training, validation, and test sets. The training data was balanced for equal class probability and then augmented with 50 iterations of random translational shift, rotation, and horizontal and vertical flips to increase the size of the training set. We shuffled the training data to counter overfitting and provided generalization in each epoch (an iteration over all examples). Finally, we trained a 3-layer CNN architecture until training and validation accuracies become consistent (<1% difference) with at least 250 epochs and then evaluated its performance on the test set.

RESULTS

We evaluated a total of 75 LGG patients with 3 image slices each (n=225) who had biopsy-proven 1p/19q status (48 nondeleted and 27 codeleted) and preoperative T1C and T2 images. The accuracies of predicting 1p/19q status in training (n=6120 slices augmented from 120 original samples) and validation (n=20% of training) were 90.30% and 89.79%, respectively. CNN performance on an unseen test set (n=42) demonstrated 88.09% accuracy.

CONCLUSION

CNNs, which learn a hierarchy of complex features directly from raw image data with their self-learning ability, provide promising results for predicting 1p/19q status noninvasively based on preoperative T1C and T2 images.

CLINICAL RELEVANCE/APPLICATION

Predicting 1p/19q status noninvasively from MR images would allow selecting effective treatment strategies for LGG patients without the need for surgical biopsy, thus reducing morbidity and mortality.

SSC11-02 Amide Proton Transfer (APT) Imaging in Patients with Acute Cerebral Infarction: Different Manifestation According to Locations

Monday, Nov. 28 10:40AM - 10:50AM Room: N226

Participants
Xiaojie Luo, MD, Beijing, China (*Presenter*) Nothing to Disclose
Chen Zhang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Min Chen, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jinyuan Zhou, PhD, Baltimore, MD (*Abstract Co-Author*) License agreement, Koninklijke Philips NV

PURPOSE

To depict image manifestations of Proton Transfer Amide (APT) imaging in patients with acute ischemic stroke accroding to different loacations in the brain, and to discuss its clinical practicability.

METHOD AND MATERIALS

Emergency admitted patients, with acute ischemic stroke from our hospital, were recruited from March to November 2015. Eventually, 100 patients (F=26, M=74, average age=72 years, symptom onset ≤24 hours) were included in this study. All patients underwent MR scanning on the brain at 3.0 Tesla. Besides the conventional scans for stroke, the APT sequence (saturation time 0.8s, saturation power 2μT) was performed. All the patients were confirmed hyperintesive infarction area in DWI first, and then performed the APT sequences.APT weighted images were calculated using magnetization transfer ratio asymmetry at 3.5ppm with respect to water. The image signals in APTw were compared with those in DWI to caculate the sensity and specificity.

RESULTS

20 cases with large cerebral infarction are were confirmed in APTw, and the positive rate was 100%. There were only 37 in 60 cases with small cerebral infarction were decipted clearly in APTw, and the positive rate was only 61.7%.The rest 20 cases were infarctions within brainstem or cerebellum. 5 cases were detected in APTw, with the possitive rate of 25%.

CONCLUSION

APTw can be used to depict acute ischemic stroke, but it is still a novel tool need improving.

CLINICAL RELEVANCE/APPLICATION

The ability of detecting infarction in APTw depends on the areas in the brain, with large infarction 100% possitive, small sized and brainstem/cerebellum 61.7% and 25%, respectively.

SSC11-03 Clinical Applicability of MRI-Intracranial Pressure Measurements in Spontaneous Intracranial Hypotension

Monday, Nov. 28 10:50AM - 11:00AM Room: N226

Participants
Yi-Hsin Tsai, Taichung, Taiwan (*Presenter*) Nothing to Disclose
Hung-Chieh Chen, MD, Taichung, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Jyh-Wen Chai, MD, PhD, Taichung, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Clayton Chi-Chang Chen, Taichung, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Wu-Chung Shen, MD, Taichung, Taiwan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the clinical feasibility of MR-intracranial pressure (MRI-ICP) measurement for non-invasive assessment of spontaneous intracranial hypotension (SIH).

METHOD AND MATERIALS

Ten healthy volunteers and 14 patients with typical orthostatic headache and clinically suspected SIH were recruited in this experiment. Our MR-ICP protocol included three retrospective ECG-gated cine phase-contrast sequences for measuring (1) blood flows of bilateral internal carotid arteries (ICA) and internal jugular veins (IJV) at the level below the foramen magnum, (2) vertebral arteries (VA) at C2-3 and (3) fluctuating CSF flow at mid-C2. The scan time was about 1 minute and 30 sec for each sequence. Each subject had three repeated protocols in succession. Time-varying intracranial volume change (ICVC), pressure gradient (PG), intracranical elastance (IE) were calculated following the method described in the literature. In addition, follow-up measurements were performed on 6 SIH patients after their symptoms were resolved.

RESULTS

The results showed significantly decreased hemodynamic and hydrodynamic activities in 9 SIH patients, with typical changes in morphological MRI, including flows of ICA, IJV, CSF, and ICVC, PG ($p<0.05$). There was no significant difference of the parameters between the normal subjects and other 5 patients with orthopedic headache but no typical MRI features of SIH. Moreover, the parameters of IJV, CSF flow, ICVC and PG were significantly increased in the 9 MRI-typical SIH patients in their remission stage, as compared with the time of initial clinical manifestation. Overall, IE was the only index which did not show significant difference in any of these groups.

CONCLUSION

Our study indicated that MR-ICP was an excellent non-invasive method for monitoring the intracranial hemo/hydrodynamics, with most of the measured parameters, including flows of IJV, CSF, ICVC, and PG, all of which showing significant difference between all three groups. With a total imaging time of approximtely 15 minutes, this MR technique may potentially be useful for differentiating typical SIH with other diagnoses, or longitudinal follow-up in such patients.

CLINICAL RELEVANCE/APPLICATION

MRI-ICP method is non-invasive and time-efficient for differential diagnosis and longitudinal follow up of SIH.

SSC11-04 Role of Cerebrospinal Fluid in Spaceflight-Induced Visual Impairment and Ocular Changes

Monday, Nov. 28 11:00AM - 11:10AM Room: N226

Participants
Noam Alperin, PhD, Miami, FL (*Presenter*) Nothing to Disclose
Ahmet M. Bagci, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Sang H. Lee, MS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Byron Lam, Miami, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ocular and vision changes know as visual impairment intracranial pressure (VIIP) syndrome have been reported in nearly two thirds of long-duration mission International Space Station (ISS) astronauts. These changes are currently attributed to cephalad vascular fluid shift induced by exposure to microgravity. This study assesses ocular shape and CSF volume changes related to spaceflight to determine the underline cause for these changes.

METHOD AND MATERIALS

High resolution orbit and brain MRI scans before and shortly after spaceflights for 7 long-duration mission ISS astronauts and 9 short-duration mission Space Shuttle astronauts were analytically measured and compared. Postflight increases in globe flattening and nerve protrusion were tested for association with increases in intra-orbital CSF volume, ventricular CSF volume, and brain tissue interstitial fluid volume.

RESULTS

Compared to short-duration astronauts, long-duration astronauts had significantly greater post-flight increases in globe flattening indices ($p<0.00001$) and optic nerve protrusion indices ($p<0.00001$). Long-duration astronauts also had significantly greater postflight increases in orbital CSF volume ($p=0.005$) and ventricular CSF volume ($p=0.048$). There were no significant post-flight changes of grey matter volume or white matter volume in either group. The large post spaceflight ocular changes observed is ISS crewmembers were associated with greater increases in intraorbital and intracranial CSF volume but not with interstitial brain tissue fluid volume.

CONCLUSION

The strong positive relationships between globe deformations and CSF volumes increase without changes in brain volumes indicate CSF has a direct role in spaceflight induced ocular changes. Vascular fluid shift has a lessor role than CSF in microgravity diced visual impairments and ocular changes syndrome.

CLINICAL RELEVANCE/APPLICATION

This study elucidate the previously unexplored role of the CSF in the formation of space-induced visual impairments. Identifying the origin for the space-induced ocular changes is necessary for the development of countermeasure to protect the crew from the ill effects of long-duration exposure to microgravity.

SSC11-06 Redefining Brain PET Imaging with Digital PET in Ultra High Definition Reconstruction and Ultra Fast Acquisition

Monday, Nov. 28 11:20AM - 11:30AM Room: N226

Participants
Jun Zhang, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Rahul Revan, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Douglas W. Scharre, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Chi-Hua Tung, Cleveland, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To improve the quality of brain PET imaging with ultra high definition (UHD) reconstruction and/or ultra fast acquisition enabled by next generation digital PET.

METHOD AND MATERIALS

10 oncology patients consented while performing an investigational brain dPET imaging on a solid state, digital photon counting PET/CT system (Vereos) before or after their standard of care clinical PET scans (13.1±0.4mCi FDG; 75±5min uptake time). Brain PET was acquired in 1-bed field-of-view with ultra-short time of 90sec. Images were reconstructed using ultra-high definition (UHD) (1mm3 voxel) using 3D OSEM with integrated time-of-flight and point spread function (PSF) enabled. Conventional PET data sets were performed on conventional PET/CT systems (using local standard of care protocols (10min acquisition and 2mm reconstruction) and compared using quantitative and blinded reader reviews. Multiple phantom comparisons using the Jaszczak, micro-J and Hoffman phantom were performed.

RESULTS

The phantom experiments consistently revealed improved quantitative accuracy for dPET compared to the conventional PET approach ($p<0.01$). 4mm micro-rods were clearly identified on UHD dPET. Even when we reduced the acquisition time of brain PET from the current standard of care 10min to ultra-short 90s, we found preferable anatomic details in all brain regions. Detailed listmode analysis found that motion was consistently substantially reduced in the faster acquisition. Applying PSF on 2mm and 1mm dPET with 325ps TOF timing resolution improved image resolution about >10% and contrast (>15%). While noises appear to be more noticeable on 2mm and 1mm PET images, reconstruction optimization successfully suppressed noise and maintained about 20% improvement SNR.

CONCLUSION

The quality and quantitative accuracy of Neuro PET imaging was significantly improved when we used ultra-high definition reconstruction using the next generation dPET technology. Furthermore, shorter acquisition times were achievable which improved visualization of anatomic detail due to reduction of motion. Digital PET promises considerable improvement for neuro PET with more precise visualization and quantification.

CLINICAL RELEVANCE/APPLICATION

Neuro PET image quality was substantially improved using ultra-high definition reconstruction and ultra fast acquisition when using next generation digital PET.

SSC11-07 Cerebral Sodium (23Na) Imaging in Patients with Migraine

Monday, Nov. 28 11:30AM - 11:40AM Room: N226

Awards
Student Travel Stipend Award

Participants

Melissa Ong, MD, Mannheim, Germany (*Presenter*) Nothing to Disclose
Alexander Schmidt, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
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Daniel Hausmann, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Lothar R. Schad, PhD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim , Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Stefan Haneder, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluation of 23Na-concentrations in subgroups of patients with clinically manifest migraine.

METHOD AND MATERIALS

In this prospective, IRB-approved study we recruited 12 patients (all female; mean age 34±11 years) who have been clinically evaluated for migraine and who have filled out a questionnaire regarding onset of disease, length, intensity (scale 1-10) and frequency of attacks and accompanying aura. The patients underwent a cerebral 23Na-magnetic resonance imaging examination at 3.0T (TimTrio, Siemens Healthcare Sector). For each scan a non-contrast enhanced T1w MP-RAGE sequence for anatomical referencing and a 3D-density-adapted, radial gradient echo (GRE-) sequence for 23Na-imaging were acquired using a dual-tuned (23Na/1H), dedicated head-coil. 23Na-sequences were reconstructed according to the MP-RAGE, allowing direct cross-referencing of regions-of-interest (ROI). Circular ROIs were placed in predetermined anatomic regions: cerebrospinal fluid (CSF), grey and white matter (GM/WM), brain stem and cerebellum. External 23Na reference phantoms doped with 5% and 2% agar gel with a sodium concentration of 154 millimoles and 50 millimoles were used to calculate the 23Na tissue concentrations. Kendall Tau and Wilcoxon rank sum test were used for statistical analysis.

RESULTS

Overall 23Na concentrations of all patients (in millimoles per liter) averaged 35.2±3.7, 40.85±2.9, 81.3±7.6, 86.9±6.2 and 32.8±3.8 and 33.4±2.8 for WM, GM, anterior and posterior CSF, brainstem and cerebellum, respectively. Significant differences in 23Na concentrations could be observed for the WM and anterior CSF in patients with and without accompanying aura ($p<0.05$). Moderate to good correlation was observed between time interval to last attack and anterior CSF and disease onset with 23Na concentrations in GM, posterior CSF, brain stem and cerebellum ($r \geq 0.4$). Furthermore, pain intensity and 23Na concentrations in GM, CSF and brainstem showed a moderate correlation ($r = 0.4$-0.5).

CONCLUSION

Cerebral 23Na imaging may have the potential to differentiate between different subgroups of migraine, and may reveal information about intraindividual pain intensity.

CLINICAL RELEVANCE/APPLICATION

Knowledge of the distribution of 23Na concentrations in brain structures for different subgroups of migraine may potentially provide a more objective clinical evaluation tool.

SSC11-08 Multinuclear MRI Evidence of Altered Callosal Sodium after Mild Traumatic Brain Injury

Monday, Nov. 28 11:40AM - 11:50AM Room: N226

Participants
Hemal Grover, New York, NY (*Presenter*) Nothing to Disclose
Fernando E Boada, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yongxian Qian, New York, NY (*Abstract Co-Author*) Founder, General Labs Cloud, LLC
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Steven Flanagan, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yvonne W. Lui, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Karthik Lakshmanan, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jacqueline Smith, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Metabolic derangements are known to occur after Traumatic Brain Injury(TBI): animal models point to initial Na+ influx causing membrane depolarization. White matter, notably the corpus callosum (CC) is particularly susceptible to damage. The purpose of this study is to compare distribution of Total Sodium Concentration(TSC) in the corpus callosum between patients of mild TBI and controls using sodium MRI.

METHOD AND MATERIALS

Seven patients(3 M;4 F, 20-52yrs)with history of mild TBI and six healthy controls were studied. Sodium MRI scans were performed on Siemens Prisma 3T scanner using custom 8 channel dual-tuned(1H-23Na) transmit/receive (Tx/Rx) head coil. Twisted projection imaging(TPI) sequence was used(FOV=220mm,matrix size=64,TE/TR=0.3/100ms,FA=90, TA=10.3min).Sodium MR images were visually inspected in conjunction with structural proton MPRAGE. TSC was measured in the genu, body and splenium with 5mm regions of interest (ROI).To assess for reproducibility, five measurements were independently taken within each area. ROIs were placed via 2 reviewer consensus. Comparison was done between cohorts with significance level of 0.05. To assess distribution of TSC along the CC in an anterior-posterior dimension, TSC genu to splenium (genu/spl) ratio was calculated.

RESULTS

TSC was higher in the genu (51.59 vs 45.6 mmol, p=0.049) and lower in the splenium (50.80 vs 41.88 mmol, p=0.01) in mTBI patients compared to controls. Genu/spl ratio was also higher in patients (1.2 vs 0.9, p=0.001) and on visual inspection, mTBI subjects demonstrated a reversal of the normal TSC anterior to posterior gradient in the CC compared with controls (Fig.1).

CONCLUSION

TSC distribution in the CC is altered after mTBI. Since changes in extracellular Na+ concentration are known to be transient after

brain injury, detected alterations in TSC are believed to be attributable to changes in intracellular Na+ concentration. Our work supports the notion of ongoing Na+ channelopathy after injury affecting callosal white matter, such as perturbed expression of sodium channels.

CLINICAL RELEVANCE/APPLICATION

Altered total sodium concentration reflects ongoing Na+ channelopathy in mild TBI,supporting further exploration of this mechanistic area in potential therapy development using sodium channel blockers

SSC11-09 Temporary Vestibular Effects of a 7 Tesla Brain MRI-Postural Measurements

Monday, Nov. 28 11:50AM - 12:00PM Room: N226

Participants
Jens M. Theysohn, MD, Essen, Germany (*Presenter*) Nothing to Disclose
Oliver Kraff, MSc, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Susanne C. Ladd, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Mark E. Ladd, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Bitz, MSC, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ultra-high-field MRI at 7 Tesla (T) elicits more transient side-effects compared to 1.5 T and 3 T, e.g. dizziness even after exiting the scanner. We aimed to generate quantitative measures for vestibular performance before and after exposure to different MRI scenarios at 7 T and 1.5 T.

METHOD AND MATERIALS

Twenty healthy volunteers (5m/5w < 30y, 5m/5w > 50y; mean age 41.0 years) underwent a Romberg's test and an Unterberger's stepping test before, 2 min after and 15 min after different 7T MRI exposure scenarios and one 1.5T scenario. Thirty-minute-exposures at both field strengths with deactivated RF coil were analyzed, as well as a 7T scenario with deactivated RF and deactivated gradient coils. Furthermore a 7T exposure of 1 minute with movement into the magnet and back out without waiting was tested. An ultrasound real-time measuring system recorded the 3D positions during 30s of one transmitter fixated to the lumbar spine (sway path length) and two shoulder transmitters (rotation). Data were compared for gender, age group, different time points, MR settings, and eyes open or closed.

RESULTS

Lumbar sway paths as well as shoulder rotations show significant changes for all long-lasting 7T scenarios with eyes closed 2 minutes after exiting the scanner. All sway path lengths normalized after 15 minutes while misrotations normalized partially. Changes after brief 7T exposure could only be seen in the stepping test. Subgroup analysis of age and gender revealed somewhat stronger sway path increase and misrotation for older volunteers at 2 minutes post 30 minutes 7T exposure. Changes after brief 7T exposure in the stepping test had a significantly larger effect in the older group. At 1.5T no significant effects were measurable.

CONCLUSION

Exposure to the static magnetic 7 Tesla field causes only a temporary dysfunction or "over-compensation" of the vestibular system not measurable at 1.5 Tesla. Older people seem more likely to show functional alterations. The Unterberger stepping test is more sensitive in detecting vestibular disturbances than the Romberg's test.

CLINICAL RELEVANCE/APPLICATION

The Unterberger stepping test is a sensitive tool to measure vestibular disturbance after a 7 Tesla exposure. It can be used to further study effects of magnetic field exposure on humans.

SSC12

Neuroradiology (White Matter Diseases)

Monday, Nov. 28 10:30AM - 12:00PM Room: N229

NR MR

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

Participants
Leo J. Wolansky, MD, Cleveland, OH (*Moderator*) Nothing to Disclose
Gaurang V. Shah, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SSC12-01 White Matter Structure Revealed by Correlation-Time Diffusion Synthetic MRI: Age Effects

Monday, Nov. 28 10:30AM - 10:40AM Room: N229

Participants
Hernan Jara, PhD, Belmont, MA (*Abstract Co-Author*) Patent holder, qMRI algorithms; Research Grant, General Electric Company; Royalties, World Scientific Publishing Co; ; ;
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Royalties, Reed Elsevier
Osamu Sakai, MD, PhD, Boston, MA (*Presenter*) Consultant, Guerbet SA

PURPOSE

The National Institutes of Health Blueprint for Neuroscience Research Human Connectome Project is in the process of mapping the connections of the adult human brain as completely as possible using diffusion tractography, functional MRI, magnetoencephalography, electroencephalography and genetics. Correlation-time diffusion (DCT) qMRI probes the diffusional motion of water in tissue at the picosecond time scale. Because DCT mapping does not use Stejskal-Tanner diffusion encoding, it is much less sensitive to motion artifacts and does have its stringent spatial resolution limitations. The purpose of this work was to study the microstructure of white matter in vivo with high spatial resolution Synthetic DCT-weighted MRI in ten patients.

METHOD AND MATERIALS

HIPAA compliant prospective study approved by the local IRB. Ten subjects (0.6-87years) were scanned at 1.5 T MR imaging system (Philips Healthcare, Best, The Netherlands). Mixed turbo spin echo is a multislice 2D pulse sequence that combines the principles of T1-weighting by inversion recovery and T2-weighting by multi-echo sampling into a single mixed MRI acquisition. Image processing was done with algorithms programed in Mathcad (2001i, PTC, Needham, MA) and in two stages, first with qMRI algorithms to generate the PD, T1, T2, and DCT maps and second, with a contrast synthesizer to generate DCT-weighted contrast series; b-value range of 0-20,000s/mm2.

RESULTS

Selected synthetic DCT-weighted images in the range from b=0-15,000s/mm2 are shown in Fig. for a 0.6yo male, 1.6yo male, 4yo male, and 17yo female. An irregular "cobblestone" texture develops in white matter at b-values greater than 3,000s/mm2; this texture becomes more accentuated as a function of increasing diffusion weighting and age. Upon white matter segmentation, we were able to construct a 3D rendering of the full connectional neuroanatomy of the brain without need for place seeds (Fig: right panel).

CONCLUSION

Rendering accurately the microarchitecture of white matter with diffusion tensor MRI is challenging.The report herein adds DCT mapping and Synthetic-MRI as accurate and promising tools for building the brain connectome.

CLINICAL RELEVANCE/APPLICATION

DCT-weighted synthetic MRI and MR Fibrography offer a unique window into the microstructure of white matter using standard clinical scanners and could be useful for assessing brain development, neurodegenerative diseases, and for building the connectome.

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/

Osamu Sakai, MD, PhD - 2013 Honored Educator
Osamu Sakai, MD, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2015 Honored Educator
Hernan Jara, PhD - 2014 Honored Educator
Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

SSC12-02 Utility of Multi-Parametric Quantitative MRI Model that Assesses Myelin and Edema for Evaluating Plaques, Periplaque White Matter, and Normal Appearing White Matter in Patients with Multiple Sclerosis

Monday, Nov. 28 10:40AM - 10:50AM Room: N229

Participants
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Misaki Nakazawa, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigeki Aoki, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

R1, R2, and proton density (PD) can be calculated from a single quantification pulse sequence. Furthermore, the myelin partial volume (VMY) and

excess parenchymal water volume (VEPW) can also be estimated from R1, R2, and PD, to indicate the quantities of myelin and edema, respectively. The aim of this study was to evaluate this multi-parametric quantitative MRI model for characterizing plaques, periplaque white matter (PWM), and normal-appearing white matter (NAWM) in patients with multiple sclerosis (MS).

METHOD AND MATERIALS

We examined 3.0-T quantitative MRI data from 21 MS patients. Quantitative MRI was performed by using the two-dimensional axial QRAPMASTER pulse sequence. This pulse sequence is a multi-slice, multi-echo, multi-saturation delay method of saturation recovery acquisition by turbo spin-echo readout, with which images are obtained by different combinations of echo time (TE) and saturation delay time (TD). In this study, two sets of TE values and four sets of TD values were used to generate eight real images and eight imaginary images in one slice to quantify R1, R2, PD, VMY and VEPW. These values were compared among plaques, PWM, and NAWM. Percentage changes of the metrics in plaques and PWM relative to NAWM were compared among these metrics. For statistical analysis, we used the Steel-Dwass test.

RESULTS

All metrics differed significantly across the three groups ($p < 0.001$). VMY, VEPW, R1, R2, and PD were more abnormal in plaques and PWM than in NAWM, with plaques showing the most abnormal values. The percentage changes of the metrics in plaques and PWM relative to NAWM were significantly more different from zero for VMY (−61.59 ± 20.28% (mean ± SD) [plaque relative to NAWM] and −10.51 ± 11.41% [PWM relative to NAWM]) and VEPW (13.82 × 10^3 ± 49.47 × 103^% and 51.33 × 10^2 ± 155.31 × 10^2%) than for R1 (−35.23 ± 13.93% and −6.08 ± 8.66%), R2 (−21.06 ± 11.39% and −4.79 ± 6.79%), and PD (23.37 ± 10.30% and 3.37 ± 4.24%).

CONCLUSION

Multi-parametric quantitative MRI captures white-matter damage in MS. VMY and VEPW are more sensitive to the MS disease process than are R1, R2, and PD. VMY and VEPW may be useful estimators of disease burden in patients with MS.

CLINICAL RELEVANCE/APPLICATION

A multi-parametric quantitative MRI model that assesses myelin and edema by a single quantification pulse sequence is useful for evaluating the disease process of multiple sclerosis.

SSC12-03 Comparison of Screening Performance between Sequential Pre-contrast DWI and ADC in Detection of Active Multiple Sclerosis Lesions to Reduce Potential Risk of Gadolinium Deposition in Patients with Multiple Sclerosis

Monday, Nov. 28 10:50AM - 11:00AM Room: N229

Participants
Wei Tian, MD, PhD, Rochester, NY (*Presenter*) Nothing to Disclose
Xiang Liu, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Henry Z. Wang, MD, PhD, Pittsford, NY (*Abstract Co-Author*) Consultant, VirtualScopics, Inc

PURPOSE

Postcontrast T1-weighted imaging (T1WI) is standard imaging protocol to monitor the activity status of multiple sclerosis (MS). However, recent studies raised the concern of gadolinium deposition in neuronal tissues induced by the repeated follow-up contrast enhancing examinations in MS patients with normal renal function. Therefore, it is important to establish diagnostic screening algorithm with noninvasive techniques to clarify MS activity status so that to avoid unnecessary injection of MR contrast agents and subsequently reduce potential risk of gadolinium deposition in patients with stable MS lesions. The purpose of our retrospective study is to compare the screening performance between diffusion weighted imaging (DWI) and apparent diffusion coefficient (ADC) to select optimal patients with possible active MS lesions for further postcontrast T1WI examination.

METHOD AND MATERIALS

We reviewed sequential MR examinations, including postcontrast T1WI and DWI sequence of 250 MS patients from 2008 to 2014. Compared to the prior examination, the DWI and ADC imaging characteristics of these new MS lesions were evaluated. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated to assess the accuracy of DWI and ADC in predicting MS activity. Chi-Square test was performed to compare between DWI and ADC.

RESULTS

Totally, 120 new MS lesions in 55 patients were enrolled in this study including 111 new enhancing lesions and 9 new nonenhancing lesions. Compared to the baseline, 116 new MS lesions presented as new hyperintensity on DWI image, and 4 new MS lesions presented enlarged hyperintensity. These new lesions showed hyperintensity (70), isointensity (44) and hypointensity (6) on ADC map. The sensitivity, accuracy and PPV of new and/or enlarged hyperintensity on DWI to predict MS enhancing status were 100%, and 92%, 92% respectively, with better prognostic value than ADC ($p=0.002$).

CONCLUSION

Our preliminary study suggests that lesions with new and/or enlarged hyperintensity on DWI indicate active MS lesions for further postcontrast T1WI sequences. This may lead to an updated imaging strategy, which could avoid repeated intravenous exposures to the patients with stable MS lesions.

CLINICAL RELEVANCE/APPLICATION

Sequential DWI examination can be used as non-invasive tool for detection of patients with possible active MS lesions in the clinical diagnostic and MR scan algorithm.

SSC12-04 MRI Evaluation of Corpus Callosum in Fabry Disease Helps in the Differential Diagnosis with Multiple Sclerosis

Monday, Nov. 28 11:00AM - 11:10AM Room: N229

Participants
Sirio Cocozza, MD, Napoli, Italy (*Presenter*) Nothing to Disclose
Antonio Pisani, Napoli, Italy (*Abstract Co-Author*) Research Grant, sanofi-aventis Group; Research Grant, Shire plc; Research Grant, Amicus Therapeutics, Inc; Travel support, sanofi-aventis Group; Travel support, Shire plc; Travel support, Amicus Therapeutics, Inc
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PURPOSE

Fabry disease (FD) is a rare X-linked inherited multi-systemic lysosomal storage disorder that affects central nervous system via micro- and

macroangiopathic changes. Due to its clinical symptoms and MRI findings, FD has been proposed as a differential diagnosis for Multiple Sclerosis (MS). Misdiagnosis of MS could lead to a delayed start or even a wrong treatment option; thus, the search for a biomarker helping in the differential diagnosis between these two conditions is crucial. Aim of this work was to evaluate the involvement of Corpus Callosum (CC) on conventional MR images and its possible role as a radiological biomarker for a differential diagnosis between FD and MS.

METHOD AND MATERIALS

In this study we retrospectively evaluated brain MRI scans of 56 patients with genetically confirmed classical diagnosis of FD (M/F: 19/37, mean age 44±13.5). The presence of white matter lesions (WML) was evaluated on "conventional" FLAIR images by two expert neuroradiologists, who rated the WML load in all patients on a scale ranging from 0 (absence of WML) to 3 (high WML load). Furthermore, a small subgroup of 8 FD patients (M/F: 3/5, mean age 57±11.3), in whom neurological symptoms were present at onset, was analyzed to test the incidence of CC-WML in these patients.

RESULTS

WML were detected in supratentorial or infratentorial locations in 23 of 56 FD patients (41.1%). Among these, 14 showed a low WML load (60.8%), 4 a moderate WM involvement (17.4%) and 5 (21.7%) a high WML load. However, a lesion in the CC, not resembling a typical MS plaque, was detected in only one FD patient (1.8%), with a very low WML load. In the subgroup with neurological onset, WML were present in 5 of 8 FD patients (62.5%), none displaying CC lesions.

CONCLUSION

FD patients show a very low incidence of CC involvement on conventional MRI images, independently of the clinical presentation and the overall degree of WM involvement. Evaluating the presence of CC lesions on conventional MR image scan be used as a biomarker for a radiological differential diagnosis between MS and FD, rapidly addressing the physician toward a correct diagnosis, and subsequent treatment options.

CLINICAL RELEVANCE/APPLICATION

Evaluation of CC can be used as a radiological biomarker for differential diagnosis between MS and FD, helping the physician to rapidly reach a correct diagnosis and start an adequate treatment.

SSC12-05 Iron is a Biomarker for Differentiating Multiple Sclerosis Lesions from Ischemic Demyelinating Lesions

Monday, Nov. 28 11:10AM - 11:20AM Room: N229

Participants
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Yi Wang, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ischemic demylinating lesions become more and more common findings in the younger adults with increasing incidence of diabetes and hypertension in younger ages. Ischemic demyelinating lesions usually appear T2-hyperintense on MRI, which mimic the inflammatory demyelinating lesions, such as multiple scelerosis. However, it is essential for differentiating them in clinic because the therapy is quite different. Iron is reported to increase remarkably in MS patients, resulting in increased susceptibility value on quantitative susceptibility mapping (QSM). Therefore, we aim to differentiate the ischemic demyelinating lesions from MS lesions by quantifying iron content using QSM.

METHOD AND MATERIALS

A total of 32 clinical confirmed relapsing-remitting MS patients (9 male/23 female, 39.3 ± 10.9 years) and 20 patients with ischemic demyelinating lesions (5 male/15 female, 50.4 ± 8.6 years) were retrospectively selected in this study. QSM images were reconstructed for each patient and all MR images were co-registered. T2-hyperintense regions were assumed to be demyelinating lesions. White matter regions without an abnormal signal on all images were assumed to be normal white matter (NWM). Region-of-interests (ROIs) of MS lesions and ischemic demyelinating lesions were semi-automatically segmented on T2-weighted images. The ROIs were overlaid onto QSM and the susceptibility values of demyelinating lesions were calculated with the susceptibility of NWM as reference for each patient. The significance of difference in susceptibility value between MS lesions and ischemic demyelinating lesions was assessed by t-test.

RESULTS

A total of 598 MS lesions and 326 ischemic demyelinating lesions were segmented in this study. The susceptibility value of MS lesions was significantly higher than that of ischemic demyelinating lesions (29.18 ± 19.94ppb vs. 11.2 ± 8.72ppb, $p<0.001$). Of the 20 patients with ischemic demyelinating lesions, 15 patients (75%) had cerebral microbleeds (the susceptibility value ranged from 72.9 to 179.66ppb), while only 2 of the 32 MS patients (6.25%) had cerebral microbleeds.

CONCLUSION

The significantly increased susceptibility value in MS lesions which mainly caused by abnormal iron deposit enable to differentiate the ischemic demyelinating lesions from MS lesions.The presence of accompanying microbleeds help to diagnose ischemic demyelinating lesions.

CLINICAL RELEVANCE/APPLICATION

Quantifying iron using QSM enable to differentiate the ischemic demyelinating lesions from MS lesions.

SSC12-06 Progressive Intrinsic T1 Shortening of the Dentate Nucleus in Multiple Sclerosis Patients- Result of Multiple Administrations of Gadolinium Contrast Agent as Opposed to Intrinsic Disease

Monday, Nov. 28 11:20AM - 11:30AM Room: N229

Participants
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Daniel Strauchler, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
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Howard P. Forman, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ajay Malhotra, MD, Stamford, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the causality of intrinsic T1 shortening in dentate nuclei in patients with multiple sclerosis (MS) – whether it is due to the disease itself versus prior gadolinium contrast administrations.

METHOD AND MATERIALS

It has been previously postulated that intrinsic T1 shortening in dentate nuclei maybe a manifestation of the disease process, being more common in the secondary progressive subtype. Recent studies have shown hyperintense globus pallidi and dentate nuclei in patients who have received multiple doses of Gadolinium contrast. We retrospectively reviewed 20 patients with MS with history of at least four doses of linear gadolinium contrast agent and compared signal intensity ratios of Globus pallidus-to-thalamus, dentate nucleus-pons, and dentate nucleus-cerebrospinal fluid ratios to determine intrinsic T1 properties over time. In addition, evaluation of the dentate nucleus in regards to progression of disease was performed. Subsequently, five selected patients were reviewed who received further several administrations of macrocyclic agents and ratios of the same areas were measured.

RESULTS

Following multiple administrations of linear gadolinium agents, there is progressive T1 shorting within the globe pallidus as well as the dentate nucleus with relative stability of the T1 shortening following the administration of several doses of macrocyclic gadolinium. Therefore, the progressive T1 shortening within the dentate nucleus is likely the result of repeated linear gadolinium administration as opposed to intrinsic disease and progression of MS.

CONCLUSION

Intrinsic T1 shortening of the dentate nucleus maybe the result of multiple prior linear agent gadolinium administrations, and not due to progression of MS.

CLINICAL RELEVANCE/APPLICATION

When evaluating the dentate nucleus in MS patients, T1 hyperintensity should be evaluated in correlation with prior contrast administrations and not ascribed to disease progression.

SSC12-07 Scanning Parameter Dependence of Crossing Nerve Fiber Depiction Accuracy in Diffusion Spectrum Imaging

Monday, Nov. 28 11:30AM - 11:40AM Room: N229

Participants
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Khin Khin Tha, MBBS, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Toru Yamamoto, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tractography, which is usually obtained by using diffusion tensor imaging (DTI), is a non-invasive method to visualize neural tracts and is used to understand structural–functional networks in the brain. However, DTI-based tractography cannot visualize fiber crossing correctly due to multi-diffusible directions. Diffusion spectrum imaging (DSI) has been developed to visualize fiber crossing clearly, but its long scan time is a hindrance for clinical use. To investigate the possibility to reduce the scan time of DSI, we clarified scanning parameter (b-value, sampling point) dependence on depiction accuracy of crossing neuronal fibers in DSI.

METHOD AND MATERIALS

We performed DSI for 12 healthy adults by using a 3-T MRI with a 64-cannnel head coil. Two imaging experiments were conducted by changing number of sampling points (62, 129, 258) with a maximum b-value of 8000 s/mm2 and maximum b-value (4000, 6000, 8000 s/mm2) with 129 sampling points. The repetition time (TR) was set at 6800 ms to allow the highest b-value (8000 s/mm2) in these experiments; scan time of each DSI was 7.5 min (62 sampling points) to 30 min (258 sampling points). Using DSI studio, the ratio of crossing voxels by more than 2 (or 3) fiber bundles in all nerve voxels (Rcr2(3)) was calculated and the volume of the depicted superior longitudinal fasciculus (SLF) was measured. One-way ANOVA was used to compare Rcr2(3) and the SLF volume along with sampling points and maximum b-values.

RESULTS

While both Rcr2(3) and the SLF volume increased with an increase in number of sampling points ($p < 0.05$), they showed no significant difference by changing maximum b-value indicating that the lowest b-value (4000 s/mm2) could decrease TR with keeping clear depiction of fiber crossing.

CONCLUSION

Although depiction accuracy of crossing neuronal fibers improves with an increase in sampling points, it is insensitive to maximum b-values higher than 4000 s/mm2 that can be performed with lesser TR in DSI.

CLINICAL RELEVANCE/APPLICATION

Abnormality in mental illness appears mainly in the frontal lobe where fibers cross frequently. Our results would help to reduce the scan time of DSI while clearly depicting of fiber crossing.

SSC12-08 Imaging Short T2 Components in Cerebral White and Gray Matter Using An Inversion Recovery Ultrashort Echo Time (IR-UTE) Sequence: A Volunteer Study at 3T

Monday, Nov. 28 11:40AM - 11:50AM Room: N229

Participants
Shujuan Fan, MD,PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Yajun Ma, San Diego, CA (*Presenter*) Nothing to Disclose
Graeme M. Bydder, MBChB, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Jiang Du, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate direct imaging of short T2 components (STCs), including myelin, in cerebral white matter (WM) and gray matter (GM) in vivo using a clinical 3T scanner.

METHOD AND MATERIALS

We implemented a 2D dual-echo inversion recovery ultrashort TE (IR-UTE) sequence to detect signals from STCs (Fig. 1). An adiabatic inversion pulse was used to invert and null the long T2 components in WM (WML) or GM (GML). The magnetization of STCs was not inverted due to fast transverse relaxation, and following recovery was detected by subsequent UTE data acquisition. Residual long T2 signals were suppressed via subtraction of the 2nd echo image from the first, or subtraction of the 1st echo image from the second, to provide high contrast imaging of STCs in WM or GM, respectively. Three volunteers were recruited. First, low resolution dual-echo IR-UTE acquisitions were performed with FOV=24 cm, 5 mm slice, bandwidth=125 kHz, flip angle=60°, TR=1500 ms, TE=8 ms/2.3 ms, readouts of 92, projections=61, reconstruction matrix=128´128, 5 TIs (20, 200, 400, 600, 800 ms), scan time ~3 min per acquisition. The nulling time TI for WML and GML were estimated separately by fitting the 2nd echo IR-UTE data. With TI optimized, high resolution dual-echo IR-UTE acquisitions were performed with readouts of 192, 131 projections, five TEs (TE=0.008/2.3; 0.2/4.4; 0.4/4.4; 0.6/4.4; 1.5/4.4 ms), scan time ~ 6.5 min per acquisition. T2* of the STCs was estimated via non-

linear exponential fitting of IR-UTE signal decay. An 8-channel head coil was used for signal reception.

METHOD AND MATERIALS

We implemented a 2D dual echo inversion recovery ultrashort TE (IR-UTE) sequence to detect signals from STCs (Fig.1). An adiabatic inversion pulse was used to invert and null the long T2 components in WM (WML) or GM (GML). Magnetization of STCs was not inverted due to fast transverse relaxation, and was detected by subsequent UTE data acquisition. Residual long T2 signals were suppressed via subtraction of the 2nd echo from the 1st one, or subtraction of the 1st echo from the 2nd one, to provide high contrast imaging of STCs in WM or GM. Three volunteers were recruited. First, low resolution acquisitions were performed with FOV=24 cm, 5 mm slice, bandwidth=125 kHz, flip angle=60□, TR=1500 ms, TE=8 □s/2.3 ms, readout=92, projections=61, reconstruction matrix=128□128, 5 TIs (20, 200, 400, 600, 800 ms), scan time ~3 min per acquisition. The nulling time TI for WML and GML were estimated separately by fitting the 2nd echo IR-UTE data. With TI optimized, high resolution acquisitions were performed with readout=192, 131 projections, five TEs (TE=0.008/2.3; 0.2/4.4; 0.4/4.4; 0.6/4.4; 1.5/4.4 ms), scan time ~ 6.5 min per acquisition. T2* of the STCs was estimated via non-linear exponential fitting of IR-UTE signal decay. An 8-channel head coil was used for signal reception.

RESULTS

Fig. 1 shows the contrast mechanism, as well as the results from a 43 yr normal volunteer. STCs in WM showed a fast signal decay with a T2* of 356±47 μs, comparable to that of purified bovine myelin extract in D2O suspension (~300 μs). This suggests myelin may be a major contributor to the observed ultrashort T2* signal. High contrast imaging of STCs in GM was also demonstrated. The contribution of myelin to the ultrashort T2* signal may vary with the brain region studied.

CONCLUSION

STCs cannot be imaged with conventional MRI sequences with TEs of several milliseconds or longer. Our preliminary results show that the IR-UTE sequence can generate high contrast images of STCs in cerebral WM and GM in vivo using a clinical 3T scanner.

CLINICAL RELEVANCE/APPLICATION

Direct imaging of STCs including myelin may significantly advance the study of many neurological diseases such as multiple sclerosis.

SSC12-09 A Scale-and Orientation-Specific Method for Advanced Analysis of Tissue Integrity using Clinical MRI: A Multiple Sclerosis Study

Monday, Nov. 28 11:50AM - 12:00PM Room: N229

Participants
Yunyan Zhang, MD, PhD, Calgary, AB (*Presenter*) Nothing to Disclose
Mark Polivchuk, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose
Peng Zhai, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Clinical MRI is very sensitive to tissue pathology as seen in multiple sclerosis (MS) but is limited to changes in tissue structure. The goal of this study was to develop and validate a new image processing method for advanced analysis of tissue integrity based on clinical MRI. Through localized assessment of tissue frequency spectra, this method aims to characterize tissue regularity and alignment at each image voxel, similar to what are expected in diffusion MRI.

METHOD AND MATERIALS

We used both simulated and clinical MR images to evaluate this method. 3T MR images were acquired from patients with MS participated in a clinical trial of minocycline at baseline, and at months 1 and 9. Both acute and chronic lesions and normal appearing white matter (NAWM) in sequential T2-weighted MRI were examined. Simulated images were chosen with structure organizations clearly seen. Based on a new local spatial-frequency assessing algorithm, polar Stockwell transform, we first calculated the multi-scale frequency spectrum at each image voxel. Then, based on the local heterogeneity and orientation of a tissue structure, we derived: 1) scale- and orientation-specific frequency contents of a tissue at individual voxel locations and 2) tissue scale and orientation maps at each frequency and direction from -90 to +90 degrees. These outcomes allowed us to identify tissue coherency and directionality around each voxel, thereby to detect changes in white matter anisotropy.

RESULTS

We found that in simulated images, calculated structure scale and alignments at test voxels were consistent with the designed imaging features. In T2-weighted MRI, there was prominent increase in image heterogeneity in acute lesions over time, which was accompanied by changes in the alignment angle of these lesions. In contrast, there were only minimal alterations in either frequency scale or spectral direction in chronic lesions and NAWM, reflecting relative stability of pathology in these tissues.

CONCLUSION

Advanced analysis of tissue spatial frequency provides a novel approach for charactering structure regularity and alignment in clinical MRI, which is not possible using conventional analysis currently.

CLINICAL RELEVANCE/APPLICATION

The new structural indices deriving from clinical MRI may not only enhance our disease monitoring ability but also innovate our patient care approach. This can benefit patients with MS and numerous similar disorders.

SSC13

Physics (CT-Dual-Energy/Spectral)

Monday, Nov. 28 10:30AM - 12:00PM Room: S403B

CT PH

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

FDA Discussions may include off-label uses.

Participants
Marc Kachelriess, PhD, Heidelberg, Germany (*Moderator*) Nothing to Disclose
Jerome Z. Liang, PhD, Stony Brook, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSC13-02 Accurate Quantification of Percent Area Luminal Stenosis by Material Decomposition of Spectral CT Images

Monday, Nov. 28 10:40AM - 10:50AM Room: S403B

Participants
Zhoubo Li, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Ahmed Halaweish, PhD, Rochester, MN (*Abstract Co-Author*) Employee, Siemens AG
Zhicong Yu, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Erik L. Ritman, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

To evaluate the accuracy of a novel method for quantifying percent area luminal stenosis using spectral CT images.

METHOD AND MATERIALS

Current stenosis quantification methods rely on segmentation of lumen area, which suffers from partial volume effect and can be highly subjective and error-prone. To overcome these limitations, we utilized material decomposition of spectral CT images to quantify percent area luminal stenosis based on the ratio of mean iodine densities between vessel locations with and without a stenosis. To assess the accuracy of this method, four phantoms with different degrees of stenosis (30~51%), vessel diameters, and calcification densities were fabricated using hydroxyapatite cylinders and test tubes filled with iodinated solutions. Dual-energy CT (DECT) images were acquired using a commercial dual-source CT system (Somatom Flash, Siemens Healthcare). CT images were also acquired from a research photon-counting CT (PCCT) scanner (Somatom CounT, Siemens) using 4 energy bins in a single exposure. 3-basis material (calcium, iodine, and water) decomposition was performed on the spectral CT images and the iodine density maps were used for stenosis measurements. For comparison, conventional single-energy CT images were acquired using the commercial CT scanner and were analyzed with a commercial stenosis analysis software (Syngo Via, Siemens). The radiation dose levels were matched among all data acquisitions.

RESULTS

Phantom experiments showed accurate estimation of percent area luminal stenosis from spectral CT images at clinical dose levels. For DECT images, the mean estimation errors were 4.4~8.2%, 3.6~9.3%, 8.0~10.3%, and -4.6~-8.1% for the four stenosis phantoms (ground truth: 51%, 51%, 51%, and 30%), respectively. For PCCT images, the errors were 1.0~3.4%, 5.7~7.8%, 2.0~9.5%, and -0.1~5.6%, respectively. Errors using single-energy CT and the commercial software were much larger, ranging from 4.4% to 46%, and were especially worse in the presence of heavy calcifications.

CONCLUSION

For both dual-source DECT and PCCT systems, the developed method accurately and conveniently estimated the percent area luminal stenosis from spectral CT images using clinically relevant dose levels.

CLINICAL RELEVANCE/APPLICATION

Quantification of luminal stenosis by spectral CT at clinical dose levels provides accurate and reproducible measurements of important information for the management of atherosclerosis.

SSC13-03 Feasibility and Accuracy of Spectral CT Imaging in Measurement of Bone Mineral Density (BMD)

Monday, Nov. 28 10:50AM - 11:00AM Room: S403B

Participants
Wenjuan Zhang, Lanzhou, China (*Presenter*) Nothing to Disclose
Junlin Zhou, Lanzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the feasibility and accuracy of spectral CT imaging in measurement of bone mineral density (BMD).

METHOD AND MATERIALS

Totally 147 female patients who underwent upper abdominal CT examination with spectral CT imaging mode were enrolled, 19 Patients the trauma, surgery, tumor or other diseases that affecting BMD were excluded. The patients were separated into 6 groups according to their ages: 18~30(23), 30~39(20), 40~49(22), 50~59(24), 60~69(19) and≥70(20). The hydroxyapatite and calcium concentration was measured at central level of L2 for 3 times, and then mean value was obtained. 119 female who underwent dual energy X-ray absorption (DEXA) examination were selected as the controls with same criteria and group division, and BMD was measured at L2. The measurement results of different ages in the study group were compared by the analysis of variance. Pearson correlation analysis was taken between age and hydroxyapatite, calcium concentration respectively. The hydroxyapatite, calcium concentration and BMD was analyzed by Pearson correlation analysis respectively.

RESULTS

There were significant differences in the hydroxyapatite and calcium concentration between different age groups($P<0.05$).Both calcium and hydroxyapatite concentrations showed positive relationship with BMD($r=0.796$ and $r=0.874$, both $P<0.05$). Females with age of 30~39 had the highest calcium concentration, hydroxyapatite concentration and BMD. As same as BMD, hydroxyapatite concentration and calcium concentration showed positive relationship to age in female≤39 years and negative relationship in >40 years.

CONCLUSION

The quantitative analysis for bone mineral density with spectral CT imaging, hydroxyapatite-based material decomposition technique was more accurate than calcium, spectral CT imaging can be used as a new and convenient method in measuring BMD.

CLINICAL RELEVANCE/APPLICATION

The hydroxyapatite-based images of spectral CT can reflect BMD as in DXA. In particular, there is a great value in the diagnosis of osteoporosis without symptoms in postmenopausal women, predict fracture risk and direct appropriate treatment to prevent fractures.

SSC13-04 Modified Dual Energy-based Three Material Decomposition for Calcium Plaque Removal Without Compromising Iodine Contrast

Monday, Nov. 28 11:00AM - 11:10AM Room: S403B

Participants
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PURPOSE

Confident removal of calcified plaques from small vessels is one of the remaining challenges in CT. Threshold-based plaque removal techniques typically fail due to calcium blooming. Dual Energy (DE) based 2-material decomposition techniques into water and either iodine or calcium (virtual non-contrast imaging) are not applicable, since decomposition will either be successful for contrast agent or for plaque; corresponding to incomplete calcium removal or negative iodine contrast, respectively. We assessed the ability for the removal of calcium-related attenuation from iodinated vessels by applying a modified three-material decomposition algorithm.

METHOD AND MATERIALS

Base materials were modified to allow decompositions into calcium (first base material), soft tissue (second base material) and iodine (third base material). After calibration and algorithm adjustments to resolve ambiguities (e.g. fat), two image stacks are generated by the algorithm, one containing just calcium and the other, the soft tissue / iodine mixture. To evaluate our method, first tubes with different mixtures of calcium plaque equivalent solution and soft tissue / iodine were measured on a SOMATOM Force (Siemens, Germany) in an anthropomorphic environment and decomposed. Phantoms simulating vessels with iodinate contrast and calcified plaques at different stenosis level were evaluated. The obtained results were rated subjectively and also compared to the known gold standard.

RESULTS

After decomposing the images of the tubes containing material mixtures, the derived base material images show systematic deviations of the CT-value, which can be larger than for virtual non-contrast imaging, while image noise is comparable. Phantoms simulating vessels and plaques showed excellent results and confident calcium removal for medium and large calcifications. In case of dense calcifications and smaller vessels, small residual calcium components were observed in the iodine/soft-tissue image.

CONCLUSION

The obtained results indicate that these modified three material decomposition algorithms may be suitable for the improved visualization of the vessel lumen, and a confident removal of plaque.

CLINICAL RELEVANCE/APPLICATION

Quantification of the degree of stenosis might be challenging with CT, especially in the case of large or dense calcifications. The proposed technique might allow for a substantially improved confidence in stenosis quantification.

SSC13-05 An Image-Domain, Contrast Material Extraction Method for Dual-Energy CT

Monday, Nov. 28 11:10AM - 11:20AM Room: S403B

Participants
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Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;

PURPOSE

To define and implement a contrast material extraction process (CMEP) for Dual-Energy CT (DECT) that extracts positive contrast-producing materials directly from image data, using their low- to –high-energy CT number ratios (dual-energy ratios).

METHOD AND MATERIALS

Following generation of the virtual monochromatic (VM) images using commercial software (GSI Viewer), the CMEP is performed within image processing freeware (Fiji). We generate a 60:80 keV VM dual-energy ratio map to define masks corresponding to the dual-energy ratio intervals of the requisite contrast materials. These ratios can be measured directly from the DECT images themselves or retreived from literature. The masks are then applied to VM images (e.g. 70 keV) to yield material-specific images. We quantitatively tested the method using a water-based phantom containing formulations of iodine, tungsten and calcium. As the material-specific CT numbers should match those of the VM images chosen for separation, we evaluated errors in the masking process by comparing the absolute and percent difference in CT number between the two. Further qualitative evaluation of the CMEP was performed in vivo with a rabbit model scanned with enteric tungsten, intravascular iodine, and skeletal calcium as the three contrast materials.

RESULTS

The three chosen materials showed distinct, non-overlapping dual-energy ratios, independent of material concentration. As such, the CMEP was successful in both phantoms and in vivo. For the phantom, the maximum difference in CT number between the VM images and the extracted material-specific images was 15 HU, which corresponded to a percentage error of 6%. False positive contrast signals were minimal, with a maximum false positive signal of 13 HU. Material-specific images of the rabbit model clearly depicted the enteric tungsten, vascular iodine and skeletal calcium.

CONCLUSION

The CMEP is a robust and flexible, yet conservative approach to material-specific dual-energy imaging. With its image-domain implementation within freeware and with no requirement of a priori information, it circumvents many of the limitations associated with conventional material decomposition.

CLINICAL RELEVANCE/APPLICATION

Methods such as the CMEP enable material-specific imaging in studies where the attenuation coefficient profiles of contrast materials may be unknown, and for the extraction of novel high-Z contrast from iodine and calcium.

SSC13-06 Accuracy and Precision of Effective Atomic Number Estimates Across Patient Size in Various Tissues using Dual Energy CT

Monday, Nov. 28 11:20AM - 11:30AM Room: S403B

Participants
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Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

To determine the achievable accuracy and precision for determining effective atomic number (Zeff) using dual-energy CT (DECT) and a commercial software tool for various tissue types and across a range of patient sizes.

METHOD AND MATERIALS

A 32 cm lateral width CIRS electron density phantom and four torso-shaped water tanks (lateral widths 15, 25, 35 and 45 cm) containing 6 tissue-simulating cylinders and one solid water cylinder, each having known elemental compositions, were scanned on a dual-source CT system (Somatom Force, Siemens Healthcare) in single-energy (SE, 120 kV) and DE (90/150Sn) modes. Additional scans were performed on the 15 and 25 cm water tanks using DE techniques of 70/150Sn and 80/150Sn, respectively. CTDIvol was matched for all SE and DE scans for a given phantom size. Images were reconstructed using quantitative kernels to preserve CT number accuracy. Zeff was estimated in each test cylinder and in the solid water cylinder using a DE Rho-Z algorithm (Syngo Via, Siemens) and compared with Zeff calculated using percent elemental composition.

RESULTS

Regression models through the origin showed excellent agreement between nominal Zeff and Zeff determined by Rho-Z, with slopes ranging from 0.9867 to 1.0124 and R2 ranging from 0.9772 to 0.9908. Mean percent error (bias) in Zeff across phantom size was 1.9%, while mean standard deviation (precision) in Zeff across phantom size was 1.4%. When compared to 90/150Sn, DE techniques of 70/150Sn and 80/150Sn showed mean differences in Zeff of 0.65% and 0.83%, respectively.

CONCLUSION

Our study demonstrated that DECT combined with Rho-Z analysis could estimate Zeff with little error or variability across patient size. The regression models comparing nominal Zeff and Zeff as determined by Rho-Z analysis show consistent slopes near unity across patient size, demonstrating independence on patient size. Additionally, in small patients, Zeff was independent of DE technique.

CLINICAL RELEVANCE/APPLICATION

Estimates of Zeff can reliably be determined across patient size using DECT. This could have clinical impact in applications requiring quantitative CT measurements, such as proton therapy planning.

SSC13-07 Equivalency Between Photon Energies (keV) in Spectral CT Imaging and Tube Voltages (kVp) in Traditional Polychromatic X-ray CT for Same CT Attenuation Values: An In Vitro Experiment

Monday, Nov. 28 11:30AM - 11:40AM Room: S403B

Participants
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Haruhiko Machida, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Isao Tanaka, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To find the equivalency between the photon energies (keV) in dual-energy spectral CT imaging and the tube voltages (kVp) in traditional polychromatic X-ray imaging (TPXI) where same CT attenuation values were obtained.

METHOD AND MATERIALS

A 1.2cm-diameter polypropylene phantom containing 4 inserts with different iodine concentrations (5, 10, 15 and 20 mg/mL) underwent both the dual-energy Spectral CT (with fast 80kVp and 140kVp switching) and traditional polychromatic X-ray scans (at the 80kVp, 100 kVp, 120 kVp and 140kVp tube voltages) at the same radiation dose level. The background was either air or soft tissue. The CT attenuation values of the iodine solutions under different kVp in traditional polychromatic x-ray imaging and at different energy levels in dual-energy spectral CT imaging were measured using the same size of region of interest and at the exact same level for both images. The keV and kVp values where CT measurements were the closest were recorded.

RESULTS

The average photon energies (in keV) corresponding to 80 kVp, 100 kVp, 120 kVp and 140kVp were 52±1.0keV, 58±1.3keV, 62±1.4keVand 66±1.3keV, respectively with air background; and 53±0.8keV, 59±1.0keV, 64±1.0keV and 68±1.0keV, respectively with the soft tissue background. The corresponding photon energies did not change significantly with the change of iodine concentration.

CONCLUSION

Monochromatic energy level in Spectral CT and kVp in traditional polychromatic x-ray imaging had good correlation and was not dependent on iodine concentration.

CLINICAL RELEVANCE/APPLICATION

The monochromatic Spectral CT images may be used to mimic traditional polychromatic x-ray CT at different tube voltage stations in terms of CT attenuation.

SSC13-08 Characterization of White and Gray Matter in the Brain by Spectral Analysis of Monoenergetic Images Derived From Dual-Layer Detector CT

Monday, Nov. 28 11:40AM - 11:50AM Room: S403B

Participants
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PURPOSE

Dual-layer detector CT generates virtual mono-energetic (ME) images at different photon energies (keV). The purpose of this study is to evaluate characterization of white matter (WM) and gray matter (GM) in different areas of the human brain by spectral analysis of mean Hounsfield Unit (HU) as a function of the energy of the ME images.

METHOD AND MATERIALS

Brain CT images of 19 patients, derived from Dual-layer Detector CT (Philips Healthcare, Cleveland, OH, USA) were analyzed. Pairs of WM and GM regions of interest (ROIs) were marked in three areas of the brain: anterior and posterior cortex with adjacent white matter, and the thalamus with the adjacent internal capsule. For each patient, ME images were generated at energies between 40-140 keV, at 1 keV intervals. At each energy level, the mean HU value and the standard deviation (SD) in each ROI were calculated. For each ROI, the curve of the mean HU values as a function of keV of the ME image was evaluated. Wilcoxon signed-rank test was used to evaluate the significance of the difference between the obtained curves.

RESULTS

For all ROIs, inter-subject variability of mean HU was lower (mean SD=4.6) than intra-subject variability within each individual ROI (mean SD=5.4), indicating concordance of the mean HU in each ROI, for all 19 patients. In all ROIs, a power function represented the regression curve of the mean HU values versus the keV of the ME image with a high correlation coefficient (R= 0.963±0.009). In each regional GM/WM ROI pair, the curves of mean HU values versus keV were significantly different (P<0.001). For GM, the curves in the anterior and posterior regions were not significantly different (P<0.303), while both curves were significantly different (P<0.001) from the curve in the thalamus. For WM, the curves in the internal capsule and posterior region were not significantly different (P<0.552), while both curves were significantly different (P<0.041) from the curve in the anterior region.

CONCLUSION

Spectral analysis of HU vs keV of mono-energetic images derived from dual-layer detector CT enables characterization of white and gray matter in different areas of the brain.

CLINICAL RELEVANCE/APPLICATION

Characterizing GM and WM in the brain by spectral analysis of mono-energetic images generated by Dual-layer detector CT may assist in identifying abnormal gray matter, for example, in acute ischemic events.

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/

Jacob Sosna, MD - 2012 Honored Educator

SSC13-09 **The Value of Automatic Spectral Imaging Mode Selection Combined With Optimized ASIR Percentages in Upper Abdominal Enhanced CT Scan with Low Contrast Agent Dose**

Monday, Nov. 28 11:50AM - 12:00PM Room: S403B

Participants
Liying Zhang, Zhengzhou, China (*Presenter*) Nothing to Disclose
Peijie Lv, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Hua Guo, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the value of automatic spectral imaging mode selection combined with adaptive statistical iterative reconstruction (ASIR) in upper abdominal enhanced CT scan with low contrast agent dose

METHOD AND MATERIALS

The study was approved by the institutional review board and informed consents were obtained from all patients. One hundred patients underwent abdominal enhancement CT during arterial phase (AP) and portal v
70keV, intervals of 5keV, 7levels) were reconstructed using 40-70%ASIR(4 levels) respectively. If the datum of image noise in HU, CT values and contrast-to-
noise ratio of the liver, pancreas, aorta and portal vein,radiation dose and qualitative visual parameters were normally distributed,they would be compared by using two independent samples t test,if not,qualitative v
point scale) they would bewas assessed by using mann whitney u test.

RESULTS

CT values in group B in the range of 40-60keV were similar or higher than group A. Imaging noise in group B at the level of 40keV with 70%ASIR, 45-50keV with 60-70%ASIR,55keV with 50-70%ASIR and 60-
70keV with 40-
70%ASIR were similar to or lower than group A. The CNR values of group B were similar to or higher than group A. In terms of overall image quality, group B at the level of 50keV with 40%ASIR and 60keV with 50%A
55keV with 60%ASIR in PVP showed similar values while 50keV with 50%ASIR, 55keV with 40-
50%ASIR,and 60keV with 40%ASIR in two phases showed higher values as compared with group A.There were no significant difference in CTDIvol [(10.9±3.8) mGy versus (11.7±2.7)mGy, P=0.19]and DLP [(244.0±1

CONCLUSION

With use of automatic spectral imaging mode selection, monochromatic images from 50 to 60keV with ASIR percentages from 40% to 50% can maintain or even improve overall image quality and reduce contrast age

CLINICAL RELEVANCE/APPLICATION

The application of low contrast agent dose can reduce adverse reactions caused by iodine contrast agent.

SSC14

Physics (Diagnostic X-rays I)

Monday, Nov. 28 10:30AM - 12:00PM Room: S404AB

PH

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

FDA Discussions may include off-label uses.

Participants
Guang-Hong Chen, PhD, Madison, WI (*Moderator*) Research funded, General Electric Company Research funded, Siemens AG
Joseph Lo, PhD, Durham, NC (*Moderator*) Research Grant, Siemens AG

Sub-Events

SSC14-01 X-ray Dark-Field Chest Radiography: A First Feasibility Study on Phantom Samples and In-Vivo Pigs

Monday, Nov. 28 10:30AM - 10:40AM Room: S404AB

Participants
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PURPOSE

To demonstrate – for the first time – that x-ray dark-field radiography is feasible with clinically relevant x-ray energies and a field-of-view suitable for human chest x-ray imaging.

METHOD AND MATERIALS

The study was institutional review board (IRB) approved. An experimental setup for grating-based dark-field radiography has been constructed and equipped with a set of three gratings, to enable phase-contrast and dark-field contrast x-ray imaging. It operates at an acceleration voltage of up to 120 kVp and with a field-of-view large enough for clinical chest x-ray radiography (> 35 cm). The setup was tested and commissioned with phantom samples and test measurements were performed to evaluate the overall imaging performance of the system. Finally, first proof-of-principle imaging experiments on living pigs were performed, particularly to assess the imaging performance of the dark-field signal with respect to the visualization of the lungs.

RESULTS

The results from this first experimental dark-field radiography system demonstrate the feasibility of performing in-vivo dark-field chest radiographies with a field-of-view larger than 32 x 35 cm2 and with acceleration voltages used in clinical practice (≥ 70 kVp). The dark-field radiographies were obtained in a 40 sec scan and show that the dark-field signal obtained for the lungs is large enough to be used for future studies on lung diseases (e.g. chronic obstructive pulmonary disease (COPD), fibrosis, or pneumonia). These results represent a milestone in the translation of x-ray dark-field imaging from current small-animal and mammography prototypes at relatively low energies (< 40 kVp) to standard radiography applications in the clinic (≥ 70 kVp).

CONCLUSION

The results of this research project clearly indicate that in-vivo dark-field chest x-ray radiography is feasible at an x-ray energy and with a field-of-view compatible with clinical radiography applications.

CLINICAL RELEVANCE/APPLICATION

Dark-field chest x-ray radiography is feasible on the human scale, and thus enables future investigations on the clinical benefit with regard to improved diagnosis and staging of lung diseases, including COPD.

SSC14-02 Tomosynthesis-Based Real-time 3D Catheter Tracking Using a Scanning-Beam Digital X-Ray System

Monday, Nov. 28 10:40AM - 10:50AM Room: S404AB

Participants
David A. Dunkerley, Madison, WI (*Presenter*) Nothing to Disclose
Michael Speidel, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Scanning-beam digital x-ray (SBDX) is an inverse geometry fluoroscopy system designed for dose reduction and real-time tomosynthesis in interventional procedures. SBDX was recently upgraded with a multi-GPU image reconstructor with capacity for 3D catheter localization tasks. This work presents the implementation of real-time (RT) 3D catheter tracking on the SBDX system.

METHOD AND MATERIALS

SBDX performs digital tomosynthesis at 32 planes x 15 frame/s. A composite of each plane stack is formed for live image display. A tomosynthesis-based tracking algorithm designed to localize high-contrast catheter elements was implemented on an Nvidia GPU simultaneous with image reconstruction. The live fluoroscopic image and live 3D tracking results were displayed using an OpenGL framework. To verify the geometric accuracy of the RT tracking algorithm, an 8 x 8 planar array of 2.3 mm steel fiducials with 1 cm spacing was imaged at a 45º angle to the source plane such that the array spanned the imaging volume. The fiducial positions tracked in RT were registered to a CT scan of the array and fiducial registration error (FRE) was calculated. To demonstrate accurate tracking of a moving target, a catheter tip was tracked as it was pulled through a sheath within an anthropomorphic chest phantom at speeds of 10, 25, and 50 mm/s. The sheath volume and centerline were extracted from a CT scan of the phantom and the root-mean-squared distance (RMSD) between the tracked tip positions and the centerline was calculated.

RESULTS

Real-time 3D tracking coordinates were displayed and recorded at 15 frame/s with no dropped frames. The 8 x 8 fiducial array geometry was accurately reproduced in tracking (FRE = 0.43 mm). The 3D distance from the tracked catheter tip to the sheath centerline averaged 0.7 to 1.0 mm for the 3 pullback sequences (RMSD = 0.8 to 1.1 mm). Of the 328 tracked catheter tip points, 99.1% were located inside the catheter sheath volume.

CONCLUSION

Accurate real-time 3D tracking concurrent with fluoroscopy was performed at 15 frame/s using the SBDX system.

CLINICAL RELEVANCE/APPLICATION

SBDX real-time catheter tracking can provide 3D spatial information about catheter positions during fluoroscopic imaging which could potentially aid in the navigation of devices to anatomic targets.

SSC14-03 Construction of a Prototype Digital Breast Tomosynthesis System with Superior Spatial Resolution

Monday, Nov. 28 10:50AM - 11:00AM Room: S404AB

Participants
Andrew D. Maidment, PhD, Philadelphia, PA (*Presenter*) Research support, Hologic, Inc; Research support, Barco nv; Research support, Analogic Corporation; Spouse, Employee, Real-Time Tomography, LLC; Spouse, Stockholder, Real-Time Tomography, LLC; Scientific Advisory Board, Real-Time Tomography, LLC; Scientific Advisory Board, Gamma Medica, Inc
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PURPOSE

To construct a prototype digital breast tomosynthesis (DBT) system with superior spatial and contrast resolution.

METHOD AND MATERIALS

A prototype DBT system was constructed from basic materials. The system supports new designs for the motion of the x-ray tube and the detector. While clinical systems restrict the x-ray tube motion to the plane of the chest wall, the new design includes a component of motion perpendicular to the chest wall; i.e., along the posteroanterior (PA) direction. In addition, the prototype system supports detector motion along the direction between the x-ray source and the breast support. The prototype system was designed based on a theoretical model developed prior to this study. The model predicts an improvement in image quality for two test objects: (1) a Defrise phantom, and (2) a resolution bar pattern. The Defrise phantom simulates thick, low-frequency structures, while the bar pattern simulates thin, high-frequency structures. Reconstructions were prepared with a commercial software (Piccolo™, Real Time Tomography, Villanova, PA).

RESULTS

First, we report upon test frequencies oriented in the direction of conventional x-ray tube motion; this direction is left-to-right in a cranial-caudal (CC) view. As theoretically predicted, the gaps between plastic plates in the Defrise phantom were visualized clearly, and the bar pattern showed super-resolution (reconstruction of frequencies greater than the detector alias frequency of 5.9 lp/mm) with a limiting resolution of 9.0 lp/mm. Second, test frequencies were oriented along the PA direction. In conventional DBT, the Defrise phantom will not be properly visualized, and the bar pattern phantom will show aliasing at high frequencies. Using the new design, the x-ray tube motion along the PA direction gives rise to an improvement in low-frequency contrast in the Defrise phantom, and the use of detector motion along the source-to-support direction provides super-resolution. Overall, the new system design generates images with markedly improved image quality over conventional DBT systems.

CONCLUSION

The prototype DBT system offers an improvement in image quality for both low- and high-frequency objects.

CLINICAL RELEVANCE/APPLICATION

The prototype design offers superior image quality, as determined for small objects (e.g., calcifications) using a bar pattern and for large objects (e.g., dense tissue) using a Defrise phantom.

SSC14-04 Depiction of Pneumothoraces in A Large Animal Model Using X-Ray Dark-Field Radiography

Monday, Nov. 28 11:00AM - 11:10AM Room: S404AB

Participants
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Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Franz Pfeiffer, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study was to assess added clinical value of dark-field radiography in pneumothorax diagnosis using a pig model.

METHOD AND MATERIALS

Experiments were performed using 2.5 months old, wild-type German landrace pigs (n=6). The animals were anesthetized, intubated and mechanically ventilated during the experiments. All pigs were imaged with an experimental grating-based large animal scanner to acquire x-ray transmission and dark-field radiographs before and after induction of a unilateral pneumothorax. All scans were performed in posterior-anterior (p.a.) direction under respiratory arrest. Image contrast ratios between lung tissue and the air filled pleural cavity were quantified for both, transmission and dark-field radiograms.

RESULTS

Images revealed that all animals had developed a unilateral pneumothorax. Pneumothoraces displayed as areas with no dark-field signal next to the adjacent lung parenchyma, which generated a strong dark-field signal. The contrast ratio between the air filled pleural space of the pneumothoraces and lung tissue was significantly higher in the dark-field (2.95 ± 0.93) than in the transmission images (0.95±1.04; $p < 0.05$) when images were acquired in p.a. direction. Consequently, detection of pneumothoraces was easier when analyzing the dark-field images.

CONCLUSION

This study shows increased contrast between lung parenchyma and air in the pleural space in x-ray dark-field radiography as compared to conventional chest x-ray in a large animal model in p.a. images. This makes this technique a promising tool for facilitated diagnosis of pneumothoraces.

CLINICAL RELEVANCE/APPLICATION

The detection of pneumothoraces can be challenging using conventional transmission images. Adding the information provided by dark-field images offers the chance to improve diagnostic sensitivity in detecting this potentially life-threatening disease.

SSC14-05 Low Dose Performance of a CdTe Single Photon Counting Detector and Its Application in Radiation Dose Reduction for X-ray Differential Phase Contrast Imaging

Monday, Nov. 28 11:10AM - 11:20AM Room: S404AB

Awards
Student Travel Stipend Award

Participants
Xu Ji, Madison, WI (*Presenter*) Nothing to Disclose
Yongshuai Ge, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Ran Zhang, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Ke Li, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Guang-Hong Chen, PhD, Madison, WI (*Abstract Co-Author*) Research funded, General Electric Company Research funded, Siemens AG

PURPOSE

The phase stepping method used in x-ray differential phase contrast imaging (DPCI) divides the total x-ray exposure into a series of sub-images, each with a lower photon number. Compared with conventional x-ray imaging, DPCI is more sensitive to the detector performance at low exposure levels, particularly the electronic noise performance. The purpose of this work is to investigate the potential of radiation dose reduction in DPCI using a single photon counting detector (PCD) with excellent low dose performance.

METHOD AND MATERIALS

The DPCI benchtop system used in this study includes a hospital-grade x-ray tube, three gratings, and two interchangeable x-ray detectors: one is a conventional Gadox-based energy-integrating detector (EID) with 48 um pixel pitch, the other one is a CdTe-based PCD with 100 um pixel pitch and 16 cm x 14 cm detection area (XC-FLITE X1, XCounter). Both detectors use the CMOS technology. The PCD has adjustable energy thresholds to selectively reject electronic noise. DPCI images of an ACR Mammography Accreditation Phantom were acquired, first using the EID at 100% dose level, then using the PCD at 67% reduced dose level. Image quality was quantified in terms of DQE(f) and MTF.

RESULTS

At the mammographic energy range, the PCD demonstrated nearly fourfold improvement in DQE(0) and better DQE(f) up until 4 lp/mm when compared with the EID. Although the EID has half of the pixel pitch size of the PCD, the MTF of the PCD matched that of the EID up to the Nyquist frequency. When the pixels of the EID were 2 by 2 binned to match those of PCD, the improvement in DQE(f) and MTF of PCD was more evident. In all cases, almost no dark current and electronic noise were observed. The 67% dose DPCI acquired with the PCD demonstrated equivalent low frequency performance; besides that, the high frequency performance of PCD was more favorable, as the image of the PCD demonstrated a finer texture and less blurry appearance.

CONCLUSION

Radiation dose reduction by a factor of 33% was achieved in differential phase contrast imaging by using a single photon counting detector with excellent low dose performance.

CLINICAL RELEVANCE/APPLICATION

Application of the photon counting detector technology to x-ray phase contrast imaging can reduce dose by 33% without sacrificing the image quality.

SSC14-06 Dose Reduction in Digital Breast Tomosynthesis with DOS-SPART

Monday, Nov. 28 11:20AM - 11:30AM Room: S404AB

Awards
Student Travel Stipend Award

Participants
John W. Garrett, MS, Madison, WI (*Presenter*) Nothing to Disclose
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Yongshuai Ge, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Ke Li, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Guang-Hong Chen, PhD, Madison, WI (*Abstract Co-Author*) Research funded, General Electric Company Research funded, Siemens AG

PURPOSE

The purpose of this study was to explore the dose reduction potential of the Denoised Ordered-Subset Statistically Penalized Algebraic Reconstruction Technique (DOS-SPART) in digital breast tomosynthesis (DBT).

METHOD AND MATERIALS

The DOS-SPART algorithm was adapted for use with DBT and carefully optimized using experimentally acquired phantom and cadaver breast datasets. DOS-SPART is a unique iterative reconstruction method that decouples spatial regularization and data consistency updates allowing for rapid reconstructions and application specific regularization. A 5.4 cm thick cadaver breast specimen with no known pathology was placed in a plastic container and imaged on a Hologic Selenia Dimensions DBT system at 32 kV and a range of dose levels. The reference dose (2.0 mGy mean glandular dose) was determined using the automatic exposure control; images were also acquired at 80%, 54%, 37%, and 15% of this reference dose. DBT image volumes were reconstructed at each dose level using both the commercial reconstruction engine and DOS-SPART. Spatial resolution was quantified using the full width half maximum (FWHM) of a measured profile through a microcalcification in the object. Noise performance was characterized

using the contrast-to-noise ratio (CNR) measured in a low contrast blood vessel in the breast.

RESULTS

At all dose levels, the high contrast spatial resolution attained with DOS-SPART was found to be improved relative to the full dose commercial reconstruction. Using DOS-SPART, the CNR for the vessel was improved at each dose level relative to the commercial reconstruction by an average of 41±14%. In addition, at 15% dose the measured CNR of the DOS-SPART reconstruction was still greater than the full dose reconstruction using the commercial reconstruction.

CONCLUSION

Since the major tasks of breast screening include calcification detection and low contrast mass detection, both high spatial resolution and good contrast/noise performance are crucial. The DOS-SPART reconstruction algorithm is able to maintain both spatial resolution and noise performance in DBT imaging at up to an 85% reduced dose. These results demonstrates the dose reduction potentials in DBT imaging with the DOS-SPART reconstruction method.

CLINICAL RELEVANCE/APPLICATION

With the DOS-SPART algorithm, radiation dose may be reduced by as much as 85% in digital breast tomosynthesis without sacrificing spatial resolution or noise performance.

SSC14-07 Evaluation of the Slice Sensitivity Profile for Quality Control in a Tomosynthesis Mammography Screening Trial

Monday, Nov. 28 11:30AM - 11:40AM Room: S404AB

Participants
Aili K. Maki, BEng, Toronto, ON (*Presenter*) Research collaboration, General Electric Company; Employee, Mammographic Physics, Inc
James G. Mainprize, PhD, Toronto, ON (*Abstract Co-Author*) Institutional research agreement, General Electric Company
Gordon Mawdsley, Toronto, ON (*Abstract Co-Author*) Manager, Medical Physics Incorporated Research collaboration, General Electric Company
Martin J. Yaffe, PhD, Toronto, ON (*Abstract Co-Author*) Research collaboration, General Electric Company Founder, Matakina International Ltd Shareholder, Matakina International Ltd Co-founder, Mammographic Physics Inc

PURPOSE

To ensure consistent image quality in an ongoing multivendor clinical trial of tomosynthesis mammography for breast cancer screening, a harmonized QC program was developed using specially designed phantoms. The slice-sensitivity profile (SSP) is characterized to monitor the resolution and characterize the reconstruction artifacts in the z direction.

METHOD AND MATERIALS

A modular phantom containing a grid of 0.07 mm aluminum BBs that could be positioned at different heights was imaged at 6-month intervals as part of the physics evaluation. The slice-sensitivity profile of the BBs was examined in the reconstructed volumes. The data were summarized by reporting the full-width half-maximum values (FWHM) of Gaussians fitted to the SSPs. To reduce the variability in the FWHM values caused by BBs being located away from the perpendicular ray, reconstructed volumes that use a Cartesian coordinate system (CCS) were transformed to a cone beam coordinate system (CBCS) by resampling each slice to account for the amount of geometric magnification at that height. The phantom was imaged on 6 units from 3 different vendors.

RESULTS

The average FWHM values measured in the CBCS varied from 3.0 mm (+/-0.1) to 8.7 mm (+/-0.4) depending on the machine type. The FWHM values measured in the transformed CBCS were 10-20% larger than those measured in the original CCS volumes, because the artefact spread functions are parallel to the z-axis instead of angled toward the x-ray focal spot. The coefficient of variation (COV) between the BBs in the modular phantom decreased by 76% when evaluated in the CBCS.

CONCLUSION

For robust and repeatable assessment of the SSP, resampling of the reconstructed volume into a cone-beam coordinate system is advantageous. The FWHM values are less dependent on location of the BBs within the phantoms and on the positioning of the phantom on the detector. This results in less variation between BBs within the grid-phantom and less temporal variation. Fundamental differences in acquisition geometry and reconstruction methods between different vendors systems are clearly reflected in the magnitudes of the measured FWHM values.

CLINICAL RELEVANCE/APPLICATION

A platform-independent QC program is fundamental to ensuring consistent clinical image quality for DBT. Robust and repeatable assessment of the artefact spread function in the reconstructed volume will help monitor and assess system performance.

SSC14-08 Advances in Dark-Field Mammography: Breast Microcalcification Assessment

Monday, Nov. 28 11:40AM - 11:50AM Room: S404AB

Participants
Konstantin Willer, Garching, Germany (*Presenter*) Nothing to Disclose
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Michael Chabior, Garching, Germany (*Abstract Co-Author*) Nothing to Disclose
Julia Herzen, Garching, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To reduce the number of invasive procedures associated with breast microcalcification biopsies, by improving and refining conventional BIRADS microcalcification assessment with dark-field mammography.

METHOD AND MATERIALS

The institutional review board (IRB) has approved this study. A dedicated grating-based radiography setup (Mo-target, 40 keV, 70 mA) was used to investigate one breast mastectomy and 31 biopsies with dark-field mammography. By comparing the absorption and scattering properties of microcalcifications clusters, information on the interior morphology on the micron-scale can be retrieved in a non-invasive manner. Insights underlying the micromorphological nature of breast calcifications were verified by comprehensive high-resolution micro-CT measurements.

RESULTS

Dark-field mammography allows a micro-structural rather than chemical classification (as hypothesized by recent literature) of breast microcalcification as ultra-fine, fine, pleomorphic and coarse textured using conventional detectors. Dark-field mammography is thereby highly sensitive to minor structural deviations. Finally, the microtexture of microcalcifications may be an indicator for tissue malignancy.

CONCLUSION

Our results demonstrate that dark-field mammography yields the potential to enhance diagnostic validity of current microcalcification analysis - which is yet limited to the exterior appearance of microcalcification clusters - and thereby reduce the number of invasive procedures.

CLINICAL RELEVANCE/APPLICATION

Assuming large-area gratings, dark-field mammography has great potential for an application in future clinical routines as it expands conventional transmission based mammography by diagnostic valuable information about morphological properties. We believe it plays a decisive role in future breast cancer diagnosis.

SSC14-09 Theoretical Investigation of the Noise Performance of Polycrystalline Silicon Active Pixel Arrays

Monday, Nov. 28 11:50AM - 12:00PM Room: S404AB

Participants
Martin Koniczek, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Albert K. Liang, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Larry E. Antonuk, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Youcef El-Mohri, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Qihua Zhao, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Diagnostic and interventional x-ray imaging has greatly benefited from the adoption of active matrix, flat-panel imagers (AMFPIs), which incorporate a single thin-film transistor (TFT) per pixel. However, the DQE of AMFPIs at low exposures, such as those encountered in fluoroscopy and digital breast tomosynthesis (DBT), degrades due to the modest signal generated per interacting x-ray relative to electronic additive noise levels of ~1000 e, or greater. One strategy to overcome this limitation, while maintaining large-area capabilities, is to introduce an amplifier circuit based on low-temperature polycrystalline silicon (poly-Si) TFTs to each pixel. Such circuits, referred to as active pixels (AP), decouple pixel reset from readout, allowing correlated multiple sampling. Both amplification and multiple sampling can reduce noise and thus restore DQE at low exposures.

METHOD AND MATERIALS

The signal and noise performance of several single- and two-stage AP designs were explored through circuit simulations. Fluoroscopic operation of a 20×20 cm2 indirect-detection array configuration with a pitch of 150 µm at 30 image frames per second is assumed. Photodiode shot noise as well as resistor and TFT thermal noise were based on established theoretical models, while flicker noise characteristics of the poly-Si TFTs were modeled based on empirical measurements.

RESULTS

A strong dependence of both TFT flicker and thermal noise on the pixel circuit design, operating voltages, and the number of samples is observed. TFT flicker noise is generally found to be the dominant noise source. While for the best single-stage amplifier design, total noise performance is found to be only slightly better than the expected electronic additive noise of comparable single-TFT AMFPIs, the best two-stage amplifier design exhibits significantly better noise performance with values below 400 e.

CONCLUSION

A methodology based on circuit simulations allowing comprehensive exploration of signal and noise characteristics of poly-Si AP arrays is reported. The results suggest significant reduction of electronic noise through signal amplification and multiple sampling.

CLINICAL RELEVANCE/APPLICATION

Active pixel arrays based on poly-Si promise reduction in electronic noise, allowing operation at lower exposures in fluoroscopy and DBT compared to current flat-panel imagers.

SSC15

Radiation Oncology (Gynecologic)

Monday, Nov. 28 10:30AM - 12:00PM Room: S104A

GU OB OI RO

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

FDA Discussions may include off-label uses.

Participants
Jerry J. Jaboin, MD, PhD, St. Louis, MO (*Moderator*) Nothing to Disclose
Tracy M. Sherertz, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSC15-01 Evaluation of Therapeutic Response to Concurrent Chemoradiotherapy in Patients With Advanced Cervical Squamous Carcinoma Using Dynamic Contrast-Enhanced MR Imaging

Monday, Nov. 28 10:30AM - 10:40AM Room: S104A

Participants
Yue Dong, Shen Yang, China (*Presenter*) Nothing to Disclose
Zao H. Zhang, Shen Yang, China (*Abstract Co-Author*) Nothing to Disclose
Shuai He, Shen Yang, China (*Abstract Co-Author*) Nothing to Disclose
Yahong Luo, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the changes of dynamic contrast-enhanced MR imaging (DCE-MRI) parameters in the patients with advanced cervical squamous carcinoma before and after concurrent chemo-radiotherapy (CCRT), and to correlate the parameters with final tumour response to therapy.

METHOD AND MATERIALS

Forty-five patients with advanced cervical squamous cancer underwent DW-MRI before CCRT (preTx), 4 weeks (postT1) after initiating treatment and at 1 month (postT2) after the end of treatment. DCE-MRI was obtained using a 3D fast field echo sequence in the axial plane (TR/TE 3.6/1.8 ms, flip angle 15°, acquisition time 5 min). Images were obtained immediately after a bolus injection of gadolinium DTPA (Magnevis,GE) at a rate of 3 ml/s. Pharmacokinetic analysis was performed according to extended tofts model, and the following quantitative parameters were calculated:volume transfer constant (Ktrans), rate constant (kep) and fraction of extravascular extracellular volume (Ve). DCE-MRI parameters were calculated in the tumour and normal myometrium. Final response to treatment as determined by changes in tumour size and volume was correlated with pre-treatment DCE-MRI parameters at each point.

RESULTS

Before therapy, the mean values of Ktrans , kep and Ve in the tumors were significantly lower than those in the myometrium ($P<0.05$). DCE-MRI parameters in the tumors showed significantly increased changes in response to CCRT ($P<0.05$) and in particular Ktrans and Ve demonstrated early significant increase (postT1) ($P<0.01$), but those in normal myometrium did not show a significant difference ($P>0.05$). Ktrans of the tumors at (preTx) was statistically associated with tumour size or volume change at postT1 and postT2. Changes of of Ktrans and kep in tumor at postT1 had a significant correlation with tumor size and volume change at postT2.

CONCLUSION

DCE-MRI parameters may help evaluate early changes of cervical squamous cancer to CCRT.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI parameters, as early biomarkers, have the potential to evaluate therapeutic responses to CCRT in advanced cervical squamous cancers.

SSC15-02 Prediction of Patient Outcome in Locally Advanced Cervical Carcinoma Following Chemo-radiation - Comparative Effectiveness of Qualitative Response Assessment Interpretation Criteria using MRI and 18F-FDG PET-CT

Monday, Nov. 28 10:40AM - 10:50AM Room: S104A

Participants
Andrew F. Scarsbrook, FRCR, Leeds, United Kingdom (*Presenter*) Nothing to Disclose
Sriram Vaidyanathan, MD,FRCR, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Fahmid Chowdhury, MBBS, FRCR, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sarah E. Swift, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Rachel Cooper, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Chirag Patel, FRCR, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluation of a qualitative response assessment scoring system at MRI and 18F-FDG PET-CT following chemo-radiation for locally advanced cervical carcinoma and correlation with patient outcome.

METHOD AND MATERIALS

77 patients with locally advanced cervical carcinoma treated with radical chemo-radiotherapy (CRT) in a single center (2011-2014) underwent MRI and 18F-FDG PET-CT 3 months post therapy. Tumor response at MRI was assessed using a 3-point scale based on residual T2-weighted signal intensity. Metabolic response at PET-CT was assessed using a 5-point scale ranging from background activity to progressive metabolic disease. Clinical and radiologic follow-up was performed in all patients (minimum 18 months). Progression-free (PFS) and overall survival (OS) was calculated using the Kaplan-Meier method (Mantel-Cox log-rank) and groups responses were correlated using Chi2 test.

RESULTS

Of 77 patients with median (range) age of 45 (24-75) years, 39 (51%) had complete response (CR) on MRI (Score M1), 10 relapsed (26%). Of 29 with complete metabolic response (CMR, Score P1/2) on PET, 2 (7%) recurred. Of 21 patients with CR on MRI and PET-CT, 2 relapsed (10%). Of 32 patients (42%) with partial response (PR) at MRI (Score M2), 15 relapsed (47%). All 8 patients with M2 and negative PET-CT remained disease free at follow-up. Of 38 patients (49%) with indeterminate uptake on PET (Score P3/4), 19 relapsed (50%). Recurrence was lower in patients with M1 (6/15, 40%) compared to M2 (11/21, 52%). 5/6 patients (83%) with significant signal intensity at MRI (Score M3) relapsed. PET-CT demonstrated progressive disease (PD, Score P5) in 9 patients (12%). Kaplan-Meier analysis demonstrated a highly statistically significant difference in PFS and OS between patients with CMR, indeterminate uptake, PMR and PD (Log-rank, $P < 0.0001$). Chi2 test demonstrated a highly statistically significant association between increasing qualitative score and risk of recurrence or death ($P<0.001$).

CONCLUSION

MRI and PET-CT provide complementary information post CRT in locally advanced cervical cancer. Qualitative scoring systems in this clinical scenario predict outcome and may help guide further patient management.

CLINICAL RELEVANCE/APPLICATION

In the era of precision medicine, objective MRI and PET-CT response assessment criteria may help guide an individualized approach to subsequent patient management in locally advanced cervical cancer.

SSC15-03 Concurrent Chemoradiotherapy Using Daily Low-Dose Cisplatin for Extrapelvic Lymph Node Recurrences after Curative Treatment for Cervical Cancer: Clinical Outcomes and in Vitro Study

Monday, Nov. 28 10:50AM - 11:00AM Room: S104A

Participants
Aki Kanazawa, Chiba, Japan (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To investigate the clinical outcomes of radiotherapy for extrapelvic lymph node recurrences after curative treatment for cervical cancer and discuss the results of our in vitro study on the effectiveness of concurrent chemoradiotherapy.Materials/Methods: A total of 20 patients, aged 29-75, who underwent radiotherapy for lymph node recurrence from 2002 and 2015 were included. The location of recurrence was para-aortic lymph node in 7, supraclavicular in 8, mediastinal in 1, supraclavicular + mediastinal in 2, and supraclavicular + para-aortic in 2 patients. The histology was squamous cell carcinoma, adenocarcinoma, adenosquamous cell carcinoma in 12, 7, 1 patient. The median total radiation dose (EQD2) was 50 Gy. Thirteen patients received concurrent chemoradiotherapy with daily low-dose cisplatin (median 8 mg/m2 per day). In addition, in vitro study was conducted; HeLa-S3 cells after exposing radiation with different doses of cisplatin were cultured and 3H-thymidine uptake was measured.Results: Local responses immediately following radiotherapy were CR in 13 patients and PR in 3 (80%). Treatment was well tolerated, with no GI/mucosal toxicity, 35% grade 3-4 leukopenia, and 25% grade 3-4 thrombocytopenia. With median follow-up period of 17 months, the 2-year local control rate was 45% and the 3-year overall survival rate was 43%. Four patients are still alive without disease over 5 years. Recurrence was observed at the field margin in 3, in-field in 9, both in and out of field in 3 patients. Neither use of chemotherapy nor dose over 50 Gy affected overall survival. A shorter interval between initial treatment and first recurrence had marginal impact on patient's poor prognosis; patients with NED vs. others: 18 months vs. 6 months. In vitro study demonstrated that exposure to blood cisplatin levels of =2.5 mg/mL had a synergistic effect in the radiation and low-dose cisplatin.Conclusion: Radiotherapy for extrapelvic lymph node recurrences after curative treatment for cervical cancer could lead to long-term survival for some patients. In vitro study using HeLa-S3 cells supported the use of concurrent administration of low-dose cisplatin with radiation therapy.

SSC15-04 Metabolic Response on Post-treatment 18F-FDG PET/CT to Predict Local Control and Survival Outcomes in Vulvar Cancer

Monday, Nov. 28 11:00AM - 11:10AM Room: S104A

Awards
Trainee Research Prize - Medical Student

Participants
Comron J. Hassanzadeh, Kansas City, MO (*Presenter*) Nothing to Disclose
Yuan J. Rao, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the response to therapy for vulvar carcinoma using post-therapy imaging with F-18 fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) and compare the metabolic response to local regional control and survival outcomes.

METHOD AND MATERIALS

This was a retrospective study of 23 women with vulvar cancer. Radiation intent was definitive in 12 patients (52%), adjuvant radiation after surgery in 8 patients (35%), and neoadjuvant radiation prior to surgery in 3 patients (13%). All patients received intensity modulated radiation treatment to a mean dose of 55.6 Gy (range 49.6 to 70 Gy). Prior to any treatment, all patients received a staging FDG-PET/CT. Post-treatment whole body FDG-PET/CT was performed at 0.2 to 7 months (median 2.5 months) after completion of radiation therapy.

RESULTS

The post-treatment FDG-PET showed no evidence of disease (complete metabolic response) in 13 patients. Residual disease or progressive disease on FDG-PET was seen in 10 patients. A Cox proportional hazards model of clinical outcome indicated that post-treatment PET response was the most significant predictor of biopsy-proven local-regional control (HR=8.89, 95% CI 1.8-43.9, p=0.01) and overall survival (HR 9.16, 95% CI 1.05-79.6, p=0.045) compared to other prognostic parameters. The 2-year local-regional control rate was 90% for patients with no evidence of disease vs. 22.5% for patients with residual or progressive disease on post-treatment PET. The 2 year overall survival was 100% for patients with no evidence of disease vs. 42.8% for patients with residual or progressive disease.

CONCLUSION

In this single-institution study of women with vulvar cancer, the post-treatment FDG response on whole-body FDG-PET/CT was predictive of local regional control and survival.

CLINICAL RELEVANCE/APPLICATION

Post-treatment 18F-FDG PET/CT may help physicians identify a subset of patients diagnosed with vulvar cancer at a higher risk of recurrence who may benefit from salvage therapy, such as surgery or radiation.

SSC15-06 Pelvic Bone Marrow Sparing in Volumetric Modulated Arc Therapy Reduced the Hematologic Toxicity for Cervical Cancer

Monday, Nov. 28 11:20AM - 11:30AM Room: S104A

Participants
Yao Sun, Oak Brook, IL (*Presenter*) Nothing to Disclose
Zhiyong Yuan, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
zhen tao, tianjin, China (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To determine if bone marrow sparing (BMS) in volumetric modulated arc therapy (VMAT) reduce the hematologic toxicity compared with VMAT without BMS.Materials/Methods: Two groups of 10+ patients with cervical cancer at our institution were enrolled respectively. All the patients received postoperative VMAT to 50.4Gy to the pelvic lymphatics and vagina. All plans were generated using our in-house-developed automatic inverse planning (AIP) algorithm. One group was treated with BMS-VMAT, while the other group was treated with VMAT without BMS. Planning objectives for PTV were minimum dose =95%, maximum dose= 107%,. The pelvic bone marrow (PBM) was limited to V5 t-test. The X2test was used to compare rates of hematologic toxicity.Results: All the patients were clinical stage IA2-IIA. The median age was 54 years old. After radical hysterectomy, eleven patients were diagnosed to have lymphovascular space involvement (LVSI); 5 patients had primary tumor size larger than 4cm; 9 patients had more than a third of stromal invasion. No patients had positive lymph node, parametria or positive surgical margins. The two groups resulted in equivalent homogeneity (1.07±1.2% vs 1.10±3.1%; P=0.210) and conformity index (0.842± 2.7% vs 0.827±1.2%; P=0.444). The PBM dose metrics showed a significant decrease in V5 (83.1%±3.2% vs 89.0%±0.8%; P=0.037) and V10 (74.8%±1.6% vs 82.3%± 2.1%; P=0.008) in the BMS-VMAT group compared to the VMAT group. However, V30 and V40 of PBM dose metrics were not significantly different between the two groups. The nadir for WCC (P=0.008) and ANC (P=0.004) were significantly reduced in the VMAT group compared to the BMS-VMAT group. In the BMS-VMAT group, 16.7% had grade 2 or higher hematologic toxicity (HT) compared with 56.7% in the VMAT group (P=0.036).Conclusion: BMS-VMAT reduced irradiation of PBM compared to VMAT without BMS, especially in the low dose radiation (V5 and V10). This analysis supports the hypothesis that low dose radiation of PBM is associated with acute HT during postoperative radiotherapy for cervical cancer. Techniques to limit pelvic bone marrow irradiation can reduce HT in cervical cancer patients.

SSC15-07 Incidence and Prognostic Value of NFkB-p65 Nuclear Versus Cytoplasmic Expression in Locally Advanced Cervical Cancer Patients Treated Definitively with Concurrent Chemoradiation

Monday, Nov. 28 11:30AM - 11:40AM Room: S104A

Participants
Darlene G. Attiah, MS, Chicago, IL (*Presenter*) Nothing to Disclose
Tamer Refaat Abdelrhman, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Irene Helenowksi, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Jonathan B. Strauss, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
William Small JR, MD, Maywood, IL (*Abstract Co-Author*) Speakers Bureau, Carl Zeiss AG; Advisory Board, Varian Medical Systems, Inc
Eric D. Donnelly, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study aims to report the incidence of NFkB-p65 nuclear versus cytoplasmic over-expression in locally advanced cervical cancer patients treated definitively with concurrent chemoradiation therapy (CRT) and their respective prognostic values on treatment outcomes.

METHOD AND MATERIALS

This IRB approved retrospective study included locally advanced cervical cancer patients, stages IB1 through IVA treated definitively with CRT. Evaluation of both nuclear and cytoplasmic immunoreactivity for NFkB-p65 was performed applying the same immunohistochemistry staining protocol reported by Garg et al. and scored quantitatively by 3 pathologists blinded to the treatment outcomes. Overall survival (OS), progression free survival (PFS), local regional control (LC), and distant metastases free survival (DMFS) rates were obtained via the Kaplan-Meier method and differences between groups were evaluated by the Log-Rank test.

RESULTS

The study evaluated 28 eligible patients with a median age of 51 ± 10 years. None of the patients expressed pretreatment NFkB-p65 nuclear immunoreactivity, whereas 15 (53.6%) and 13(46.4%) had cytoplasmic expression with a recurrence H-index ≥180 and <180, respectively. For patients with pretreatment cytoplasmic NFKB H-index ≥180, and <180, the 5-year OS were 49.45% and 64.10% (P-Value = 0.34), PFS were 39.29% and 57.69% (P-value = 0.21), LC were 78.57% and 69.23% (P-value = 0.86), and DMFS were 49.11% and 76.92% (P-value = 0.18), respectively.

CONCLUSION

This study demonstrated that NFkB-p65 have a significantly higher incidence of cytoplasmic versus nuclear expression. Cytoplasmic NFkB-p65 over-expression (H-index ≥180) was associated with a non-statistically significant trend towards poor clinical outcomes in locally advanced cervical cancer patients treated definitively with CRT.

CLINICAL RELEVANCE/APPLICATION

NFkB-p65 have a significantly higher incidence of cytoplasmic versus nuclear expression, and did not demonstrate significant association with treatment outcomes in locally advanced cervical cancer patients treated definitively with CRT.

SSC15-08 Outcomes of a Single Institution Study of Radiation Sandwiched between 6 Cycles of Chemotherapy for Surgically Staged High-Risk Endometrioid Adenocarcinoma

Monday, Nov. 28 11:40AM - 11:50AM Room: S104A

Awards
Student Travel Stipend Award

Participants
Sujith Baliga, MD, New York , NY (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The optimal treatment modality for patients with high-risk endometrial cancers, including the sequencing of radiation and chemotherapy, is not yet well established. Here we report our experience of radiation "sandwiched" between 6 cycles of chemotherapy for patients with surgically staged high-risk endometrioid adenocarcinoma (EA). Materials/Methods: From April 2010 – June 2014, 27 patients with Stage IA-IVB histologically confirmed high-risk EA were treated with a combination of adjuvant sandwich chemoradiation. Inclusion criteria include patients with histologically documented EA defined by the following: IA Grade 3 with LVSI, IB G2 or IB G3, any surgical Stage II or Stage III disease, and any surgical Stage IV disease with no residual macroscopic tumor. Chemotherapy consisted of a combination of Carboplatin (AUC 6 pre-RT and AUC 5 post-RT) and Paclitaxel (175 mg/m2). Chemotherapy was administered every 21 days for 3 cycles, followed by a planned chemotherapy break during which external beam radiotherapy (EBRT) and 3 high dose rate (HDR) brachytherapy vaginal cylinder treatments were sequentially delivered. Chemotherapy was resumed after the completion of EBRT and typically overlapped with the HDR brachytherapy. Post-RT chemotherapy was administered for 3 cycles. EBRT consisted of 45 Gy to the pelvis utilizing IMRT, and extended field RT (EFRT), to include the para-aortic (PA) nodes, was used if 2 or more pelvic lymph nodes were involved or if there was PA disease. RTOG toxicity criteria were used to calculate the cumulative gastrointestinal (GI), genitourinary (GU), and hematologic toxicity. Results: Mean age of our cohort at diagnosis was 58 years. The median follow up was 25 months. 7 patients had Stage I disease (25%), 5 patients had Stage II disease (17.9%), 4 patients had Stage IIIA disease (14.3%), 6 patients had Stage IIIC1 disease (25%), 4 patients had Stage IIIC2 disease (14.3%) and 1 patient had Stage IVB disease (3.6%). There were no local or distant failures in our cohort. The rate of acute Grade 2 GI and GU toxicity was 10.7% and 0%, respectively. Acute grade 3 GI toxicity occurred in 1 patient (3.6%). The rate of late grade 3 GU or GI toxicity was 3.6% and 3.6%, respectively. The rate of acute grade 3 thrombocytopenia, anemia, and neutropenia were 7.1%, 3.6%, and 35.7%, respectively. 7.1% of patients required chemotherapy dose reduction and 17.9% of patients required cycle delay. Conclusion: In patients with high risk EA, adjuvant sandwich chemoradiation results in excellent loco-regional and distant control with acceptable toxicity.

SSC16

Vascular Interventional (Percutaneous Ablation Outside of the Liver)

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

IR US

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

FDA Discussions may include off-label uses.

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

Sub-Events

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

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

Awards
Student Travel Stipend Award

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

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

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/

Damian E. Dupuy, MD - 2012 Honored Educator

SSC16-02 Percutaneous CT-Guided Renal Cryoablation: A Long-Term Follow-up and Low Morbidity for Nearly Any Tumor Location

Monday, Nov. 28 10:40AM - 10:50AM Room: E352

Participants
Hussein D. Aoun, MD, Dearborn, MI (*Abstract Co-Author*) Nothing to Disclose
Peter J. Littrup, MD, Providence, RI (*Abstract Co-Author*) Founder, CryoMedix, LLC; Research Grant, Galil Medical Ltd; Research Grant, Endo International plc; Consultant, Delphinus Medical Technologies, Inc
Barbara A. Adam, MSN, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Mohamed M. Jaber, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Fatima Memon, MD, Detroit, MI (*Presenter*) Nothing to Disclose
Matthew Prus, BS, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Mark J. Krycia, BS, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

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

Monday, Nov. 28 10:50AM - 11:00AM Room: E352

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

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

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

Monday, Nov. 28 11:00AM - 11:10AM Room: E352

Participants
Eun-Joo Park, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Yun Deok Ahn, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yuri Cheon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Young Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

For an alternative of cancer treatment, combined therapy of FUS and chemo-agent has promising potential.

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

Monday, Nov. 28 11:10AM - 11:20AM Room: E352

Awards
Student Travel Stipend Award

Participants
Paige N. Hopewell, MD, PhD, Louisville, KY (*Presenter*) Nothing to Disclose
Brittany J. Schulz, MD, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
Tracy L. Van Meter, MD, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
Robert Martin, Louisville, KY (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Coldwell, MD, PhD, Louisville, KY (*Abstract Co-Author*) Consultant, Sirtex Medical Ltd Consultant, DFINE, Inc

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

Between 3/2011-11/2015, 36 patients were eligible for retrospective review. Vasculature abnormalities were the most common finding (51% of the total occurrences, 23/36 patients) including post-procedural narrowing (50%), pseudoaneurysm formation

(22%), occlusion of a major peripancreatic vessel (17%), and splenic infarct (11%).

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

SSC16-06 Percutaneous Image-Guided Cryoablation of T1 Renal Cell Carcinoma: Outcomes in 285 Patients

Monday, Nov. 28 11:20AM - 11:30AM Room: E352

Participants
Farzad Sedaghat, MD, Boston, MA (*Presenter*) Nothing to Disclose
Kemal Tuncali, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul B. Shyn, MD, Boston, MA (*Abstract Co-Author*) Research Consultant, Galil Medical Ltd; Research Grant, Siemens AG
Servet Tatli, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Vincent M. Levesque, MA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stuart G. Silverman, MD, Brookline, MA (*Abstract Co-Author*) Author, Wolters Kluwer nv

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

Image-guided cryoablation is clinically efficacious and a viable alternative to partial nephrectomy.

SSC16-07 Percutaneous Soft Tissue Cryoablation of the Head and Neck: A Safe and Effective Treatment Option

Monday, Nov. 28 11:30AM - 11:40AM Room: E352

Participants
Hussein D. Aoun, MD, Dearborn, MI (*Abstract Co-Author*) Nothing to Disclose
Salah Abdelhadi, MD, Detroit, MI (*Presenter*) Nothing to Disclose
Peter J. Littrup, MD, Providence, RI (*Abstract Co-Author*) Founder, CryoMedix, LLC; Research Grant, Galil Medical Ltd; Research Grant, Endo International plc; Consultant, Delphinus Medical Technologies, Inc
Barbara A. Adam, MSN, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Matthew Prus, BS, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

Percutaneous cryoablation was performed under conscious sedation, with only one patient requiring intubation due to anticipated

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

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

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

Participants
Nour-Eldin A. Nour-Eldin, MD,PhD, Frankfurt Am Main, Germany (*Presenter*) Nothing to Disclose
Benjamin Kaltenbach, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Mohammed A. Alsubhi, BMBS, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the value contrast enhanced (CE-MRI) follow-up in the assessment of tumor response of microwave (MW) ablated pulmonary metastases by correlating the results with CE-CT.

METHOD AND MATERIALS

This prospective study included 130 ablation sessions for pulmonary metastases in 80 patients. CE-MRI Chest scanning was performed 1week before the ablation and at 24hours, 3, 6, 9 and12months post ablation. Thin section CT Volumetric measurement of the lesions was performed at the same time periods as a second parameter for comparison. The lesion MRI enhancement intensity in each study was estimated, and the ratio to the paraspinal muscle enhancement intensity at the same level was measured (Lesion Muscle Signal (LMS ratio).The correlations between post ablation follow-up CT volume of tumors and CE-MRI LMS ratio at the follow-up periods were assessed.

RESULTS

The preablation tumor volumes range: 0.30-6.1cm (mean: 1.5cm^3, SD:1.3). LMS ratio < 1was associated with post ablation reduction of tumor volume (denoting scaring),while LMS ratio>1were noted in: preablation due to high contrast enhancement of the tumor,in24h post ablation due to the inflammatory response associated with the thermal ablation and due to tumor residue or progress. Weak correlation was detected between the LMS-ratios and CT-volumetric changes in 24h post ablation. Strong correlation between the LMS ratios was estimated between the follow up periods of 3months(SpearmanR:0.62,p=0.0021),6months (SpearmanR:0.66,p=0.001),9months(SpearmanR:0.61,p<0.001)and 12months (Spearman R:0.7, p<0.00001).

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

CE-MRI may be used for the evaluation of tumor response post pulmonary ablation therapy.

RCA23

3D Printing (Mimics) (Hands-on)

Monday, Nov. 28 12:30PM - 2:00PM Room: S401AB

IN

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

Participants

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Ai-Li Wang, Ottawa, ON (*Presenter*) Nothing to Disclose
Ekin P. Akyuz, BSc, Ottawa, ON (*Presenter*) Nothing to Disclose
Nicole Wake, MS, New York, NY, (nicole.wake@med.nyu.edu) (*Presenter*) Nothing to Disclose
Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Gerald T. Grant, MD, MS, Louisville, KY (*Presenter*) Nothing to Disclose
Satheesh Krishna, MD, Ottawa, ON, (dr.satheeshkrishna@gmail.com) (*Presenter*) Nothing to Disclose
John P. Lichtenberger III, MD, Bethesda, MD, (john.lichtenberger@usuhs.edu) (*Presenter*) Author, Reed Elsevier
Ashish Gupta, MD, Ottawa, ON (*Presenter*) Grant, Medtronic plc
Elizabeth George, MD, Boston, MA (*Presenter*) Nothing to Disclose
Jane S. Matsumoto, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Amy E. Alexander, BEng, Rochester, MN (*Presenter*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with the computational processing of cross-sectional images required to enable 3D printing using practical examples. 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' refers to fabrication of a tangible object from a digital file by a 3D printer. Materials are deposited layer-by-layer and then fused to form the final object. There are several 3D printing technologies that share similarities but differ in speed, cost, and resolution of the product. Digital Imaging and Communications in Medicine (DICOM) image files cannot be used directly for 3D printing; further steps are necessary to make them readable by 3D printers. 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. 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/

Frank J. Rybicki III, MD, PhD - 2016 Honored Educator

RCB23

Using Keynote: An Alternative to Power Point (Hands-on)

Monday, Nov. 28 12:30PM - 2:00PM Room: S401CD

ED IN

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

Participants
Shawn D. Teague, MD, Denver, CO, (sdteague@gmail.com) (*Presenter*) Stockholder, Apple Inc

LEARNING OBJECTIVES

1) Modify the master slides used in a template. 2) Change the aspect ratio for a presentation from 4:3 to 16:9. 3) Utilize movies in a presentation.

ABSTRACT

RCC23

3D Printing: Clinical Applications I

Monday, Nov. 28 12:30PM - 2:00PM Room: S501ABC

CA NR ED IN

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

Participants
Shi-Joon Yoo, MD, Toronto, ON (*Moderator*) Owner, 3D HOPE Medical; CEO, IMIB-CHD;
John P. Lichtenberger III, MD, Bethesda, MD (*Moderator*) Author, Reed Elsevier

LEARNING OBJECTIVES

Sub-Events

RCC23A Introduction to 3D Printing

Participants
J. Elliott Brown, MD, New Haven, CT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

Define 3D Printing and understand the basic terminologyUnderstand the steps to 3D printingUnderstand the software that can be used to prepare a 3D print

ABSTRACT

Active Handout:J. Elliott Brown

http://abstract.rsna.org/uploads/2016/16005043/RCC23A RSNA handout Intro to 3D printing.pdf

RCC23B Role of 3D Printing in Congenital Heart Disease

Participants
Shi-Joon Yoo, MD, Toronto, ON (*Presenter*) Owner, 3D HOPE Medical; CEO, IMIB-CHD;

LEARNING OBJECTIVES

1) Understand 3D printing process for heart models. 2) Know how 3D printing helps pediatric cardiac surgery, with case examples. 3) Know the future directions of 3D printing for cardiac surgery.

ABSTRACT

Using rapid prototyping or 3D printing, physical replicas of the hearts can be provided to surgeons before their surgical decision and procedure. The replicas fill the gap between the imagination from the medical images and the reality. By having the replicas in hands, the surgeons can make optimum surgical decision and simulate the intended procedures on the replica prior to the procedure. This allows precise surgical procedures with reduced procedure and anasthesia time. In cases in the grey zone for biventricular versus univentricular repair, the replicas are tremendously helpful in a binary decision. The presentation will include a few clincal cases where 3D printing played a crucial role in surgical decision making.

RCC23C 3D Printing in Maxillofacial/ Orthopedic Surgery

Participants
Edward J. Caterson, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

RCC23D Creating a 3D Printing Lab in Radiology

Participants
Kent R. Thielen, MD, Rochester, MN, (thielen.kent@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Gain basic understanding of the resources and infrastructure utilized in creating a collaborative 3D Printing Lab in Radiology. 2) Understand potential patient and organizational benefits of a centralized 3D Printing Lab. 3) Recognize potential limitations / barriers to creating a centralized 3D Printing Lab.

ABSTRACT

MSAS23

Quality of Healthcare-Current and Future Models of Improvement (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Monday, Nov. 28 1:30PM - 3:00PM Room: S105AB

SQ

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

Participants
Steven P. DeColle, Edmonton, AB (*Moderator*) Nothing to Disclose
Dana Aragon, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose

Sub-Events

MSAS23A Do You See What I See-Improving Patient Outcomes through Peer Learning

Participants
Susan Walker, Edmonton, AB (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define key components of our successful Quality Assurance Program. 2) Understand lessons learned. 3) Recognize the possibilities with a successful Quality Assurance program.

ABSTRACT

Alberta Health Services (AHS) is Canada's largest province wide, fully-integrated health system, responsible for delivering health services to the over four million people living in Alberta. AHS has implemented a province-wide Quality Assurance program within Diagnostic Imaging including over 130 sites. Radiologists and technologists perform peer learning on randomly selected, de-identified exams from across the province. The goal of the program is to reduce errors and increase quality and patient outcomes through education. This presentation will share our key components of success, lessons learned and the future possibilities of where the program can take improving patient outcomes.

MSAS23B Best Practices in Digital Radiography

Participants
Tracy Herrmann, MEd, RT, Cincinnati, OH, (tracy.herrmann@uc.edu) (*Presenter*) Spouse, Employee, Siemens AG

LEARNING OBJECTIVES

1) Describe social marketing and radiation safety initiatives. 2) Recommend practices necessary to optimize exposure technique and minimize exposure to the patient before, during and after the digital radiography examination. 3) Identify special considerations for digital imaging of pediatric patients. 4) Promote collaboration and radiation safety in the workplace.

ABSTRACT

Digital image receptors provide the opportunity for efficient and dynamic practices in medical radiography. However, digital imaging technology also permits overexposure to the patient with little to no effect on image quality. This presentation will describe social marketing and radiation safety initiatives designed to decrease patient dose in computed radiography (CR) and flat panel digital radiography (DR) while maintaining optimal image quality. Best practices before, during and after the digital radiography examination for both pediatric and adult imaging will be shared. Participants will examine collaborative best practices to promote at their workplace.

MSCT21

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

Monday, Nov. 28 1:30PM - 3:00PM Room: S100AB

CH

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

Participants
Diana Litmanovich, MD, Haifa, Israel, (dlitmano@bidmc.harvard.edu) (*Director*) Nothing to Disclose

Sub-Events

MSCT21A Congenital Thoracic Pathology

Participants
Edward Y. Lee, MD, MPH, Boston, MA, (Edward.Lee@childrens.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss various congenital thoracic pathology that occurs in children. 2) Review imaging modalities for evaluating congenital thoracic pathology in children. 3) Learn characteristic imaging findings of congenital thoracic pathology in children.

MSCT21B Smoking Related Lung Disease

Participants
Brent Little, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the typical imaging appearances of smoking related lung disease, with attention to computed tomography. 2) Appreciate both "classic" and more recently described smoking related lung diseases, with a focus on problem solving and differential considerations.

ABSTRACT

MSCT21C Pulmonary Infections

Participants
Christian J. Herold, MD, Vienna, Austria (*Presenter*) Research Grant, Siemens AG; Research Grant, Bayer AG; Research Grant, Agfa-Gevaert Group; Research Grant, Bracco Group; Research Grant, Guerbet SA; Speakers Bureau, Bayer AG; Speakers Bureau, Bracco Group; Stockholder, Hologic, Inc

LEARNING OBJECTIVES

1) Discuss, in a case-based review, the etiologic, clinical, and microbiologic factors that influence the presentation of pulmonary infections. 2) Illustrate typical and atypical presentations of pulmonary infections at imaging. 3) Understand the spectrum of non-infectious entities that potentially mimic pulmonary infections. 4) Utilize all available clinical and radiologic information to arrive at a comprehensive diagnosis when pulmonary infection is suspected.

MSMC23

Cardiac CT Mentored Case Review: Part III (In Conjunction with the North American Society for Cardiovascular Imaging) (An Interactive Session)

Monday, Nov. 28 1:30PM - 3:00PM Room: S406A

CA CH CT

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

Participants
Jill E. Jacobs, MD, New York, NY (*Director*) Nothing to Disclose
Elliot K. Fishman, MD, Baltimore, MD, (efishman@jhmi.edu) (*Moderator*) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company;
U. Joseph Schoepf, MD, Charleston, SC, (schoepf@musc.edu) (*Moderator*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; Consultant, Guerbet SA; ; ;

LEARNING OBJECTIVES

1) Identify cardiac and coronary artery anatomy. 2) Recognize cardiac disease processes, including coronary atherosclerosis, as diagnosed on CT. 3) Understand methods of cardiac CT and coronary CT angiography post-processing.4)understand the role of coronary artery calcium scoring

ABSTRACT

Sub-Events

MSMC23A Pulmonary Veins and Pericardial Disease

Participants
Jacobo Kirsch, MD, Weston, FL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe normal versus anomalous pulmonary venous anatomy. 2) Understand the imaging findings of complications of ablation for atrial fibrillation. 3) Describe abnormalities of the pulmonary veins identifiable on routine CT. 4) Identify the most common pericardial abnormalities evaluated with CT.

Honored Educators

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Jacobo Kirsch, MD - 2013 Honored Educator

MSMC23B Coronary Atherosclerosis III

Participants
Elliot K. Fishman, MD, Baltimore, MD (*Presenter*) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company;

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

The goal of this session is to learn how to interpret pathology involving the coronary arteries beyond the detection of coronary artery stenosis. Focus on exam acquisition protocols, study interpretation protocols, and minimizing radiation dose are addressed. Specific topics addressed will also include coronary artery aneurysm, myocardial bridging, anomalous coronary arteries as well as vasculitis. Potential pitfalls will be addressed and pearls for study optimization will also be discussed.

Honored Educators

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Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
Elliot K. Fishman, MD - 2016 Honored Educator

MSMI23

Molecular Imaging Symposium: Neurologic MI Applications

Monday, Nov. 28 1:30PM - 3:00PM Room: S405AB

NR MI

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

FDA Discussions may include off-label uses.

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Moderator*) Royalties, General Electric Company; Research Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd;
Peter Herscovitch, MD, Bethesda, MD (*Moderator*) Nothing to Disclose

Sub-Events

MSMI23A Overview of MI in Neurology

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Presenter*) Royalties, General Electric Company; Research Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd;

LEARNING OBJECTIVES

1) Learn recent development of molecular imaging in the field of neurosciences. 2) Understand technologies used in molecular brain imaging. 3) Discuss opportunities and challenges in molecular brain imaging.

MSMI23B MI in Dementia

Participants
Alexander Drzezga, MD, Cologne, Germany (*Presenter*) Consultant, Siemens AG; Consultant, Bayer AG; Consultant, General Electric Company; Consultant, Eli Lilly and Company; Consultant, The Piramal Group; Speakers Bureau, Siemens AG; Speakers Bureau, Bayer AG; Speakers Bureau, General Electric Company; Speakers Bureau, Eli Lilly and Company; Speakers Bureau, The Piramal Group

LEARNING OBJECTIVES

1) Gain overview on types of molecular neuropathology involved in the development of different forms of dementia and understand currently discussed disease concepts. 2) Learn about the currently available methods for imaging molecular pathology such as amyloid-deposition and tau-aggregation in dementia and their current status of validation. 3) Gain insights on the clinical value of the individual available methods and their combination with regard to earlier detection, more reliable diagnosis and therapy monitoring of disease.

MSMI23C MI in Movement Disorders

Participants
Kirk A. Frey, MD, PhD, Ann Arbor, MI (*Presenter*) Consultant, MIM Software Inc; Consultant, Eli Lilly and Company; Stockholder, General Electric Company; Stockholder, Johnson & Johnson; Stockholder, Novo Nordisk AS; Stockholder, Bristol-Myers Squibb Company; Stockholder, Merck & Co, Inc;

MSMI23D Emerging Molecular Brain Imaging

Participants
Jonathan E. McConathy, MD, PhD, Birmingham, AL, (jmcconathy@uabmc.edu) (*Presenter*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research Consultant, General Electric Company;

LEARNING OBJECTIVES

1) Participants will be familiar with newer molecular imaging approaches to dementia including tracers targeting tau, alpha-synuclein, and neuroinflammation as well as simultaneous PET/MRI which is particularly well-suited to neuroimaging.

ABSTRACT

Imaging biomarkers for Alzheimer's disease (AD) and other neurodegenerative diseases are playing increasingly important roles in both research and patient care. Many neurodegenerative diseases involve the deposition of characteristic proteins including amyloid, tau, and alpha-synuclein which are target for molecular neuroimaging and potentially for therapy. Additionally, processes such as neuroinflammation appear to contribute to the pathophysiology of many neurodegenerative diseases including AD. In this talk, these newer approaches to molecular neuroimaging in dementia will be discussed including their potential clinical applications in patients with cognitive impairment and dementia.

MSMI23E Clinical Translation in Molecular Brain Imaging

Participants
Peter Herscovitch, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the FDA approval process for diagnostic radiopharmaceuticals Describe the current status of CMS coverage for diagnostic radiopharmaceuticals. 2) Describe the current status of CMS coverage for amyloid PET radiopharmaceuticals and coverage with evidence development (CED). 3) Understand the design and implementation of the Imaging Dementia—Evidence for Amyloid Scanning (IDEAS) Study.

ABSTRACT

The final steps in clinical translation of molecular imaging radiopharmaceuticals for neurological studies are approval by the U.S. Food and Drug Administration (FDA) for marketing and by insurance carriers for reimbursement. Given the age of patients most likely to require brain imaging studies for neurodegenerative disorders, coverage approval by the U.S. Centers for Medicare and Medicaid ("Medicare") is crucial. This talk will discuss the steps required that lead to FDA approval of a radiopharmaceutical, including the IND process and Phase 1, 2, and 3 clinical trials. It should be noted that FDA approval does not necessarily lead to Medicare approval, especially for PET agents. The CMS approval process will be outlined, including the increasing need to demonstrate the ability of PET imaging to provide improved health outcomes. CMS coverage with evidence development (CED) of PET amyloid imaging agents will be described, with a focus on the design and implementation of the Imaging Dementia—Evidence for Amyloid Scanning (IDEAS) Study.

PS20

Monday Plenary Session

Monday, Nov. 28 1:30PM - 2:45PM Room: Arie Crown Theater

HP

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credit: 1.00

Participants
Richard L. Baron, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Sub-Events

PS20A Presentation of Honorary Membership

Participants
Carlo Bartolozzi, MD, Pisa, Italy (*Presenter*) Nothing to Disclose
Luis Donoso-Bach, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
Osamu Matsui, MD, Kanazawa, Japan (*Presenter*) Nothing to Disclose

PS20B Dedication of the Annual Oration in Diagnostic Radiology to the Memory of Edward B. Singleton, MD (1920-2015)

Participants

PS20C Annual Oration in Diagnostic Radiology: Health Care Transformation: Driving Value through Imaging

Participants
Vivian S. Lee, MD, PhD, Salt Lake City, UT (*Presenter*) Board of Directors, Merrimack Pharmaceuticals, Inc
Richard L. Baron, MD, Chicago, IL (*Presenter*) Nothing to Disclose

In the evolution from fee-for-service health care to value-driven population health, health care systems must learn to embrace patient-centered, value-focused practices, and the leaders of these systems must be committed to building these cultures. Radiology departments serve as a centralized core of experts guiding accurate diagnosis and informing care pathways, and therefore have tremendous opportunity in defining and enhancing value for providers and their patients. At University of Utah and elsewhere, engaged radiologists are tapping into the health system's culture of value to evolve the way providers engage with imaging specialists to improve patient expectations, and created real and measurable cost efficiencies. Important tools that have been implemented include "value-driven outcomes" to measure quality and costs, patient-reported outcomes tools to integrate patient perspectives in the value equation, patient and referrer-satisfaction measurement tools, and new value improvement training programs for residents and fellows are among several examples to be discussed. The transformation of health care requires engaged radiologists to produce more cost effective, high quality, patient-centered outcomes.

SPPH21

AAPM/RSNA Basic Physics Lecture for the RT: Hybrid Imaging: Past, Present, and Future

Monday, Nov. 28 1:30PM - 2:45PM Room: S402AB

CT MR NM PH

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Scott J. Emerson, MS, Royal Oak, MI, (scott.emerson@beaumont.edu) (*Moderator*) Nothing to Disclose
Osama R. Mawlawi, PhD, Houston, TX, (omawlawi@mdanderson.org) (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Advances in PET/CT imaging. 2) Advances in SPECT/CT imaging. 3) Challenges and opportunities of PET/MR imaging.

ABSTRACT

Nuclear medicine hybrid imaging (PET/CT and SPECT/CT) has undergone several technological advances over the past decade. This lecture will review the evolution of hybrid imaging and describe the technological advances in the field from system design to image generation and data analysis tools. The lecture will cover innovations in detector design, resolution recovery, time of flight imaging, quantitative evaluation, attenuation correction, and reconstruction algorithms. The lecture will also cover PET/MR imaging and its current challenges and opportunities.

URL

SPPH22

Physics Symposium: Best of the SRS/SBRT AAPM Summer School

Monday, Nov. 28 1:30PM - 5:45PM Room: S102C

PH SQ

AMA PRA Category 1 Credits ™: 4.00
ARRT Category A+ Credits: 4.50

Participants
Sonja Dieterich, PhD, Sacramento, CA (*Moderator*) Scientific Advisor, MGS Research, Inc

LEARNING OBJECTIVES

1) Identify critical anatomical features of major SRS/SBRT targets. 2) Learn techniques used in small field dosimetry and the order of magnitude of treatment uncertainties. 3) Learn essential treatment planning techniques, especially with regards to repiratory motion management. 4) Gain knowledge about treatment delivery devices for SRS/SBRT. 5) Understand resources and safety practices for SRS/SBRT.

ABSTRACT

This session summarizes the highlights of the 2014 AAPM Summer School on SRS/SBRT. The first speaker will highlight critical anatomical structures which physicists and treatment planners need to be aware of in SRS/SBRT. Contouring atlases specific to SRS/SBRT are discussed, e.g. the consensus guidelines published by the spine consortium.The second lecture focuses on the physics of small field dosimetry, which is a special skill set within the field of clinical medical physics. The state-of-the art recommendation on detector selection and measurement techniques will be discussed, including current recommendations on the use of detector correction factors.The third speaker will summarize treatment planning approaches specific to classic SRS/SBRT targets in the brain, lung, GI and GU regions. The appropriate use of respiratory management techniques for SBRT in lung, liver and pancreas requires the careful and considerate application of complex technology. Current society recommendations and peer-reviewed literature on accepted approaches to respiratory motion management will be summarized.In the last decade, the selection of treatment machines capable of delivering SRS/SBRT treatments with the required spatial and dosimetric accuracy has increased significantly. The speaker will discuss the major technical components of each delivery device, highlighting strength and weaknesses of each system as they apply to SRS/SBRT.SRS/SBRT delivers a high dose with steep dose gradients in 1-5 fractions, using complex technology with image guidance. Both the risk of error and the impact of errors is amplified under these circumstances. The last speaker of this session will discuss selected case reports of errors, including a root cause analysis. Current safety initiatives and recommendations for improved safety practices will be introduced. Resources to guide safe and effective implementation of an SRS/SBRT program will be discussed and shared with the audience.

Sub-Events

SPPH22A Anatomy for Cranial and Spine SRS/SBRT

Participants
Zachary A. Kohutek, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the anatomy relevant to CNS radiotherapy of brain and spine tumors. 2) Explain the dose constraints for treatment of brain and spine tumors.

SPPH22B Small Field Dosimetry and Uncertainty

Participants
Sonja Dieterich, PhD, Sacramento, CA, (sdieterich@ucdavis.edu) (*Presenter*) Scientific Advisor, MGS Research, Inc

LEARNING OBJECTIVES

View learning objectives under the main course title.

ABSTRACT

This lecture lecture focuses on the physics of small field dosimetry, which is a special skill set within the field of clinical medical physics. The state-of-the art recommendation on detector selection and measurement techniques will be discussed, including current recommendations on the use of detector correction factors.

Active Handout:Sonja Dieterich

http://abstract.rsna.org/uploads/2016/16001020/ACTIVE SPPH22B.pdf

SPPH22C Treatment Planning and Respiratory Motion Management for SBRT

Participants
Kristi R. Hendrickson, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

SPPH22D SRS/SBRT Delivery Devices

Participants
James Gordon, PhD, Birmingham, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

SPPH22E Safety and Quality for SRS/SBRT

Participants
Stanley H. Benedict, PhD, Sacramento, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

Active Handout:Stanley H Benedict

http://abstract.rsna.org/uploads/2016/16001023/SPPH22E Benedict RSNA2016 SBRTSafetyQA.pdf

SPSP21

Imagen Cuantitativa (Biomarcadores) En La Práctica Clínica: Sesión del Colegio Interamericano de Radiología (CIR) en Espanol/Quantitative Imaging and Biomarkers in Clinical Practice: Session of the Interamerican College of Radiology (CIR) in Spanish

Monday, Nov. 28 1:30PM - 4:30PM Room: E451A

BR CA GI MK NR BQ MR

AMA PRA Category 1 Credits ™: 3.00
ARRT Category A+ Credits: 3.50

FDA Discussions may include off-label uses.

Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (*Moderator*) Nothing to Disclose
Jose L. Criales, MD, Mexico City, Mexico (*Moderator*) Nothing to Disclose
Miguel E. Stoopen, MD, Mexico City, Mexico (*Moderator*) Nothing to Disclose

Sub-Events

SPSP21A Bienvenida/Welcome

Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose
Miguel E. Stoopen, MD, Mexico City, Mexico, (mstoopen@ctscanner.mx) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

Coordinator

ABSTRACT

Coordinator no abstract

URL

Coordinator

SPSP21B La Imagen Medica Personalizada y Precisa/Precise and Personalized Medical Imaging

Participants
Luis Marti-Bonmati, MD, PhD, Godella, Spain, (Luis.Marti@uv.es) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand what imaging biomarkers are and how they can improve diagnosis and treatment follow-up. 2) To describe the different types of biomarkers. 3) To analyze the process of biomarkers development, including validation, qualification and standardization.

ABSTRACT

Imaging seems ideally suited to flourish as a quantitative science. Quantitative imaging biomarkers extract and measure objective biological characteristics from any type of medical images, being resolved in space, through parametric images, and in time, as response maps. As medical imaging does not destroy the evaluated samples, test-retest evaluations are feasible, allowing the repetition of experiments and measurements as frequently as desired. Each voxel in a computer derived image represents both the location and the value of a specific calculated parameter (morphological, biological, response) obtained by the application of mathematical or simulation models to the source images. These synthetic parametric maps represent the new paradigm in clinical radiology and should be considered as virtual biopsies, showing different morphological and biopathological abnormalities. Biomarkers can be classified as prognostic, if accuracy of patient diagnosis or prognosis is improved; predictive, if the most beneficial treatment can be defined; response, when the beneficial outcomes can be shown after treatment; and monitoring, to detect relapse or toxicity.

URL

SPSP21C Esclerosis Múltiple : Seguimiento Cuantitativo/Multiple Sclerosis: Quantitative Follow Up

Participants
Leonardo Vedolin, MD, PhD, Sao Paulo, Brazil, (leonardovedolin@hotmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To describe basic background about quantitative MRI techniques applied to multiple sclerosis. 2) To discuss how quantitative MRI techniques contribute to monitoring of MS progression.

ABSTRACT

Multiple sclerosis (MS) is a chronic demyelinating and neurodegenerative disease that affects the central nervous system (CNS). Brain and spine MRI are most important paraclinical tool for the diagnosis of MS as conventional MRI techniques, such as T2/FLAIR weighted and gadolinium-enhanced T1-weighted sequences are highly sensitive for detecting focal active white matter lesions. However, these techniques are not specific enough to detect diffuse injuries in both grey and white matter. Pathological and imaging data indicated that lesion pattern and timely detection of tissue damage could help identify patients with an increased risk

of developing severe disability and cognitive impairment. In this context, advanced quantitative MR tools have been used to access brain and spinal cord lesions in MS. Proton magnetic resonance spectroscopy (MRS) has been used in patients with CIS to identify tissue damage apart from the visible T2 lesions. Diffusion tensor imaging and magnetization transfer imaging have also revealed differences in normal-appearing brain tissue between patients with CIS and controls. Additionally, double inversion recovery (DIR) sequence, quantitative susceptibility mapping and phase sensitive inversion recovery (PSIR) are promising technique to monitor cortical damage and disease progression in patients with MS. The purpose of this lecture are (1) to describe basic background regarding quantitative MRI techniques applied to multiple sclerosis and (2) to discuss how quantitative MRI techniques contribute to monitoring of MS progression.

URL

SPSP21D **Preguntas/Q & A**

Participants

SPSP21E **Resonancia Magnética en las Cardiopatias/Non-invasive Evaluation of Cardiac Disease by MRI**

Participants
Aloha Meave, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

SPSP21F **Enfermedad Hepática por Depósito (Esteatosis, Fibrosis, Cirrosis y Hemocromatosis)/Liver Storage Disease (Steatosis, Fibrosis, Cirrhosis, and Hemochromatosis)**

Participants
Manuela Franca, MD, Porto, Portugal, (mariamanuela.franca@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the most common imaging features related to different liver storage diseases. 2) Understand that fat, iron and fibrosis commonly co-exist in different diffuse liver diseases. 3) Apply the best MR imaging techniques to assess and to quantify liver steatosis and iron overload, and to stage liver fibrosis/cirrhosis. 4) Discuss the clinical relevance of MR imaging biomarkers in different clinical scenarios of liver diseases, emphasizing the role of MR biomarkers on follow up of patients and treatment monitoring, taking hemochromatosis as a clinical example.

ABSTRACT

Different amounts of fat, iron deposits and fibrosis can be found in different diffuse liver diseases. Because liver biopsy has several limitations, MR imaging biomarkers have been developed for fat and iron quantification, and to stage liver fibrosis.Quantification of proton density fat fraction (PDFF) can be accurately performed with multi-echo chemical shift encoded (MECSE) gradient echo MR sequences, which must be corrected for T1 relaxation, T2* decay effect, noise and fat spectral complexity. Quantification of liver iron content is needed to detect and stage iron overload, and also to monitor iron-reducing treatments. Iron MR quantification may be performed with R2/R2* relaxometry techniques. Also, MECSE-MR sequences allow to simultaneously quantifying PDFF and R2* of liver parenchyma. MR elastography can detect and stage significant or advanced fibrosis and cirrhosis, with high accuracy.All of these MR measurements are increasingly being used as non-invasive biomarkers of hepatic steatosis, siderosis and fibrosis.

URL

SPSP21G **Preguntas/Q & A**

Participants

SPSP21H **Presentación del CIR/CIR Update**

Participants
Miguel A. Pinochet, MD, Santiago, Chile (*Presenter*) Nothing to Disclose
Dante R. Casale Menier, MD, Ciudad Juarez, Mexico (*Presenter*) Nothing to Disclose

SPSP21I **Cáncer de Próstata: Marcadores en Diagnóstico y Seguimiento/Prostate Cancer: Biomarkers in Diagnosis and Follow Up**

Participants
Ivan Pedrosa, MD, Dallas, TX (*Presenter*) Nothing to Disclose

SPSP21J **Osteoartrosis: Evaluación Cuantitativa del Cartílago Articular/Osteoarthritis: Cartilage Quantitative Evaluation**

Participants
Nicolas Zilleruelo, MD, Santiago, Chile, (nzilleruelo@alemana.cl) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Assess the potential of technological innovations and advances to enhance clinical practice and problem-solving. 2) Identify the different quantitative techniques in the study of articular cartilage. 3) Practical applications of these quantitative techniques and discuss their clinical relevance.

SPSP21K **Preguntas/Q & A**

Participants

SPSP21L **Evaluación de la Respuesta Precoz a la Terapia Neoadyuvante en el Cáncer de Mama con Biomarcadores de Imagen/Early Response Evaluation to Neoadjuvant Chemotherapy in Breast Cancer with Imaging Biomarkers**

Participants
Julia Camps Herrero, DIPLPHYS, Alzira, Spain, (juliacamps@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To know the diagnostic accuracy of Diffusion MRI in the evaluation of early response to Neoadjuvant Chemotherapy (NAC). 2) To learn the proof of principle and proof of mechanism of Diffusion Tensor MRI (DTI) as an Imaging Biomarker. 3) To learn about the results of early response evaluation to NAC with DTI.

ABSTRACT

Dynamic contrast-enhanced (DCE) Breast MRI is the standard imaging modality in the response evaluation to neoadjuvant chemotherapy (NAC). Diagnostic accuracy of DCE-MRI in response evaluation to NAC is limited to around 70% in published meta-analysis with very few studies dealing with early response evaluation and DCE-MRI.Diffusion MRI has been show to be a solid imaging biomarker in the evaluation of response to neoadjuvant chemotherapy (NAC) and a recent meta-analysis (Wu, Breast Cancer Res Treat, 2012) showed that it adds sensitivity to the high specificity provided by DCE-MRI. Pickles et al showed in 2006 that diffusion changes precede size reduction in neoadjuvant treatment of breast cancer (Magnetic Resonance Imaging, 2006).Diffusion Tensor imaging (DTI) is a three-dimensional technique, one must apply diffusion gradients along at least 6 non co-linear, non coplanar directions in order to provide enough information. The mammary ducts are anisotropic structures which need non-scalar or multiple ADC measurements in order to characterize the orientation-dependent water mobility in this tissues. These multiple ADC measurements are provided by DTI. We show our preliminary results in more than 30 patients treated with NAC in which we performed an early evaluation after the first two cycles of treatment with DTI, proving that the prediction of response to NAC is earlier and more accurate than the response evaluation with DCE-MRI.

URL

SPSP21M **Respuesta Oncológica: Imagen Híbrida/Oncologic Response: Hybrid Imaging**

Participants
Andres Kohan, MD, Capital Federal, Argentina, (andres.a.kohan@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) List current hybrid imaging methods for assessing tumor response. 2) Identify which method is best to be used in specific clinical scenarios. 3) Assess oncologic response through hybrid imaging.

ABSTRACT

URL

SPSP21N **Preguntas/Q & A**

Participants

SPSP21O **Clausura/Closing**

Participants
Jose L. Criales, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (*Presenter*) Royalties, Reed Elsevier
Pablo R. Ros, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

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/

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Jorge A. Soto, MD - 2015 Honored Educator

VSIO21

Interventional Oncology Series: Hepatocellular Carcinoma and Cholangiocarcinoma

Monday, Nov. 28 1:30PM - 6:00PM Room: S406B

GI IR

AMA PRA Category 1 Credits ™: 4.50
ARRT Category A+ Credits: 5.00

FDA Discussions may include off-label uses.

Participants
Riccardo A. Lencioni, MD, Pisa, Italy, (rlencioni@med.miami.edu) (*Moderator*) Research Consultant, BTG International Ltd; Research Consultant, Guerbet SA; Research Consultant, Bayer AG

LEARNING OBJECTIVES

1) To understand the spectrum of interventional oncology treatments currently available for liver cancer patients. 2) To discuss the results of recent clinical studies investigating interventional oncology treatments for liver cancer. 3) To describe the role of interventional oncology in the multidisciplinary management of patients with liver cancer.

ABSTRACT

Sub-Events

VSIO21-01 HCC: Medical Oncologist's Perspective

Monday, Nov. 28 1:30PM - 1:50PM Room: S406B

Participants
Ghassan K. Abou-Alfa, MD, New York, NY, (abou-alg@mskcc.org) (*Presenter*) Research Grant, Abbott Laboratories; Research Grant, Amgen Inc; Research Grant, AstraZeneca PLC; Research Grant, Bayer AG; Research Grant, Eli Lilly and Company; Research Grant, Exelixis, Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Immunomedics, Inc; Research Grant, Incyte Corporation; Research Grant, Momenta Pharmaceuticals; Research Grant, Myriad Genetics, Inc; Research Grant, Novartis AG; Research Grant, OncoMed Pharmaceuticals, Inc; Research Grant, Polaris Group; Research Grant, Vicus Therapeutics, LLC; Consultant, Aduro BioTech, Inc; Consultant, Astellas Group; Consultant, Onxeo SA; Consultant, Boston Scientific Corporation; Consultant, Boston Therapeutics, Inc; Consultant, Bristol-Myers Squibb Company; Consultant, CASI Pharmaceuticals Inc; Consultant, Celgene Corporation; Consultant, Cipla Ltd; Consultant, Eli Lilly and Company; Consultant, Gilead Sciences, Inc; Consultant, IntegraGen SA; Consultant, AstraZeneca PLC; Consultant, Merrimack Pharmaceuticals, Inc; Consultant, Momenta Pharmaceuticals; Consultant, Novartis AG; Consultant, Onxeo SA; Consultant, AbbVie Inc; Consultant, sanofi-aventis Group; Consultant, Silenseed Ltd; Consultant, SillaJen, Inc; Consultant, Vicus Therapeutics, LLC

LEARNING OBJECTIVES

1) Recognize the two disease state, the cancer itself and the generally associated cirrhosis of hepatocellular carcinoma (HCC). 2) Recognize the current standards of care used for advanced and metastatic HCC. 3) Learn about the current clinical trials combining local plus systemic therapy for locally advanced and metastatic HCC.

ABSTRACT

As the understanding of the science of advanced hepatocellular carcinoma (HCC) deepens, and with the therapeutic advances we are living, the perspectives of the different disciplines onto the management of HCC seem to converge. An understanding of the two diseases in one that inflict patients with HCC is critical. Recognizing the cirrhosis is a must to help guide therapy and assess outcome. The advent of sorafenib has been followed by a whole armamentarium of clinical trials that so far has not yielded any positive outcome that moves the needle of improved survival further to the right. This is at least the case until the time of writing this abstract on the first of March 2016. While specialists wait to see the impact if any of immunotherapy in HCC, another novel approach continues to be underway: Combining local and systemic therapy. While has yielded so far discouraging results with the combination of TACE sorafenib, the study of this approach is not over yet, as investigators are visiting this approach with novel therapeutics including checkpoint inhibitors and extending it to other stages of disease, especially the metastatic setting. It won't be long time before interventional radiologists and medical oncology may need to sit with the patient and deliver therapy at the same time.

VSIO21-02 RFA Plus Lyso Thermosensitive Liposomal Doxorubicin Improves Survival Using Metric of RFA Duration per Tumor Volume: Retrospective Analysis of Prospective Randomized Controlled Trial

Monday, Nov. 28 1:50PM - 2:00PM Room: S406B

Participants
Haydar Celik, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Paul Wakim, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
John W. Karanian, PhD, Laurel, MD (*Abstract Co-Author*) Nothing to Disclose
William F. Pritchard JR, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Meryll Castro, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Bradford J. Wood, MD, Bethesda, MD (*Abstract Co-Author*) Researcher, Koninklijke Philips NV; Researcher, Celsion Corporation; Researcher, BTG International Ltd; Researcher, W. L. Gore & Associates, Inc ; Researcher, Cook Group Incorporated; Patent agreement, VitalDyne, Inc; Intellectual property, Koninklijke Philips NV; Intellectual property, BTG International Ltd; ; ; ;
Shelby Leonard, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Won Y. Tak, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Nicholas Borys, Lawrenceville, NJ (*Abstract Co-Author*) Sr. Vice President, Celsion Corporation; Officer, Celsion Corporation
Riccardo A. Lencioni, MD, Pisa, Italy (*Abstract Co-Author*) Research Consultant, BTG International Ltd; Research Consultant, Guerbet SA; Research Consultant, Bayer AG

PURPOSE

Lyso-thermosensitive liposomal doxorubicin (LTLD) releases cytotoxic doxorubicin locally in the region of mild hyperthermia (40–42 °C). The purpose of this study is to evaluate a novel treatment parameter, burn time per tumor volume (min/ml), for correlation with clinical outcomes of RFA with LTLD.

METHOD AND MATERIALS

HEAT study is a double-blind, randomized controlled phase III trial of RFA-only vs RFA+LTLD. Patients with 3-7 cm diameter hepatocellular carcinoma (HCC) were included in the HEAT study, but only single lesions were used for this analysis (RFA only n=210 vs. RFA+LTLD n=227). The effect of burn time per tumor (pre-treatment) volume on progression free survival (PFS) and overall survival (OS) was analyzed using multiple covariate Cox proportional hazard model.

RESULTS

Average burn time per volume for RFA+LTLD patients was 22.7% less than RFA-only patients. Furthermore, Cox multiple covariate analysis was utilized to test the interaction of two different parameters: treatment groups (RFA-only vs. RFA+LTLD) and burn time per tumor volume. OS was found to be significant (p=0.038, Hazard Ratio=0.85): increase in the burn time per tumor volume improves survival in the RFA+LTLD patients compared to RFA only patients. On the other hand, a similar result was not observed for PFS (p=0.389, HR=1.059). Each group (RFA only and RFA+LTLD) was also individually analyzed for effects of burn time per tumor volume. For RFA+LTLD patients, one unit increase in RFA duration per tumor volume improved OS of RFA+LTLD patients by 19.6% (p=0.017, Hazard Ratio=0.836, CI=0.722-0.968, n=227). Conversely, burn time per tumor volume did not significantly affect RFA-only patients (p=0.57, Hazard Ratio=0.99, n=210).Kaplan-Meier analysis showed even more dramatic differences in a subgroup of patients (147/437) with the burn times per tumor volume larger than 2.5 min/ml (Fig).

CONCLUSION

LTLD may improve overall survival as RFA duration per unit tumor volume increases. This is a post hoc study, therefore should be confirmed with prospective studies. Defining optimal device use to maximize drug deposition may require correlating the drug pharmacokinetics with duration of RFA.

CLINICAL RELEVANCE/APPLICATION

Longer burn times may optimize LTLD drug effects. Burn time per tumor volume may be a better measure for RFA+LTLD assessment.

VSIO21-03 HCC: Interventional Oncologist's Perspective

Monday, Nov. 28 2:00PM - 2:20PM Room: S406B

Participants
Riccardo A. Lencioni, MD, Pisa, Italy, (rlencioni@med.miami.edu) (*Presenter*) Research Consultant, BTG International Ltd; Research Consultant, Guerbet SA; Research Consultant, Bayer AG

LEARNING OBJECTIVES

1) To understand the spectrum of interventional oncology treatments currently available for liver cancer patients. 2) To discuss the results of recent clinical studies investigating interventional oncology treatments for liver cancer. 3) To describe the role of interventional oncology in the multidisciplinary management of patients with liver cancer.

ABSTRACT

VSIO21-04 Sorafenib-loaded Theranostic Microspheres for the Transarterial Chemoembolization of a Liver

Monday, Nov. 28 2:20PM - 2:30PM Room: S406B

Participants
Hyo-Cheol Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kyu Ri Son, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Woo Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun-Jong Cho, Chuncheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop poly(lactic-co-glycolic acid) (PLGA) microspheres that can co-encapsulated sorafenib and triiodobenzoic acid (TIBA) for simultaneous transarterial embolization (TAE) and local delivery of sorafenib.

METHOD AND MATERIALS

Sorafenib and TIBA-loaded PLGA microspheres (SOF/TIBA/PLGA) were fabricated using a modified oil-in-water method. After fabrication, the microspheres were characterized for size, biodegradability, drug release profiles, CT imaging properties in vitro. After these initial in vitro characterization, a rat hepatoma model was employed to enable in vivo studies investigating pharmacokinetics, tumor responses after TAE, and CT-monitoring capability.

RESULTS

The mean diameter of developed MSs was 28.5 ± 2.1 μm and the average of sorafenib encapsulation efficiency was 58.20% in this study. The mean contents of sorafenib and iodine in MSs were 5.11% and 23.15%, respectively. In vitro drug release study demonstrated that sorafenib release on day 1, 4, and 28 were 35.07 ± 0.59%, 46.64 ± 1.32%, and 67.41 ± 5.00%, respectively. According to the in vivo studies, PLGA MSs were detectable on post-procedural CT images. Both tumor concentration of sorafenib and tumor-to-liver drug concentration ratio were significantly higher in the SOF/TIBA/PLGA group compared with the sorafenib oral administration group ($p < .05$). Tumor growth rate, addressed one week after the procedure, was significantly lower in the SOF/TIBA/PLGA group compared with the blank PLGA MSs group and control group (no treatment) ($p < .05$).

CONCLUSION

SOF/TIBA/PLGA was promising materials for TAE of liver tumors, as providing sufficient anticancer effect, angiogenesis inhibition, and imageability.

CLINICAL RELEVANCE/APPLICATION

Sorafenib-loaded PLGA microsphere can be used for chemoembolization of HCC patients.

VSIO21-05 TACE in 2016: Techniques, Results, Practice Patterns

Monday, Nov. 28 2:30PM - 2:50PM Room: S406B

Participants
Jean-Francois H. Geschwind, MD, Westport, CT, (jeff.geschwind@yale.edu) (*Presenter*) Consultant, BTG International Ltd; Consultant, Bayer AG; Consultant, Guerbet SA; Consultant, Sterigenics International LLC; Consultant, Koninklijke Philips NV; Consultant, Jennerex Biotherapeutics, Inc; Grant, BTG International Ltd; Grant, Bayer AG; Grant, Koninklijke Philips NV; Grant, Sterigenics International LLC; Grant, Threshold Pharmaceuticals, Inc; Grant, Guerbet SA; Founder and CEO, PreScience Labs, LLC

LEARNING OBJECTIVES

1. Understand the indications for TACE for HCC2. Know the side effects, toxicities, and expected results of TACE for HCC patients3. Understand the potential for combining TACE with systemic therapies

ABSTRACT

VSIO21-06 Spectral Photon-counting CT: Spatial Differentiation of Static Contrast versus Radiopaque Image-able Drug Eluting Microspheres

Monday, Nov. 28 2:50PM - 3:00PM Room: S406B

Participants
Amir Pourmorteza, PhD, Bethesda, MD (*Presenter*) Researcher, Siemens AG
Ayele Negussie, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Rolf Symons, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
William F. Pritchard JR, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Elliot B. Levy, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Bradford J. Wood, MD, Bethesda, MD (*Abstract Co-Author*) Researcher, Koninklijke Philips NV; Researcher, Celsion Corporation; Researcher, BTG International Ltd; Researcher, W. L. Gore & Associates, Inc ; Researcher, Cook Group Incorporated; Patent agreement, VitalDyne, Inc; Intellectual property, Koninklijke Philips NV; Intellectual property, BTG International Ltd; ; ; ;
David A. Bluemke, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Research support, Siemens AG

PURPOSE

Spectral CT makes it possible to differentiate two or more high atomic number contrast agents (CA) or drug delivery vectors that otherwise cannot be separately resolved using single energy CT or fluoroscopy. Here we demonstrate the feasibility of using a single spectral photon-counting CT (PCCT) scan to image and localize both custom and FDA-cleared microspheres mixed in one of two FDA-cleared CA's to assess the spatial heterogeneity of microspheres vs CA, which would be desirable after transarterial embolization (TAE).

METHOD AND MATERIALS

Two combinations of microspheres and vascular CAs were studied: I+Gd (LC Bead LUMI iodinated microspheres and gadolinium-based CA (Magnevist, Bayer)) and Bi+I (custom fabricated bismuth-engineered microspheres and iodinated CA (Isovue 300, Bracco)). Vascular phantoms were fabricated with beads inside 4-mm plastic tubes (resembling small vessels) with vascular CA diluted to approximate clinical concentrations. A prototype whole-body PCCT scanner (Siemens Healthcare) was used. Using test tubes with calibrated dilutions of CAs, we searched for energy thresholds that maximized the separation between the CA inside the bead and the vascular CA, while minimizing image noise. The lower threshold was set at 22 keV and the higher threshold was swept around the k-edge energies of Gd and Bi (50, 90 keV). Images were reconstructed with color maps correlating to these different PCCT detections.

RESULTS

The high energy threshold was incremented by 3keV steps at 80 and 140 kVp tube voltage settings. The following threshold and tube voltage settings provided optimized material separation and image noise tradeoff (I+Gd: 52 keV at 80 kVp and Bi+I: 75 keV at 140 kVp). Linear material decomposition of the PCCT images showed clear differentiation between beads and vascular CA.

CONCLUSION

The results show the feasibility of tuning the spectra thresholds of a PCCT scanner in order to differentiate radiopaque microspheres from adjacent static columns of contrast following embolization. Such differentiation may optimally inform endpoints in embolization or locations of tumor at risk for under-dosing or under-treatment. Future work will include in vivo experiments in a large animal model.

CLINICAL RELEVANCE/APPLICATION

Photon-counting CT may be used to characterize the outcome of TAE by localization and differentiation of microspheres and vascular columns of contrast between microspheres in a single scan.

VSIO21-07 Y90 Radioembolization: Current Indications and Protocols

Monday, Nov. 28 3:00PM - 3:20PM Room: S406B

Participants
Riad Salem, MD, MBA, Chicago, IL (*Presenter*) Research Consultant, BTG International Ltd Research Grant, BTG International Ltd

VSIO21-08 Prospective Trial using Internal Pair-production Positron-emission Tomography (PET) after Radioembolization to Determine the Effects of Yttrium-90 (90Y) Dose on Liver Toxicity

Monday, Nov. 28 3:20PM - 3:30PM Room: S406B

Participants
Keith T. Chan, MD, MS, Seattle, WA (*Presenter*) Spouse, Employee, Health Advocacy Strategies, LLC
Adam M. Alessio, PhD, Seattle, WA (*Abstract Co-Author*) Research Grant, General Electric Company
Sandeep Vaidya, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Guy E. Johnson, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
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Sharon W. Kwan, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
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David H. Lewis, MD, Seattle, WA (*Abstract Co-Author*) Research funded, Eli Lilly and Company
Siddharth A. Padia, MD, Seattle, WA (*Abstract Co-Author*) Consultant, BTG International Ltd; Research Grant, Koninklijke Philips NV

PURPOSE

90Y internal pair-production PET can quantify the radiation dose delivered to non-tumoral hepatic parenchyma after radioembolization. This study prospectively correlates radiation dose in normal liver to treatment-related toxicity.

METHOD AND MATERIALS

A single-arm prospective trial was performed at a single institution under IRB approval. 35 patients with unresectable intrahepatic malignancies were enrolled. Inclusion criteria were: ECOG performance status 0–2, Child-Pugh A or B, and first 90Y radioembolization treatment. Time-of-flight PET imaging without additional tracer administration was performed the same day after 90Y treatment. Volumetric analysis of the non-tumor liver parenchyma was performed using a proprietary software and 90Y dose calculated. Patients were evaluated at 30 and 90 days post-treatment. Hypoalbuminemia, hyperbilirubinemia, elevation of AST and ALT, and leukopenia were assessed using multivariate models as indices of liver toxicity, with CTCAE Grade ≤1 change in laboratory values compared to Grade ≥2.

RESULTS

34 patients (median age 60, range 42–79) were included. 79% had HCC, 3% had cholangiocarcinoma, and 18% had liver metastases. One patient was excluded for poor image registration. 27 patients had underlying cirrhosis (81% HBV/HCV, 30% alcohol-related). 29 and 5 patients were Child-Pugh A and B, respectively. Most treatments (76%) were performed via lobar artery infusions with average delivered activity of 3.1GBq. No liver failure, abscess, biloma, or death occurred within 90 days. 15 patients had Grade ≤1 toxicity. 12 patients had Grade 2, 7 had Grade 3, and none had Grade 4 or higher toxicity. The median dose delivered to the normal liver in the treated lobe was 49Gy [range 5–133]. Patients with a Grade ≥2 change in albumin, bilirubin, and AST had a significantly higher parenchymal dose than those with Grade ≤1 (62±34Gy vs 39±21Gy, p=0.01). Multivariate models of each toxicity index showed that parenchymal dose is the most common factor associated with Grade ≥2 toxicity.

CONCLUSION

90Y delivered dose to normal liver parenchyma can be measured by internal pair-production PET after radioembolization and predicts post-treatment liver toxicity.

CLINICAL RELEVANCE/APPLICATION

90Y-PET tumor dosimetry permits immediate assessment of the dose received by normal liver after radioembolization and may predict treatment-related liver toxicity.

VSIO21-09 Panel Discussion: Management of Intermediate-Advanced HCC

Monday, Nov. 28 3:30PM - 3:45PM Room: S406B

Participants

VSIO21-10 Identification of Novel Angiogenesis Biomarkers Showing Transient and Sustained Changes in Circulating Levels after Hepatic Arterial Embolization for Hepatocellular Carcinoma

Monday, Nov. 28 3:45PM - 3:55PM Room: S406B

Awards
Student Travel Stipend Award

Participants
James S. Ronald, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose
Gemini L. Janas, RT, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Willa Chen, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Paul V. Suhocki, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Waleska M. Pabon-Ramos, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
David R. Sopko, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Andrew Nixon, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Charles Y. Kim, MD, Durham, NC (*Abstract Co-Author*) Consultant, Halyard Health, Inc; Consultant, Cryolife, Inc; Consultant, Merit Medical Systems, Inc

PURPOSE

Prior studies of angiogenesis biomarker response after hepatic embolotherapy for hepatocellular carcinoma (HCC) in humans have been restricted to chemoembolization and radioembolization, which may confound biomarker response to ischemia. Furthermore, while many studies have focused on a limited number of biomarkers, numerous molecular pathways are implicated in angiogenesis. The purpose of this study was to characterize serum biomarker responses related to ischemia after bland transarterial embolization (TAE) of HCC using a robust and modern panel of circulating angiogenesis and associated biomarkers.

METHOD AND MATERIALS

This prospective study enrolled 25 patients with untreated HCC (LI-RADS 5 or biopsy proven) undergoing TAE as the sole method of oncologic treatment. A panel of 19 angiogenesis biomarkers were measured immediately prior to treatment and at 1 day, 2 weeks, and 4 weeks after treatment using multiplex enzyme-linked immunosorbent assays. Paired Wilcoxon rank sum tests were used to identify changes in biomarker levels compared with pre-TAE levels. Multiple testing corrections were performed.

RESULTS

Ten of 19 biomarkers showed statistically significant transient changes on the day following TAE, 10 biomarkers showed significant elevations at 2 weeks, and 2 biomarkers remained elevated as late as 4 weeks following TAE. IL-6 expression was initially increased but quickly returned to baseline levels. PDGF-AA, and PDGF-BB were transiently downregulated on the day following TAE. TGFß-2 was initially downregulated followed later by an increase in TGFß-1. TSP-2 also showed delayed upregulation at 2 weeks. Interestingly VEGF-D was upregulated for at least 2 weeks following TAE whereas VEGF-A showed only transient change. TIMP-1, ICAM-1, PlGF, and VEGFR-2 and 3 showed early and sustained upregulation persisting at least 2 weeks following TAE whereas VEGFR-1 showed little change. OPN and VCAM-1 showed the most sustained upregulation, extending at least 4 weeks following TAE.

CONCLUSION

Using a current panel of angiogenesis biomarkers, multiple biomarkers demonstrated significant changes after TAE, including several novel factors demonstrating sustained upregulation.

CLINICAL RELEVANCE/APPLICATION

Identification of specific pro-angiogenesis pathways after TAE may guide therapeutic targets for blocking the angiogenic response, which has been implicated in residual/recurrent tumorigenesis.

VSIO21-11 Characterizing Alterations in BCAA Metabolism in HCC in Vitro under TAE-like Ischemia Using Carbon-13 NMRS

Monday, Nov. 28 3:55PM - 4:05PM Room: S406B

Awards
Student Travel Stipend Award

Participants
Mike Sheng, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Santiago Pulido, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Michael Noji, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Gregory J. Nadolski II, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Stephen J. Hunt, MD,PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Terence P. Gade, MD, PhD, New York, NY (*Abstract Co-Author*) Research Grant, Guerbet SA

PURPOSE

Transarterial embolization (TAE) is the gold standard treatment for unresectable hepatocellular carcinoma (HCC). Under TAE ischemic environments, HCC cells undergo metabolic reprogramming that enables survival by facilitating reduction oxidation chemistry (redox) homeostasis. Specifically, we have focused on the redox regulation of protein function through the role of branched chain aminotransferase (BCAT1 and BCAT2), enzymes that are epigenetically re-expressed in HCC and play a central role in the metabolism of branched-chain amino acids (BCAAs), especially leucine and its α-keto acid (α-ketoisocaproic acid [KIC]) precursor. Utilizing carbon-13 NMR spectroscopy, we characterize alterations of BCAA metabolism in HCC cells surviving severe, TAE-like ischemia.

METHOD AND MATERIALS

13C-NMR spectroscopy of [1-13C] KIC and [1-13C] leucine metabolism was performed on previously established diethylnitrosamine (DEN)-induced rat HCC cell lines to assess alterations in BCAA metabolism *in vitro* under TAE-like ischemia compared to standard conditions. Western blot and qPCR was applied to elucidate changes in BCAT1/BCAT2 protein and RNA under stressed conditions.

RESULTS

HCC cells incubated with [1-13C] KIC under ischemia demonstrated metabolism of [1-13C] KIC to [1-13C] CO2 and nearly absent metabolism to [1-13C] leucine, in keeping with reductive stress induced inactivation of BCAT and activation of branched chain ketoacid dehydrogenase (BCKDH). These findings were corroborated by Western blot analysis which showed decreased BCAT1/BCAT2 and increased BCKDH protein expression under ischemic conditions.

CONCLUSION

HCC cells in TAE-like ischemic conditions undergo inactivation of BCAT and increased expression of BCKDH, leading to increased BCAA catabolism.

CLINICAL RELEVANCE/APPLICATION

Characterization of alterations in protein metabolism in HCC cells under TAE-like ischemic conditions could provide an effective biomarker of surviving cancer cells.

VSIO21-12 Radiofrequency Hyperthermia-Enhanced Direct Intratumoral Chemotherapy of Hepatocellular Carcinoma via an Interventional Molecular Imaging-Guided Approach

Monday, Nov. 28 4:05PM - 4:15PM Room: S406B

Participants
Jun Gao, MD, PhD, Seattle, WA (*Presenter*) Nothing to Disclose
Feng Zhang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Yin Jin, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

Yaoping Shi, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jianfeng Wang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Xiaoming Yang, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recurrence often occurs in the margin of radiofrequency (RF) ablated hepatocellular carcinoma (HCC), due to residual tumor cells in the peritumoral zone. One potential strategy to overcome this clinical problem is combining RF ablation with adjuvant treatments. In this study, we investigated the opportunity of using RFH to enhance interventional molecular imaging-guided, direct intratumoral chemotherapy of HCC.

METHOD AND MATERIALS

For both in-vitro confirmation and in-vivo validation, different groups of Luciferase/mCherry-labeled human HCC cells (Lu/mC-HepG2) and mice with subcutaneous Lu/mC-HepG2 xenografts were treated by: (i) combination therapy with liposomal doxorubicin plus RFH at 42 **I**; (ii) liposomal doxorubicin alone; (iii) RFH alone; and (iv) saline. For in-vitro confirmation, MTS assay, confocal microscopy and flow cytometry were used to compare cell viabilities and apoptosis among different treatment groups. For in vivo validation, liposomal doxorubicin was directly injected into the tumor under ultrasound imaging guidance, followed by intratumoral RFH for 30 min. Changes on bioluminescent signals and sizes of tumors were followed up by quantitative molecular optical and ultrasound imaging overtime, which were correlated with subsequent histology confirmation.

RESULTS

Of in vitro experiments, MTS assay demonstrated the lowest cell proliferation in combination therapy compared with other three treatments (25.0±5.6% vs 49.7±5.2% vs 94.2±3.9% vs 100%, $p<0.001$). Flow cytometry showed the highest apoptotic index in combination therapy compared to other treatments (37.9±3.2% vs 32.2±1.7% vs 2.9±1.7% vs 1.8±0.7%, $p<0.001$). Of in vivo experiments, optical imaging demonstrated a significant decrease of bioluminescence intensities in combination therapy compared with other treatments (0.53±0.10 vs 1.4±0.5 vs 2.8±0.8 vs 3.0±0.3, $p<0.05$). Ultrasound images further showed the smallest tumor volume for combination therapy compared to other treatments (0.7±0.1 vs 1.8±0.4 vs 3.0±0.8 vs 3.3±0.3, $p<0.05$). Both imaging findings were confirmed by histologic correlation.

CONCLUSION

We have successfully validated the feasibility of using RFH to enhance direct intratumoral liposomal doxorubicin therapy of HCC.

CLINICAL RELEVANCE/APPLICATION

This concept may open new avenues for effective management of HCCs by combining RF technology with interventional molecular imaging-guided direct intratumoral chemotherapy.

VSIO21-13 Making Sense of Alabtion Technologies for Liver Cancer

Monday, Nov. 28 4:15PM - 4:35PM Room: S406B

Participants
Govindarajan Narayanan, MD, Miami, FL (*Presenter*) Consultant, BTG International Ltd; Consultant, AngioDynamics, Inc; Consultant, Medtronic plc; Consultant, Guerbet SA

VSIO21-14 Transcatheter Arterial Chemoembolization (TACE) followed by Immediate Radiofrequency Ablation (RFA) versus TACE alone in Treatment of Solitary Huge Hepatocellular Carcinoma (HCC>=10cm)

Monday, Nov. 28 4:35PM - 4:45PM Room: S406B

Participants
Zhijun Wang Sr, MD, PhD, Beijing, China (*Presenter*) Nothing to Disclose

PURPOSE

To compare the long-term clinical benefit of conventional TACE followed by immediate CBCT(C-arm Cone Bean CT) guided RFA and TACE alone in treatment of solitary huge HCC (≥10cm).

METHOD AND MATERIALS

This is a retrospective study involving 75 patients with unresectable solitary huge HCC (10.0 cm in diameter or larger) admitted to Chinese PLA General Hospital (Beijing, China) between January 2010 and March 2013. The median follow-up time was 33 months (range, 6–72 months). Of these patients, 44 patients received TACE alone and 31 patients received TACE immediately followed by CBCT guided RFA. For TACE with synchronous RFA group, all of patents received one to three cycles of TACE before combined therapy. The tumor response rate, treatment sessions were compared between the two modalities and overall survival (OS) were hierarchically analyzed using log–rank tests.

RESULTS

All patients successfully underwent TACE alone or TACE followed by immediate RFA with no serious complications. The median survival time was 19 months (range, 4–52 months) for TACE alone and 38 months (range, 6–70 months) for TACE with synchronous RFA group. Comparing to TACE alone, the combined therapeutic modality showed higher rates of complete response (87.1%) with fewer sessions ($P<0.001$). The 1-year, 2-year, and 3-year OS rates we were 66.7%, 31.8%, and 18.2% in TACE alone group, respectively. In contrast, for TACE with synchronous RFA group, the 1-year, 2-year, and 3-year OS rates were 90.3%, 64.5%, and 48.4%, respectively. This difference was statistically significant between the two groups ($P<0.001$).

CONCLUSION

TACE combined with synchronous RFA had advantages in prolonging OS, higher tumor response rate and decreasing therapeutic sessions in patients with unresectable solitary huge HCC when compared to TACE alone. The promising results suggest that the further prospective studies are required to confirm the findings of this study.

CLINICAL RELEVANCE/APPLICATION

The combined therapeutic modalities have the clinical benefit to improve the long-term outcome in treatment of solitary huge HCC.

VSIO21-15 Interventional Oncology Treatment of Cholangiocarcinoma

Monday, Nov. 28 4:45PM - 5:05PM Room: S406B

Participants
Sarah B. White, MD,MS, Philadelphia, PA, (sbwhite@mw.edu) (*Presenter*) Research support, Guerbet SA; Research support, Siemens AG; Consultant, Guerbet SA; Consultant, IO Rad

LEARNING OBJECTIVES

VSIO21-16 Treatment of Recurrent, Unresectable Intrahepatic Cholangiocarcinoma using Multi-Agent DSM TACE (Triple-TACE)

Monday, Nov. 28 5:05PM - 5:15PM Room: S406B

Participants
Fabian Goerg, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Bruners, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Presenter*) Nothing to Disclose

PURPOSE

The aim of the study was to evaluate the efficacy of transarterial multi-agent chemoembolization used in combination with degradable starch microspheres in patients with recurrent, unresectable cholangiocarcinoma (ICC)

METHOD AND MATERIALS

Single-center study on 18 patients (mean age 63y) with unresectable ICC, of whom 7 had undergone hemihepatectomy or trisectorectomy, and another 4 had undergone segmentectomy, and who were secondary-progressive under systemic chemotherapy, were treated by multi-agent DSM-TACE according to a standardized protocol. A total 45 sessions of TACE were performed in 4 week intervals with a mean of 2.5 sessions per patient. The cytotoxic agents were Cisplatin, Mitomycin C and Doxorubicin ("Triple-TACE"). Degradable starch microspheres with a mean diameter of 50 µm were mixed with mitomycin and doxorubicine. After thorough angiography of the celiac trunc and hepatic vessels, a microcatheter was placed in the respective hepatic artery. Cisplatin was injected via perfusor set at 1 ml/min. The mitomycin/doxorubicine/DSM mixture was hand injected under permanent fluoroscopic control of antegrade flow. Local tumor response was evaluated by MRI and CT. In patients with bilio-enteric anastomses, aggressive preventive antibiotic treatment was applied.

RESULTS

Local tumor response according to RECIST 1.1 was as follows: One patient was lost to follow-up; another patient with whole-liver ICC underwent liver transplantation. For the remaining 16 patients for whom follow-up is available, complete response was observed in 2 patients (12.5%), one of whom has remained without intrahepatic disease for over 28 months; partial response in 8 patients (50%), stable disease in 6 patients (43.8%). Beyond RECIST, based on multiparametric hepatic MRI, the reduction of hepatic vital tumor load was categorized as follows: None of the patients had progressive intrahepatic disease; 2/16 (12.5%) had unchanged tumor load; 8/16 (50%) had a substantial reduction of vital tumor load; 4/16 (25%) had an almost complete reduction of tumor load, and 2/16 (12.5%) complete reduction with no vital tumor left.

CONCLUSION

Response assessment based on Recist 1.1 and multiparametric MRI showed excellent local tumor control in patients with ICC after Triple-TACE with degradable starch microspheres.

CLINICAL RELEVANCE/APPLICATION

Triple-TACE with degradable starch microspheres is effective for treatment of otherwise therapy-refractory intrahepatic ICC.

VSIO21-17 Clinical Value of Multimodality 3D Imaging in Interventional Oncology

Monday, Nov. 28 5:15PM - 5:35PM Room: S406B

Participants
Julius Chapiro, MD, New Haven, CT, (julius.chapiro@yale.edu) (*Presenter*) Research Grant, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Understand the challenges in assessing tumor response after interventional oncology procedures. 2) Become acquainted with the more recently introduced solutions for this problem such as computer-assisted tumor segmentation and image analysis. 3) Learn about the previously available tumor response criteria as well as the more recently introduced three-dimensional software-assisted approaches such as the quantitative European Association for the Study of the Liver (qEASL) criteria.

ABSTRACT

Assessing the tumor response of liver cancer lesions after intraarterial therapies is of major clinical interest. Over the last two decades, tumor response criteria have come a long way from purely size-based, anatomic methods such as the Response Evaluation Criteria in Solid Tumors towards more functional, enhancement- and diffusion-based parameters with a strong emphasis on MRI as the ultimate imaging modality. However, the relatively low reproducibility of those one- and two-dimenstional techniques (modified Response Evaluation Criteria in Solid Tumors and the European Association for the Study of the Liver criteria) provided the rationale for the development of new, three-dimensional (3D) quantitative assessment techniques. This talk will summarize and compare the existing methodologies used for 3D quantitative tumor analysis and provide an overview of the published clinical evidence for the benefits of 3D quantitative tumor response assessment techniques.

VSIO21-18 Use of Enhancing Tumor Burden on MRI for Response Assessment and Prediction of the Survival after 90Yttrium Radioembolization in Hepatocellular Carcinoma

Monday, Nov. 28 5:35PM - 5:45PM Room: S406B

Participants
Duc Do Minh, BSc, Berlin, Germany (*Presenter*) Nothing to Disclose
Julius Chapiro, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Ming De Lin, PhD, Cambridge, MA (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Mansur Ghani, BS, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Qiang Huang, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Cuihong Liu, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Bruno R. Tegel, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
David Wainstejn, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernhard Gebauer, MD, Berlin, Germany (*Abstract Co-Author*) 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
Jean-Francois H. Geschwind, MD, Westport, CT (*Abstract Co-Author*) Consultant, BTG International Ltd; Consultant, Bayer AG; Consultant, Guerbet SA; Consultant, Sterigenics International LLC; Consultant, Koninklijke Philips NV; Consultant, Jennerex Biotherapeutics, Inc; Grant, BTG International Ltd; Grant, Bayer AG; Grant, Koninklijke Philips NV; Grant, Sterigenics International LLC; Grant, Threshold Pharmaceuticals, Inc; Grant, Guerbet SA; Founder and CEO, PreScience Labs, LLC

PURPOSE

Assessing tumor response after 90Yttrium radioembolization (Y90) has proven difficult when using traditional guidelines for image assessment (i.e. RECIST, mRECIST, WHO and EASL). Thus, novel methodologies for an early assessment of treatment response in patients with relatively short overall survival are needed. This study investigates the concept of enhancing tumor burden [ETB] and uses a whole-liver quantification of tumor enhancement as an early imaging biomarker for tumor response in patients with hepatocellular carcinoma (HCC) after the initial Y90.

METHOD AND MATERIALS

This retrospective single-center study included 35 HCC patients who underwent Y90 between 2000 and 2015. A semi-automated 3D quantification of the ETB as seen on baseline and follow-up contrast enhanced MR imaging was performed (qEASL prototype, Philips Healthcare). Several cutoffs were tested to define response (≥25%, 30%, 50% or 65% volumetric decrease in ETB). The paired student t-test was used to compare pre-and post-therapy ETB. Survival analysis included Kaplan-Meier curves with the log-rank test and Cox-proportional hazards modeling (uni- and multivariate). The predictive value of the various response cutoffs was evaluated via the Akaike information criterion (AIC).

RESULTS

Mean patient age was 62.0 years, 73.3% of patients were males. Only minimal decrease of mean ETB was measured after Y90 (156.4 cm3 to 150.1 cm3; p=0.78). Regarding the cutoff values of ≥25%, 30% and 50%, ETB response was associated with longer survival (HR:0.26; 0.22; 0.09, retrospectively, for p 50%, ETB response with the 50% cutoff remained significant in the multi-variate analysis (HR: 0.09, 95%CI: 0.02-0.41, p<0.01).

CONCLUSION

Volumetric changes in the ETB can be used as an imaging biomarker for tumor response and early survival prediction in patients with HCC after the initial lobar.

CLINICAL RELEVANCE/APPLICATION

Early response assessment after Y90 can be achieve using the ETB concept applied to contrast-enhanced MR imaging as early as 4-8 weeks after the initial therapy session, thus allowing for early therapeutic decisions. The implications of these results warrant further analysis in larger patient cohorts.

VSIO21-19 Tumor Board

Monday, Nov. 28 5:45PM - 6:00PM Room: S406B

Participants

RCA24

3D Printing Hands-on with Open Source Software: Introduction (Hands-on)

Monday, Nov. 28 2:30PM - 4:00PM Room: S401AB

IN

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

Participants

Michael W. Itagaki, MD, MBA, Seattle, WA (*Moderator*) Owner, Embodi3D, LLC
Beth A. Ripley, MD, PhD, Seattle, WA, (bar23@uw.edu) (*Presenter*) Nothing to Disclose
Tatiana Kelil, MD, Brookline, MA, (Tkelil@partners.org) (*Presenter*) Nothing to Disclose
Anish Ghodadra, MD, Pittsburgh, PA, (aghodadramd@gmail.com) (*Presenter*) Nothing to Disclose
Hansol Kim, MD, Boston, MA (*Presenter*) Nothing to Disclose
Steve D. Pieper, PhD, Cambridge, MA (*Presenter*) CEO, Isomics, Inc; Employee, Isomics, Inc; Owner, Isomics, Inc; Research collaboration, Siemens AG; Research collaboration, Novartis AG; Consultant, Wright Medical Technology, Inc; Consultant, New Frontier Medical; Consultant, Harmonus; Consultant, Stryker Corporation; Research collaboration, gigmade;
Dmitry Levin, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn about basic 3D printing technologies and file formats used in 3D printing. 2) To learn how to segment a medical imaging scan with free and open-source software and export that anatomy of interest into a digital 3D printable model. 3) To perform basic customizations to the digital 3D printable model with smoothing, text, cuts, and sculpting prior to physical creation with a 3D printer.

ABSTRACT

"3D printing" refers to fabrication of a physical object from a digital file with layer-by-layer deposition instead of conventional machining, and allows for creation of complex geometries, including anatomical objects derived from medical scans. 3D printing is increasingly used in medicine for surgical planning, education, and device testing. The purpose of this hands-on course is to teach the learner to convert a standard Digital Imaging and Communications in Medicine (DICOM) data set from a medical scan into a physical 3D printed model through a series of simple steps using free and open-source software. Basic methods of 3D printing will be reviewed. Initial steps include viewing and segmenting the imaging scan with 3D Slicer, an open-source software package. The anatomy will then be exported into stereolithography (STL) file format, the standard engineering format that 3D printers use. Then, further editing and manipulation such as smoothing, cutting, and applying text will be demonstrated using MeshMixer and Blender, both free software programs. Methods described will work with Windows, Macintosh, and Linux computers. The learner will be given access to comprehensive resources for self-study before and after the meeting, including an extensive training manual and online video tutorials.

Active Handout:Michael Ward Itagaki

http://abstract.rsna.org/uploads/2016/14003455/active RCA24-34 Intro to Open Source 3D Printing.pdf

RCB24

Teaching Congenital Heart Disease with 3D Printed Models (Hands-on) I: Double Outlet Right Ventricle

Monday, Nov. 28 2:30PM - 4:00PM Room: S401CD

CA IN

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

Participants

Shi-Joon Yoo, MD, Toronto, ON (*Presenter*) Owner, 3D HOPE Medical; CEO, IMIB-CHD;
Frank J. Rybicki III, MD, PhD, Ottawa, ON, (frybicki@toh.ca) (*Presenter*) Nothing to Disclose
William J. Weadock, MD, Ann Arbor, MI (*Presenter*) Owner, Weadock Software, LLC
Cynthia K. Rigsby, MD, Chicago, IL, (crigsby@luriechildrens.org) (*Presenter*) Nothing to Disclose
Hyun Woo Goo, MD, Seoul, Korea, Republic Of, (hwgoo@amc.seoul.kr) (*Presenter*) Nothing to Disclose
Andreas Giannopoulos, MD, Boston, MA, (andgiannop@hotmail.com) (*Presenter*) Nothing to Disclose
Taylor Chung, MD, Oakland, CA (*Presenter*) Travel support, Koninklijke Philips NV;
Rajesh Krishnamurthy, MD, Houston, TX (*Presenter*) Nothing to Disclose
Whal Lee, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the terms used in describing the pathology of double outlet right ventricle. 2) Understand the pathologic and surgical anatomy of various forms of double outlet right ventricle. 3) Develop ideas how to image the patients with double outlet right ventricle for surgical management.

ABSTRACT

Congenital heart diseases are the most common significant birth defects requiring surgical treatment in the majority of cases. Understanding of pathologic anatomy is crucial in surgical decision and performing optimal surgical procedures. Learning cardiac morphology has relied on the pathologic specimens removed from dead patients or at the time of transplantation. However, the pathologic specimens are rare and hardly represent the whole spectrum of diseases. 3D print models from the CT and MR angiograms of the patients with congenital heart disease are great resources for teaching and can revolutionize education. In this hands-on session, 3D print models of hearts will be used for comprehensive understanding of various morphologic spectrum of double outlet right ventricle. The session will consist of 15-minute introductory lecture, 60-minute hands-on observation and 15-minute discussion and evaluation. Experts on congenital heart disease pathology will be available for guidance and answering questions throughout the session.

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 J. Rybicki III, MD, PhD - 2016 Honored Educator

RCC24

Health IT Entrepreneurship

Monday, Nov. 28 2:30PM - 4:00PM Room: S501ABC

IN

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

Participants
Curtis P. Langlotz, MD, PhD, Menlo Park, CA, (langlotz@stanford.edu) (*Moderator*) Shareholder, Montage Healthcare Solutions, Inc; Spouse, Consultant, Novartis AG;

LEARNING OBJECTIVES

1) Learn the pros and cons that should be considered when deciding to start a new radiology-related health IT business venture. 2) Understand key intellectual property and tech transfer issues related to health IT businesses. 3) Prepare for the variety of fundraising strategies, growth trajectories, and pivots that may affect small health IT businesses. 4) Examine the factors that lead to the success or failure of health IT startups.

Sub-Events

RCC24A Tales of a Health IT Entrepreneur: From Concept to Startup to Small Business Venture

Participants
William W. Boonn, MD, Penn Valley, PA (*Presenter*) Officer, Nuance Communications, Inc; Shareholder, Nuance Communications, Inc

LEARNING OBJECTIVES

View learning objectives under the 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/

William W. Boonn, MD - 2012 Honored Educator

RCC24B Health IT Startup Becomes Large Company with Successful Exit

Participants
Paul J. Chang, MD, Chicago, IL (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Advisory Board, Bayer AG

LEARNING OBJECTIVES

View learning objectives under the main course title.

RCC24C Starting a Health IT Consulting Company

Participants
Donald Dennison, Waterloo, ON, (don@dondennison.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understanding the author's journey from a role in the vendor community to an independent consultant. 2) Deciding if a career in consulting is right for you. 3) Defining the services you will provide. 4) Marketing yourself and your abilities. 5) Keeping your knowledge current and relevant. 6) Lessons learned along the way.

ABSTRACT

RCC24D Health IT Startup Ceases Operations

Participants
Curtis P. Langlotz, MD, PhD, Menlo Park, CA, (langlotz@stanford.edu) (*Presenter*) Shareholder, Montage Healthcare Solutions, Inc; Spouse, Consultant, Novartis AG;

LEARNING OBJECTIVES

1) Understand some of the pitfalls of starting a Health IT business. 2) Learn the secrets of successful failure. 3) Review some of the difficult aspects of running a small Health IT business.

MSRO23

BOOST: Gastrointestinal-Case-based Review (An Interactive Session)

Monday, Nov. 28 3:00PM - 4:15PM Room: S103AB

GI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Mukesh G. Harisinghani, MD, Boston, MA (*Presenter*) Nothing to Disclose
Theodore S. Hong, MD, Boston, MA (*Presenter*) Nothing to Disclose
Lawrence Blaszkowsky, MD, Boston, MA (*Presenter*) Spouse, Stockholder, Pfizer Inc
Cristina Ferrone, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Achieve a basic understanding of the anatomy pertinent to the pancreatico-biliary region and imaging appearance of pancreaticobiliary tumors. 2)Understand strengths and limitations of imaging techniques, including MRI, PET-CT and CT, as they are used in delineating primary tumor and staging involved regional nodes. 3) Identify reasons for local recurrence and recognize the imaging appearances of these recurrences. 4) Improve radiation therapy delivery through understanding the contouring recommendations for the gross tumor volume (GTV) and clinical target volumes (CTV) for anorectal tumors, both in the locally advanced and postoperative setting.

ABSTRACT

In this course cross sectional imaging will be used to contour normal pancreatico-biliary anatomy as well as tumors involving this anatomical region. Also patterns of spread of pathological lymph nodes will be shown, and corss sectional imaging will be used to contour the regional nodal lesions. Cases will be
presented and the participants will be stimulated to do the contouring themselves, and will have feed-back on their results

MSRO26

BOOST: CNS - Current Controversies in CNS Tumors: Case-Based Approach with Role of MR/PET Imaging (An Interactive Session)

Monday, Nov. 28 3:00PM - 4:15PM Room: S103CD

NR MR NM RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants

Andrew S. Chi, MD,PhD, New York, NY (*Presenter*) Nothing to Disclose
Daniel P. Cahill, Boston, MA (*Presenter*) Consulting, Merck & Co, Inc
Whitney B. Pope, MD, PhD, Los Angeles, CA (*Presenter*) Research Consultant, F. Hoffmann-La Roche Ltd; Research Consultant, Amgen Inc; Research Consultant, Tocagen Inc; ;
Christina I. Tsien, MD, Saint Louis, MO (*Presenter*) Speaker, Merck & Co, Inc

LEARNING OBJECTIVES

1) Identify areas of controversy in the management of CNS tumors. 2) Apply cranial MR/PET information to answer challenging clinical management questions.

ABSTRACT

SSE01

Breast Imaging (MRI Response to Treatment)

Monday, Nov. 28 3:00PM - 4:00PM Room: Arie Crown Theater

BR BQ MR

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

FDA Discussions may include off-label uses.

Participants
Nola M. Hylton, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Moderator*) Research Grant, Hologic, Inc;

Sub-Events

SSE01-01 Multiparametric Baseline Contrast Enhanced Magnetic Resonance Imaging (CE-MRI) for Prediction of Pathologic Complete Response (pCR) to Neoadjuvant Chemotherapy (NAC) in Breast Cancer

Monday, Nov. 28 3:00PM - 3:10PM Room: Arie Crown Theater

Awards
Student Travel Stipend Award

Participants
Maryam Etesami, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Nathaniel Braman, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Christina Dubchuk, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Prateek Prasanna, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Anant Madabhushi, PhD, Piscataway, NJ (*Abstract Co-Author*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Abstract Co-Author*) Research Grant, Hologic, Inc;

PURPOSE

Imaging based pretreatment prediction of response to NAC in locally advanced breast cancer patients can improve patient selection for NAC and determining prognosis. We have investigated the role of baseline multiparametric DCE-MRI for prediction of pCR in different breast cancer receptor subtypes.

METHOD AND MATERIALS

We retrospectively studied 75 biopsy proven breast cancer patients who had DCE-MRI with diffusion weighted imaging (DWI) prior to NAC followed by breast surgery. The morphology (tumor size, type, and margin), multi-focality of malignancy, qualitative enhancement (pattern and curve type) and quantitative enhancement kinetics (Ktrans, Kep, and Ve calculated by Tofts model), absolute apparent diffusion coefficient (ADC) and normalized ADC (tumor ADC divided by normal glandular tissue ADC), and receptor subtype (luminal [ER/PR+] and non-luminal [triple negative/HER2+]) were assessed for prediction of pCR versus no pCR. Binary logistic regression was used for univariate and multivariate analysis.

RESULTS

Twenty two patients (29%) had pCR. In univariate analysis, smaller tumor size (p=.03), lower normalized ADC (p=.01), circumscribed margin (p=.04), lower Ktrans (p=.05), lower Ve (p=.04), and non-luminal receptor (p=.003) were significantly correlated with pCR. In multivariate analysis, tumor size (p=.02), normalized ADC (p=.03), and receptor subtype (p=.04) remained significantly correlated with pCR; whereas, Ktrans (p=0.07) and Ve (p=.08) became near-significantly correlated with pCR. Following classifying patients based on receptor subtypes, none of the evaluated parameters were significantly correlated with pCR in luminal subtype. In non-luminal subtype, lower normalized ADC (p=.02) and lack of multifocality (p=.02) were significantly correlated with pCR. Absolute tumor ADC, qualitative enhancement parameters, and Kep were not significantly different in pCR versus no pCR in any group.

CONCLUSION

On baseline DCE-MRI, tumor morphology (size and margin), DWI with normalized ADC, and quantitative enhancement kinetics (Ktrans and Ve) may be predictive of pCR to NAC in breast cancers. These predictive measures are stronger in triple-negative and HER2-enriched subtypes compared to luminal subtype.

CLINICAL RELEVANCE/APPLICATION

Baseline DCE-MRI with DWI and quantitative pharmacokinetics is valuable in pretreatment prediction of breast cancer response to NAC and can improve patient selection for NAC.

SSE01-02 Simpsons Diversity Index as a Biomarker of Quantification of Vascular Heterogeneity for Prediction of Overall Survival after Neoadjuvant Treatment for Locally Advanced Breast Cancer

Monday, Nov. 28 3:10PM - 3:20PM Room: Arie Crown Theater

Participants
Stylianos Drisis, MD, Brussels, Belgium (*Presenter*) Nothing to Disclose
Marc P. Lemort, MD, Louvain La Neuve, Belgium (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate Simsons diversity index as a biomarker for quantification of heterogeneity of vascular permeability as a biomarker of overall survival (OS) after to neoadjuvant treatment for locally advanced breast cancer.

METHOD AND MATERIALS

Two MRI examination were performed, one baseline and control examination after two of three cycles of anthracyclines regiment for 48 patients. Quantitive DCE-MRI was performed and Ktrans was categorized as Kt 2sd, 3sd and 4sd corresponding to 2, 3 and 4 sd more than Ktrans value of the mammary gland. Then, Simsons' index was calculated according to the following formula: 1-((kt2sd*(kt2sd-1)+kt3sd*(kt3sd-1)+kt4sd*(kt4sd-1))/(Σ(kt2sd:kt4sd)*(Σ(kt2sd:kt4sd)-1)))The continuing variable of Simsons index was then converted to 4 quadrilles (group 1 representing the lowest and group 4 the highest vascular heterogeneity. OS was calculated using the Kaplan Mayer statistical analysis and comparison of survival curves was performed by Logrank test.

RESULTS

At MRI1 Simpsons index group1 and group2 showed better OS than group3. The comparison of group1 versus group3 showed a p = 0,09 and for group2 versus group3 p = 0,15. At MRI2 Simpsons index group1 and group2 showed better OS than group3. The comparison of group1 versus group3 showed a p = 0,06 and for group2 versus group3 p = 0,23. However group4 had similar OS at MRI as group1.

CONCLUSION

Vascular permeability heterogeneity can be quantified with a known Simpsons index. This quantification showed good correlation with 5 years OS for groups 1, 2 and 3.

CLINICAL RELEVANCE/APPLICATION

Heterogeneous tumors tend to show resistance during neoadjuvant treatment. By quantifying heterogeneity of vascular permeability we could possibly predict heterogeneous molecular background and select patients for alternative treatments.

SSE01-03 Lesion to Background Signal Enhancement Ratio on Breast MRI is Useful in Distinguishing Presence of Residual Tumor versus No Residual Tumor after Neoadjuvant Chemotherapy

Monday, Nov. 28 3:20PM - 3:30PM Room: Arie Crown Theater

Participants
Sooyeon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
In-Ae Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Ui Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soo-Yeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bo Ra Kwon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Su Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To investigate whether the lesion to background signal enhancement ratio (SER) on dynamic contrast enhanced (DCE)-MRI is useful in distinguishing residual tumor versus no residual tumor as well as minimal invasive tumor versus residual DCIS on histopathology after neoadjuvant chemotherapy (NAC).

METHOD AND MATERIALS

Between 2009 and 2015, 861 consecutive women who had undergone NAC, DCE-MRI, and subsequent surgery were identified. Among them, a total of 221 women (mean age 47.9, range 26-82 years) with no residual tumor (n= 75), residual DCIS (n= 51) or minimal invasive tumor ≤ 5mm (n=95) on histopathology were included. To compare the mean SER (signal intensity of the lesion / signal intensity of normal parenchyma) and lesion size on MRI according to the presence of residual tumor, independent sample t-test and multivariate logistic regression analysis were performed. Area under the receiver operating characteristic curve (Az) was used to evaluate performance of SER.

RESULTS

Mean SER of residual tumor (minimal invasive tumor plus DCIS) was higher than that of no residual tumor (1.72±0.40 vs. 1.49±0.32, P<0.001). Mean SER of residual DCIS was not different that of minimal invasive tumor (1.78±0.36 vs. 1.69±0.41, P=0.181). Mean MRI lesion size of residual tumor was larger than that of no residual tumor (2.42±1.97cm vs. 1.37±1.57cm, P<0.001). In multivariate analysis, higher SER (OR, 6.206, 95% CI, 2.512-15.331, P<0.001) and larger lesion size on MRI (OR, 1.576; 95% CI, 1.249-1.988, P<0.001) were independently associated with the presence of residual tumor. Az value of SER in distinguishing residual tumor versus no residual tumor was 0.662 (95% CI: 0.595-0.724) with an optimal cut-off point of 1.7 yielding maximal sum of sensitivity and specificity.

CONCLUSION

Lesion to background SER on MRI was useful in distinguishing presence of residual tumor from no residual tumor after NAC, however, it was not useful in distinguishing minimal invasive tumor from residual DCIS.

CLINICAL RELEVANCE/APPLICATION

When an enhancing lesion shows its SER < 1.7 on DCE-MRI after NAC, the lesion has high possibility of pathologic complete response, which might be helpful in deciding surgical extent.

SSE01-04 Computerized Texture Analysis of Locally Advanced Breast Cancers on Pre Treatment MRI May Identify Triple-Negative Tumors and Help Predicting Response to Neo-Adjuvant Chemotherapy

Monday, Nov. 28 3:30PM - 3:40PM Room: Arie Crown Theater

Participants
Foucauld Chamming's, MD, PhD, Montreal, QC (*Presenter*) Speaker, Supersonic Imagine
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PURPOSE

To evaluate whether texture analysis of breast cancers on pre-treatment Magnetic Resonance Imaging (MRI) may identify tumor sub-types and predict Pathologic Complete Response (pCR) to Neo Adjuvant Chemotherapy (NAC).

METHOD AND MATERIALS

Institutional review board was obtained. 85 patients with 86 Locally Advanced Breast Cancers (LABC) who underwent breast MRI before NAC were included in this retrospective study. 2D texture analysis was performed using TexRAD® software on T2-weighted (T2W) and one minute post-contrast non-subtracted T1-weighted (T1W) MRI with filtering technique. Quantitative parameters were compared between Triple Negative Breast Cancers (TNBC) and non-TNBC and between complete and non-complete responders using Mann Whitney U test. Multivariate logistic regression (LR) analysis with stepwise selection was used to determine independent parameters and to build a prediction model for identification of TNBC. Prediction performance of this model was assessed using Receiving Operator Curves (ROC) analysis.

RESULTS

sixteen (19 %) tumors were Triple Negative Breast Cancers (TNBC). pCR was achieved in thirty tumors (35%). On univariate analysis, mean (P=0.006), Mean Proportion of Positive pixel (mpp) (P=0.038), skewness (P=0.018) and kurtosis (P=0.005) on T2W and kurtosis on post-contrast T1W (P=0.0037) showed significant difference between the TNBC and non-TNBC groups. Kurtosis on T2W (P=0.008) showed a significant difference between the pCR and non-pCR groups. On multivariate analysis, kurtosis on T2W (P=0.033; Odd Ratio (OR): 1.44, 95% Confidence Interval (CI): [1.02-2.34]) and post contrast T1W (P=0.009; OR: 3.31 [1.32-9.92]) were independent parameters for identification of TNBC. A multivariate model incorporating T2W and post-contrast T1W kurtosis showed good performance (area under the curve: 0.815; sensitivity: 75%; specificity: 72%; Accuracy: 72%) for the identification of TNBC.

CONCLUSION

Among quantitative parameters derived from texture analysis of LABC on pre-treatment MRI, kurtosis appears to be significantly associated with pathologic response to NAC and to be a promising biomarker for the identification of TNBC.

CLINICAL RELEVANCE/APPLICATION

Computerized texture analysis of breast cancers on pre-treatment MRI might be used to better characterize tumors and improve selection of patient before neo adjuvant chemotherapy.

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/

Caroline Reinhold, MD, MSc - 2013 Honored Educator
Caroline Reinhold, MD, MSc - 2014 Honored Educator

SSE01-05 Triple Negative Breast Cancer: MRI Characteristics and Clinico-pathologic Factors Associated with Response to Neoadjuvant Chemotherapy

Monday, Nov. 28 3:40PM - 3:50PM Room: Arie Crown Theater

Participants
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Eun Young Chae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Hak Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of the study was to investigate the findings of MRI and clinico-pathologic factors associated with response to neoadjuvant chemotherapy in patients with triple negative breast cancer (TNBC).

METHOD AND MATERIALS

Our institutional review board approved this retrospective study. Between Jan 2009 and Dec 2009, 74 TNBC patients who had baseline MRI, completed neoadjuvant chemotherapy, and underwent surgery in our consititute. Clinico-pathologic factors of the tumor including tumor type, nuclear grade, histologic grade, Ki-67 index, axillary LN involvement, and stage were evaluated. Pathological CR (pCR) was defined as the absence of invasive cancer. Near pCR was defined as presence of only a very small residual invasive cancer of less than 0.3 cm in diameter or of a small number of scattered tumor cells. Morphologic characteristics of the tumor, kinetics and pattern of tumor volume reduction on follow-up MRI were evaluated. Tumor characteristics such as size, presentation of the tumor being mass or non-mass, shape, margin and internal enhancement characteristics of the tumor, and kinetic curve assessment were defined and assessed according to BI-RADS lexicon. Additional MRI features such as presence of intratumoral necrosis, T2 signal intensity, multiplicity, background parenchymal enhancement, and amount of fibroglandular tissue were evaluated. All Clinical-pathologic and MRI findings were compared between the patients with pCR including near pCR and non-pCR.

RESULTS

Among 74 patients, 19 patients (26%) showed pCR. Nuclear grade (p=0.017), histologic grade (p=0.008), and presence of axilla lymph node involvement (p=0.023) showed statistical significance difference between pCR and non-pCR group. Shape of the tumor

at baseline MRI (p=0.039) and pattern of reduction at follow-up MRI (p=0.024) showed significant difference. At multivariate analysis, shape of the tumor was independently associated with recurrence. Patients in the group were likely to have irregular shape compared with those in non-pCR group (OR 3.61).

CONCLUSION

In this study, an association between pathologic response to neoadjuvant chemotherapy and MRI characteristics and clinico-pathologic factors were found in patients with triple negative breast cancer.

CLINICAL RELEVANCE/APPLICATION

MRI characteristics, changes on follow-up MRI and clinico-pathologic factors may be helpful in assessing response to neoadjuvant chemotherapy in patients with triple negative breast cancer.

SSE01-06 Assessment of Treatment Response to Neoadjuvant Chemotherapy in Breast Cancer using non-Mono-Exponential Diffusion Models: A Feasibility Study

Monday, Nov. 28 3:50PM - 4:00PM Room: Arie Crown Theater

Participants
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Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Presenter*) Research Grant, GlaxoSmithKline plc; Research Grant, General Electric Company; Research Grant, Hologic, Inc

PURPOSE

To assess the utility of the mono-exponential (ME), bi-exponential (BE) and stretched-exponential (SE) models in evaluating response of breast tumours to neoadjuvant chemotherapy (NACT) at 3T.

METHOD AND MATERIALS

Thirty-six female patients (median age; 53 years) with invasive breast cancer undergoing NACT were prospectively enrolled for diffusion-weighted MRI (DW-MRI) in this IRB-approved study prior to the start of treatment. For assessment of early treatment response, changes in parameters were evaluated on the mid-treatment MRI in 22 patients. DW-MRI was performed using 8 b-values (0, 30, 60, 90, 120, 300, 600, 900 s/mm2). Apparent diffusion coefficient (ADC), tissue diffusion coefficient (Dt), vascular fraction (f), distributed diffusion coefficient (DDC) and alpha (α) parameters were derived. Regions of interest were drawn on the largest tumour diameter and data was analysed on a voxel-wise basis. T-tests compared the baseline and change in parameters between response groups. Receiver operator characteristics (ROC) curves for response prediction were generated. Repeatability was assessed at inter- and intra-observer levels.

RESULTS

All patients underwent the baseline MRI whereas 22 lesions were available at mid-treatment. Sixteen patients demonstrated complete response while 20 were non-responders. At pre-treatment, the mean diffusion coefficients showed significant differences between groups ($p<0.05$). On ROC analysis, DDC showed a larger area under the curve (0.756) compared to ADC and Dt. The DDC cut-off to differentiate response groups ($1.141\times10\text{-}3mm2/s$) yielded the highest measures of sensitivity (81%) and specificity (72%). At mid-treatment, increase in ADC and DDC showed significant differences between response groups (p=0.03, p=0.04). However the change in Dt was not significant (p=0.14). The decrease in f in responders was substantially different from the increase in non-responders (p=0.05). Responders also showed larger increase in α, although non-significant (p=0.68). Overall, the SE parameters showed excellent repeatability.

CONCLUSION

DW-MRI is sensitive to baseline and early treatment changes in breast cancer using non-mono-exponential models and the SE model can potentially monitor such changes.

CLINICAL RELEVANCE/APPLICATION

Multi-exponential models offer imaging biomarkers, which can potentially provide insights to the cellular compartments and membranes and may become more sensitive to treatment-induced tissue changes.

SSE02

Breast Imaging (Quantitative Imaging and CAD)

Monday, Nov. 28 3:00PM - 4:00PM Room: E450A

BR BQ DM IN

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

FDA Discussions may include off-label uses.

Participants
Sungheon G. Kim, PhD, New York, NY (*Moderator*) Nothing to Disclose
Robert M. Nishikawa, PhD, Pittsburgh, PA (*Moderator*) Royalties, Hologic, Inc; Research Consultant, iCAD, Inc;

Sub-Events

SSE02-01 Concurrent CAD for Digital Breast Tomosynthesis

Monday, Nov. 28 3:00PM - 3:10PM Room: E450A

Participants
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Jeffrey W. Hoffmeister, MD, Nashua, NH (*Abstract Co-Author*) Employee, iCAD, Inc; Stockholder, iCAD, Inc

PURPOSE

Digital Breast Tomosynthesis (DBT) is more accurate than Full-Field Digital Mammography (FFDM) alone, but prolongs reading time. A reader study evaluated the concurrent use of a Computer-Aided Detection (CAD) system to shorten reading time, while maintaining performance.

METHOD AND MATERIALS

A CAD system was developed to detect suspicious soft tissue lesions (masses, architectural distortions and asymmetries) in DBT planes. Rather than marking lesions, detected locations are extracted from the DBT planes and blended into the corresponding 2D synthetic image. Thus, lesions can be efficiently viewed in a CAD-enhanced 2D synthetic image without overlapping tissue. Twenty (20) radiologists retrospectively reviewed 240 cases in a multi-reader, multi-case (MRMC) crossover design. An enriched DBT sample included 67 malignancies in 60 patients and compared reading with CAD versus without CAD. All readers reviewed all cases with and without CAD in 2 visits separated by a memory washout period of at least 4 weeks. Radiologist performance was assessed by measuring Area Under the Receiver Operating Characteristic (ROC) Curve (AUC) for malignant lesions with CAD versus without CAD. Reading time, sensitivity, specificity and recall rate were also assessed.

RESULTS

Reading time improved 29.2% with use of CAD (95% CI: 21.1%, 36.5%; $p < 0.01$). Reader performance was non-inferior with CAD, for nonlinferiority margin delta = 0.05. Average AUC increased by 0.007 (95% CI: l0.013, 0.028; non-inferiority $p < 0.01$), from 0.839 without CAD to 0.846 with CAD. Average sensitivity increased with CAD from 0.847 without CAD to 0.870 with CAD (95% CI: -0.006, 0.053); showing a 0.032 increase in average sensitivity for soft tissue densities (95% CI: l0.002, 0.066), from 0.837 without CAD to 0.869 with CAD. Average specificity decreased from 0.525 without CAD to 0.507 with CAD (-0.018; 95% CI: -0.041, 0.005), and average recall rate for non-cancers increased from 0.476 without CAD to 0.494 with CAD (0.018; 95% CI: -0.005, 0.041).

CONCLUSION

Concurrent use of CAD results in a 29.2% faster reading time with non-inferiority of radiologist performance compared to reading without CAD.

CLINICAL RELEVANCE/APPLICATION

Concurrent use of CAD maintains high performance of DBT with a significant reduction in reading time.

SSE02-02 Dynamic Textural Analysis of Pre-treatment DCE-MRI Predicts Pathological Complete Response to Neoadjuvant Chemotherapy in Breast Cancer

Monday, Nov. 28 3:10PM - 3:20PM Room: E450A

Awards
Student Travel Stipend Award

Participants
Nathaniel Braman, Cleveland, OH (*Presenter*) Nothing to Disclose
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Christina Dubchuk, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Abstract Co-Author*) Research Grant, Hologic, Inc;
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PURPOSE

Fewer than 30% of breast cancer patients who undergo neo-adjuvant chemotherapy (NAC) prior to surgery achieve pathological complete response (pCR). A pre-treatment dynamic contrast-enhanced MR imaging (DCE-MRI) biomarker predictive of pCR would enable more precise prognosis assessment and NAC targeting. We explore radiomic analysis of computer-extracted dynamic texture features at two DCE-MRI enhancement phases as a means of predicting breast cancer NAC response from baseline imaging.

METHOD AND MATERIALS

75 1.5T DCE-MRI scans prior to NAC were retrospectively analyzed. 22 patients had histology-confirmed pCR, while 53 had partial or non-response (NR). Computer-extracted texture features (Haralick, Co-occurrence of Local Anisotropic Gradient Orientations (CoLIAGe), and Laws) were separately extracted from initial and peak enhancement phases. The 5 most distinguishing features were selected by interaction capping and used to train a random forest classifier in a 3-fold cross-validation setting. Ability to predict pCR was assessed by area under the receiver operating characteristic curve (AUC) among all patients and within luminal (ER/PR+, 9 pCR, 41 NR) and non-luminal (triple-negative and HER2+, 13 pCR, 12 NR) patient subgroups.

RESULTS

Initial post-contrast phase texture features were effective in predicting pCR within luminal lesions (AUC = .863 ± .051), as well as identifying responders without separation by subtype (.831 ± .044). Prediction of pCR from initial phase was less reliable within the non-luminal group (AUC = .743 ± .087), yet peak contrast features better entified non-luminal responders than within luminal or all subtype groups (.831± .060 vs. .732 ± .054 and .679 ± .043). Top distinguishing features for the luminal group were homogeneity-based: standard deviation of CoLIAGe energy and sum variance, Haralick inverse difference moment. Non-luminal studies were partially identified by similar homogeneity features like CoLIAGe energy, but also by Laws energy features that detect "spottiness" and edges.

CONCLUSION

Dynamic textural analysis of DCE-MRI phases was shown to successfully predict pCR to NAC in luminal and non-luminal breast cancers.

CLINICAL RELEVANCE/APPLICATION

The ability to identify patients who will achieve pCR to NAC from baseline DCE-MRI texture features may provide a pre-treatment indicator of pathological complete response to neo-adjuvant chemotherapy, avoiding both under and over treatment of breast cancer subtypes.

SSE02-03 Could 'Deep Learning' Reduce Unnecessary Biopsies of Mammographic Microcalcifications?

Monday, Nov. 28 3:20PM - 3:30PM Room: E450A

Participants
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PURPOSE

To investigate whether a machine learning technique known as deep learning, which selects image pixel data directly (rather than human-designed features) in the extraction of image descriptors, has potential to reduce breast biopsies of benign mammographic microcalcifications without associated findings.

METHOD AND MATERIALS

The HIPAA compliant dataset contained diagnostic mammography images of biopsy-sampled BIRADS 4 and 5 lesions in 107 patients for whom the lesion was visible only as microcalcifications. There were 21 patients with breast cancer (7 invasive and 14 in situ), and 86 with benign lesions. For each image a 256x256 region of interest containing the microcalcification was selected by an expert radiologist. The region of interest was used directly as input to a deep learning method trained on a very large independent set of non-medical images. The image descriptors thus extracted were subsequently used in a nested leave-one-out-by-case (i.e., patient) model selection and classification protocol. The number of benign breast biopsies that could be avoided at zero loss in sensitivity to diagnose cancer was evaluated for the deep learning method and compared to that obtained based on a subjective probability of malignancy assigned by an expert radiologist as part of this study. Here, bootstrapping was used to assess statistical significance.

RESULTS

At 100% sensitivity, on average, the numbers of benign biopsies that could be avoided were 38 of 86 by the deep learning-based method and 11 of 86 based on the probability of malignancy assigned by the radiologist. The deep learning-based method operated at 44% specificity (95% confidence interval [34-55%]) and the study radiologist at 13% [6-20%] ($p<.001$). Note that clinical specificity for this dataset was zero since all lesions underwent biopsy.

CONCLUSION

There seems to be great potential for the application of deep learning methods as an aid to radiologists in the analysis of medical images.

CLINICAL RELEVANCE/APPLICATION

Reducing the number of unnecessary breast biopsies without loss in diagnostic sensitivity is an important step towards improved breast cancer diagnosis and cost reduction.

SSE02-04 Quantitative Characteristics of Background Parencymal Enhancement in Longitudinal Breast DCE-MRIs of Healthy Women

Monday, Nov. 28 3:30PM - 3:40PM Room: E450A

Participants
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PURPOSE

Breast DCE-MRI background parenchymal enhancement (BPE) has been reported to be associated with breast cancer risk. It became clinically important to understand key characteristics of BPE in developing it as a potential risk biomarker. In this study we investigated quantitative statistics and temporal variations of BPE in a longitudinal breast DCE-MRI dataset acquired from healthy women.

METHOD AND MATERIALS

We retrospectively identified 251 longitudinal breast DCE-MRI scans (earliest on Sep 2004 and latest on Dec 2015) from 93 women (31% have BRCA1/2 mutations) who underwent high-risk breast MRI screening at our institution (2-6 sequential scans per woman). For all the 251 scans, the average age-at-scan was 48.8±7.2 YO (range 26-67), the average between-scan time was 419±165 days (range 171-1605), and 134 (53%) were pre-menopausal with the rest post-menopausal. All 93 women remain breast cancer-free at the time of analysis. Fully automated computerized methods were applied to quantify BPE from the first post-contrast sequence at both bilateral and unilateral level. A quantitative BPE measure (BPE%) was derived as the percentage of the volume of enhanced voxels (at least 20% relative enhancement) over the fibroglandular tissue relative to the volume of fibroglandular tissue. A set of descriptive statistics were computed for BPE%, and variability of BPE% between sequential scans was measured by the intraclass correlation coefficient (ICC) in a linear mixed effects model.

RESULTS

For all 251 scans, mean BPE% was 25.1% ±13.7 (range 1.1% - 83.9%); the Pearson's correlation coefficient of BPE% between left (mean 27.4%±14.7) and right breasts (mean 24.2%±14.1) was 0.85; mean BPE% was 29.7%±15.0 (range 9.2% - 83.9%) for pre-menopausal and 20.9%±10.9 (range 1.1% - 67.0%) for post-menopausal scans (unpaired t-test $p<0.0001$). For 71 (or 48) women who had at least 2 (or 3) sequential scans, ICC of BPE% was 0.63 (or 0.46), and temporal variations of BPE% between longitudinal scans are shown in the figure.

CONCLUSION

In longitudinal DCE-MRI scans of breast cancer-free women, BPE% is highly correlated bilaterally, significantly higher among pre- than post-menopausal women, and the mean value decreases with aging.

CLINICAL RELEVANCE/APPLICATION

Quantitative characterization of BPE in longitudinal MRIs of healthy women will help determine BPE's temporal variability and reproducibility, building baseline measures for its use as a risk biomarker.

SSE02-05 Applying Data-driven Imaging Biomarker in Mammography for Breast Cancer Screening

Monday, Nov. 28 3:40PM - 3:50PM Room: E450A

Participants
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PURPOSE

To assess feasibility of data-driven imaging biomarker (DIB; an imaging biomarker that is derived from large-scale medical image data by using deep learning technology) in mammography and evaluate its potential for detection of breast cancer.

METHOD AND MATERIALS

We collected 9,757 digital mammograms from five institutions. 3,228 cancer cases were confirmed by pathology. 6,529 normal cases were defined by BIRADS final assessment category 1 without developing malignancy for 2 years. Each case includes 4 views of mammograms. 800 cases were randomly chosen as validation (n=400) and test (n=400) sets, and the remainder (2428 for cancer, 5,729 for normal) were used for training. The core algorithm of DIB-M (DIB for mammography) is deep convolutional neural network; a deep learning algorithm specialized for images. It learns discriminative features directly from training data according to the final task (cancer detection). For each case in training data, the probability of cancer inferred from DIB-M is compared with the

ground-truth diagnosis result (cancer: 1, normal: 0). Then the model parameters for DIB-M are updated based on the error between the prediction and the ground-truth. Training proceeds to minimize the prediction error of the entire training set, and the final DIB-M performed the best on the validation set is used for evaluation. We performed the experiment with 3 different random-split datasets to verify performance consistency.

RESULTS

AUC was 0.813 and 0.814 for the validation and test sets, respectively. Accuracy at threshold 0.5 was 72.9% (validation) and 73.4% (test). Sensitivity (specificity) according to different thresholds for the test set is: 0.940 (0.383), 0.810 (0.635), 0.690 (0.778), 0.505 (0.903), and 0.313 (0.983) with respect to the thresholds 0.1, 0.3, 0.5, 0.7, and 0.9. ROC curves according to 3 random sets were similar (Fig.1).

CONCLUSION

This research showed the potential of DIB-M as a screening tool for breast cancer. Further studies using a large number of high-quality data including benign cases are needed to further investigate its feasibility as a screening tool.

CLINICAL RELEVANCE/APPLICATION

Unlike previous computer-aided detection (CAD) algorithms, DIB-M is purely based on data-driven features from a large-scale mammography data instead of manually designed features. With further validation, DIB-M may help radiologists to diagnose breast cancer with higher accuracy and efficiency.

SSE02-06 Computer-Aided Detection (CAD)-Generated Kinetic Features of Preoperative Breast MR Imaging: Association with Disease-Free Survival of Patients with Invasive Breast Cancer

Monday, Nov. 28 3:50PM - 4:00PM Room: E450A

Participants
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Seung Hyun Lee, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Tae Hong Lee, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Suk Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively investigate whether the kinetic features of breast cancers assessed with computer-aided detection (CAD) at preoperative magnetic resonance (MR) imaging are associated with disease-free survival in patients with invasive breast cancer.

METHOD AND MATERIALS

This is an institutional review board-approved retrospective study, with a waiver of informed consent. Between January 2012 and February 2013, 330 consecutive women (mean age, 52.9 years; age range, 32-88 years) with newly diagnosed invasive breast cancer who had undergone preoperative MR imaging and curative surgery were identified. We retrospectively reviewed all preoperative MR images using a commercially available CAD system and noted the following kinetic parameters for each lesion: peak enhancement (the highest pixel signal intensity in the first post-contrast series), angio-volume (the total volume of the enhancing lesion), and delay enhancement profiles (the proportions of washout, plateau, and persistent-enhancing component within a tumor). Cox's proportional hazards modeling was used to identify associations between CAD-generated kinetic features and disease-free survival, after controlling for clinicopathological variables.

RESULTS

A total of 31 recurrences developed at a median follow-up time of 42 months (range, 3-50 months). The mean peak enhancement was significantly higher in patients with recurrences than in those who remained disease-free (553.65 ± 686.59 vs. 249.89 ± 263.25, P=0.020). Multivariate Cox's analysis showed that a higher peak enhancement (hazard ratio [HR]=1.001, 95% confidence interval [CI]=1.000-1.002, P=0.009) and presence of lymphovascular invasion (HR=2.433, 95% CI=1.086-5.449, P=0.031) were independently, and significantly, associated with poorer disease-free survival.

CONCLUSION

A higher CAD-measured peak enhancement at preoperative breast MR imaging was independently associated with poorer disease-free survival of patients with invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION

Kinetic features assessed by applying computer-aided detection (CAD) to preoperative breast MR images can be used to identify a subgroup of breast cancer patients at high risk of recurrence.

SSE03

Cardiac (Dual-Energy CT Imaging)

Monday, Nov. 28 3:00PM - 4:00PM Room: S502AB

CA CT

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

FDA Discussions may include off-label uses.

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Sub-Events

SSE03-01 Uric Acid Crystals in Coronary Plaque by 128-slice Dual Energy Computed Tomography (DECT)?: Ex-vivo and In-vivo Case Controlled Study

Monday, Nov. 28 3:00PM - 3:10PM Room: S502AB

Participants
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PURPOSE

Whether hyperuriceamia is a dependent or independent cardiac risk factor, is controversely debated. Pathomechanisms are complex and fairly understood, and systemic inflammation may play a role.There is anecdotal histological evidence of urate in vessels walls. Our objective was to assess whether dual energy computed tomography (DECT) detects uric acid precipation in coronary artery plaque in–vivo and ex-vivo

METHOD AND MATERIALS

We performed an IRB approved ex-vivo phantom and an in-vivo matched case-controlled study: 1)In – vivo: 53 patients underwent 128-slice dual energy computed tomography (DECT) (Definiton Flash;Siemens)with both a cardiac (prospective ECG-gated;100 kV/140 kV) and peripheral extremity protocol of one anatomic region (either knee, hand or foot). Gout positives (G+) were defined as presenting with gout tophi>1cm in peripheral extremities. Post-processing was performed with "gout" DE subtraction curves. 2) Ex-vivo: Urate crystals in different NaCL solutions (5%/10%/15%/20%/25%) were placed in tubes and scanned by DECT. Coronary plaque models simulating urate plaque, calcifying plaque and normal coronary arteries, were scanned with the same standardized cardiac CT protocol.

METHOD AND MATERIALS

We performed an IRB approved ex-vivo phantom and an in-vivo matched case-controlled study. 1) In – vivo: 53 patients underwent dual energy 128- slice dual source computed tomography (DECT) (Siemens Definition Flash) with both a cardiac (prospective ECG-gated, 100 kV and 140 kV; fused 120kV) and peripheral extremity protocol (right and left joints) of one anatomic region (either knee, hand or foot). The gout positive (G+) group was defined as the presence of gout tophi>1cm proofen by DECT in peripheral extremities. Artifacts were excluded. Post-processing was performed with the „gout" dual energy subtraction layover curves (DE, MMWP, Siemens) 2) Ex-vivo: Urate crystals within different NaCL solutions (5%, 10%, 15%, 20%, 25%) were placed in tubes and scanned with the same standardized CT protocols as described above. Then, a coronary plaque model simulating urate plaque, calcifying plaque and normal coronary arteries was designed and scanned with the same cardiac DECT protocol.

RESULTS

53 patients (20 G+ and 33 G-) were included. Prevalence of urate precipations in coronary artery plaque in the G+ group was higher with 13/20 vs 4/33 (65% vs 1.2%); ($p<0.001$). When matching 20 G+ with 20 controls without hyperuricemia for age and gender, more urate positive coronary plaque were found in G+ (OR 9.8; 95% CI 2.2- 54.9) ($p=0.003$). The number of urate+ coronary plaques by DECT was higher (32 vs 4; $p<0.0001$) in G+ than in controls. In urate plaque, 6 lesions were only non-calcifying and 26 mixed calcified, mean density was 232.3 HU (range, 213- 264). Calcium Score was higher in G+ (578 vs 120.6 Agatston Units, $p=0.007$). Ex-vivo: Urate crystals were detected by DECT in 15% solutions upwards. The urate coronary plaque modell (green) was clearly distinguished from calcifying (blue).

CONCLUSION

Uric acid crystal detection in coronary artery plaque seems feasible by cardiac DECT. Patients with clinical prooven gout precipated more urate in coronary plaque, which may stimulate intraplaque inflammation.

CLINICAL RELEVANCE/APPLICATION

Hyperuricaemia is a rather independent cardiac risk factor. Patients with urate crystal positive coronary plaque might benefit from drugs targeting systemic crystal resolution

SSE03-02 Dual-Energy CT for Detection of Acute Myocardial Infarction: Is Delayed Acquisition Better than First-Pass Acquisition? Comparison with PET

Monday, Nov. 28 3:10PM - 3:20PM Room: S502AB

Participants
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Tao Jiang, Bei Jing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of first-pass and delayed dual-energy CT (DECT) for the detection of acute myocardial infarction (AMI).

METHOD AND MATERIALS

This study was approved by the local ethics committee, and written informed consent was obtained from each patient. Consecutive AMI patients were prospectively recruited in this study. First-pass and delayed DECT were underwent before 13N-ammonia PET. All examinations were performed under rest. The DECT iodine distribution maps of first-pass and delayed acquisition were visually assessed. Diagnostic performances of first-pass and delayed DECT were compared on a per-segment basis with 13N-ammonia PET as the reference standard.

RESULTS

CT and PET examinations were successfully performed in 27 patients. A total of 459 segments were analyzed. The diagnostic accuracy of first-pass and delayed DECT was high on a per-segment basis (89.8% and 91.5%). The area under the receiver operating characteristic curve of delayed DECT (0.915) was larger than first-pass (0.897) on a per-segment basis but the difference between them has no statistical significance ($P < 0.05$) using the method of DeLong et al.

CONCLUSION

First-pass DECT shows high diagnostic accuracy for detection of acute myocardial infarction with no inferior to delayed DECT.

CLINICAL RELEVANCE/APPLICATION

For patients early after acute myocardial infarction, first-pass DECT is a convenient imaging modality with the ability to provide both information on severity of coronary stenosis and extent of myocardial infarction requiring only 1 scan.

SSE03-03 Virtual Calcium Subtraction at Coronary CT Angiography using 3rd Generation Dual-Source Dual-Energy CT: Efficiency and Image Quality Analysis

Monday, Nov. 28 3:20PM - 3:30PM Room: S502AB

Participants
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Domenico De Santis, MD, Charleston, SC (*Presenter*) Nothing to Disclose

PURPOSE

To compare the luminal visualization, diagnostic confidence, and objective image quality at 3rd generation dual-source dual-energy (DECT) coronary CT angiography achievable through a virtual calcified plaque subtraction (CS) algorithm. Results were compared with non-subtracted linear blending DECT series (NS).

METHOD AND MATERIALS

Twenty patients were consecutively enrolled into our IRB approved prospective study. Image series were created with dedicated software using DECT datasets of 90kV and 150kV. CS series underwent calcified plaque subtraction based on a prototype modified three-material decomposition algorithm. Luminal visualization was rated based on a 3-point scale: 1, non-assessable; 2, partly assessable; and 3, full diagnostic visualization. Stenosis grades were determined as either normal, <50%, 50-99%, and occlusion. Diagnostic confidence for stenosis grades was scored using a 3-point scale: 1, uncertain; 2, likely correct; and 3, definitely correct. Two radiologists independently reviewed CS and NS. Coronary segments with severe motion artifact or without any calcified plaque were excluded. Contrast to noise ratio (CNR) and signal to noise ratio (SNR) were calculated.

RESULTS

A total of 129 coronary segments showed calcified plaque on DECT. Luminal visualization was significantly better in CS than NS series according to both observers (2.3±0.6 vs. 1.8±0.6, $p<0.001$ for R1; 2.0±0.5 vs. 1.9±0.5, $p=0.045$ for R2). Diagnostic confidence was also significantly higher in CS than NS series (2.3±0.6 vs. 1.8±0.5, $p<0.001$ for R1; 2.2±0.7 vs. 1.9±0.7, $p<0.001$ for R2). CS showed significantly lower CNR and SNR than NS (5.7± 2.2 vs. 11.0±7.4, $p=0.001$ for CNR; 6.6±2.6 vs. 12.0±5.9, $p<0.001$ for SNR). Moderate and fair interobserver agreement was achieved for luminal visualization and diagnostic confidence with CS ($\kappa=0.275$ and 0.416), whereas only fair or slightly poor agreement was recorded with NS ($\kappa=0.228$ and 0.118).

CONCLUSION

Subtraction of calcified plaque at coronary CT angiography can be accomplished using DECT and enhances luminal visualization. Further research will investigate the effect of this advanced post processing technique on diagnostic accuracy in comparison with invasive reference standards.

CLINICAL RELEVANCE/APPLICATION

Using dual-energy CT-based calcified plaque subtraction may successfully address a well-known limitation of this test and enhance

the specificity of lesion characterization, thus avoiding unnecessary catheterization.

SSE03-04 Volume-Based Quantification Using Dual-Energy Computed Tomography in Patients with Cardiac Tumors: Comparison with Late Gadolinium Enhancement Cardiac Magnetic Resonance Imaging

Monday, Nov. 28 3:30PM - 3:40PM Room: S502AB

Participants
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PURPOSE

The purpose of this study was to assess the diagnostic value of a volume based quantification using dual-energy cardiac computed tomography (CCT) for differentiating between cardiac tumors and thrombi and to compare quantitative CCT values with late gadolinium enhancement cardiac magnetic resonance (LGE-CMR) parameters.

METHOD AND MATERIALS

Our institutional review board approved this study, and patients provided informed consent. We prospectively enrolled 31 patients who had a cardiac mass on echocardiography or computed tomography (CT). All patients underwent dual-energy CCT (GE HD750, electrocardiography-gated) and 20 patients underwent LGE-CMR imaging. For quantitative analysis, the following parameters of the cardiac masses were measured: CT attenuation values in Hounsfield units (HU), iodine concentration (IC, mg/ml), and signal intensity (SI) ratio. A mixed effects model was used to evaluate the significance of differences in mean CT attenuation values, mean iodine concentration, and SI ratios between the cardiac tumor and thrombus groups. Diagnostic performance of each parameter was evaluated by constructing a receiver operating characteristics (ROC) curve.

RESULTS

There were a total of 17 cardiac tumors and 15 cardiac thrombi. The mean iodine concentration (mg/ml) was significantly higher in cardiac tumors than cardiac thrombi (3.405 ± 2.624 for cardiac tumors; 2.056 ± 2.793 for cardiac thrombi, p=0.001). The diagnostic performance of the IC and SI ratio for differentiating cardiac tumors from thrombi was not significantly different (AUC; 0.822 vs. 0.945, p=0.084).

CONCLUSION

Dual-energy CCT using volume-based iodine measurements can be used to differentiate between cardiac tumors and thrombi.

CLINICAL RELEVANCE/APPLICATION

Given the superiority of iodine-based measurements using dual-energy CCT in differentiating cardiac tumors from thrombi compared with conventional contrast CT, CCT parameters can be incorporated into the decision process of selecting candidates for surgery. Dual-energy CCT is a helpful complementary tool to differentiate a tumor from a thrombus in cases in which echocardiography or conventional contrast CT is inconclusive.

SSE03-05 Diagnostic Accuracy of Monoenergetic Reconstruction and Nonlinear Blending on Myocardial Infarction Using Dual-Energy CT: Comparison with 3 T Cardiac MR

Monday, Nov. 28 3:40PM - 3:50PM Room: S502AB

Participants
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PURPOSE

To evaluate the image quality and diagnostic accuracy of both monoenergetic reconstruction and nonlinear blending LE-DECT in detecting myocardial infarction, as 3T cardiac MR a reference.

METHOD AND MATERIALS

Twenty patients with coronary artery disease were prospectively enrolled and underwent LE-DECT and late gadolinium enhancement CMR (LGE-CMR). LE-DECT images were reconstructed as monoenergetic spectral images 40-190 Kev with 10 Kev interval and non-linear blending setting. Images were assessed for image quality, LE extent (percentile % of whole ventricle segments).

RESULTS

Fifty-two myocardial segments (15%) showed LGE on CMR. LE-DECT detected 70 myocardial segments. The signal-noise ratio, contrast-to-noise ratio of images at 70Kev was better than that of other series. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of 70 Kev in detecting myocardial infarction in per-segment level was 58%,92%,78%,90%,88%, respectively. However, LE extent detected at 70 Kev was overestimated 12% in comparison with CMR in per-segment level.

CONCLUSION

LE-DECT using monoenergetic reconstruction at 70Kev significantly improves image quality and diagnostic accuracy. However, LE extent of myocardial infarction detected with LE-DECT is overestimated compared with CMR.

CLINICAL RELEVANCE/APPLICATION

LE-DECT with monoenergetic reconstruction at 70 Kev significantly improves image quality for detection of myocardial infarction.

SSE03-06 Value of a Noise-optimized Virtual Monoenergetic Reconstruction Technique in Dual-Energy CT for Planning of Transcatheter Aortic Valve Replacement

Monday, Nov. 28 3:50PM - 4:00PM Room: S502AB

Participants
Simon S. Martin, MD, Frankfurt, Germany (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate objective and subjective image quality of a noise-optimized virtual monoenergetic imaging (VMI+) reconstruction technique in dual-energy computed tomography (DECT) angiography prior to transcatheter aortic valve replacement (TAVR).

METHOD AND MATERIALS

Datasets of 47 patients (35 men; 64.1±10.9 years) who underwent DECT angiography of heart and vascular access prior to TAVR were reconstructed with standard linear blending (F_0.5), VMI+ and traditional monoenergetic (VMI) algorithms in 10-keV intervals from 40-100 keV. Vascular enhancement and image noise of 10 arterial segments were measured in each patient; signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of multiple arterial segments were calculated. Three radiologists with different levels of experience in cardiac CT imaging subjectively assessed image quality, iodine enhancement and image noise to compare the different post-processed datasets.

RESULTS

Overall, 470 arterial segments were evaluated. Mean SNR and CNR were highest in 40 keV VMI+ series (SNR, 27.8±13.0; CNR, 26.3±12.7), significantly (all $p<0.001$) superior to all VMI series which showed highest values at 70 keV (SNR, 18.5±7.6; CNR, 16.0±7.4), as well as linearly-blended F_0.5 series (SNR, 16.8±7.3; CNR, 13.6±6.9). Highest subjective image quality scores were observed for 40, 50, and 60 keV VMI+ reconstructions (all $p>0.05$), significantly superior to all VMI and standard linearly-blended images (all $p<0.01$).

CONCLUSION

Low-keV VMI+ reconstructions significantly increase CNR and SNR compared to VMI and standard linear-blending image reconstruction and improve subjective image quality in preprocedural DECT angiography in the context of TAVR planning.

CLINICAL RELEVANCE/APPLICATION

Noise-optimized virtual monoenergetic DECT imaging improves image quality for TAVR planning.

SSE04

Cardiac (Cardiac Valve Disease)

Monday, Nov. 28 3:00PM - 4:00PM Room: S504AB

CA CT

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

FDA Discussions may include off-label uses.

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James C. Carr, MD, Chicago, IL (*Moderator*) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA
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Sub-Events

SSE04-01 Impact of Institutional Volume on Transcatheter Aortic Valve Replacement Sizing: A Multicenter Retrospective Study

Monday, Nov. 28 3:00PM - 3:10PM Room: S504AB

Participants
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PURPOSE

Computed tomography (CT) is the standard imaging modality for aortic annular sizing in transcatheter aortic valve replacement (TAVR). We sought to assess the relationship between TAVR procedural volume and CT measurement accuracy.

METHOD AND MATERIALS

Within a large health system, TAVR is performed at low (<40/year), intermediate (40-75/year), and high volume sites (>75/year). 181 patients underwent TAVR with Sapien XT from 1/14-6/15: 21 low volume site, 62 intermediate volume site, and 98 high volume site. All patients had a pre-procedural CT interpreted by the site radiologist. Heart teams independently decided TAVR prosthesis sizing.Patient data was obtained from the medical record. Two blinded readers remeasured the annulus minor axis, major axis, mean diameter, area-derived diameter, and perimeter. Data was analyzed using Pearson coefficient, chi-squared test, student's t-test, or Mann-Whitney test, and adjusted for multiple comparisons using Hommel procedure.

RESULTS

Baseline patient characteristics were similar across sites. Aortic annular measurements were incompletely reported at 45% of low volume sites, 80% intermediate sites, and 10% high volume sites ($p<0.01$). Reported mean annular size differed significantly across sites ($p<0.01$), whereas independent reviewers found no significant differences ($p=0.25$). There was a poor correlation between reported CT measurements and independent reviewers at low ($r=0.31$) and intermediate volume sites ($r=0.34$), and a strong correlation at the high volume site ($r=0.96$), $p<0.01$.Significant mismatch between predicted valve size based on CT reports and implanted valve size occurred at all sites ($p<0.01$), less often at high volume (18%) compared to intermediate (80%) and low volume sites (29%), $p<0.01$. Undersizing the TAVR prosthesis relative to predicted size on CT was associated with increased risk of paravalvular leak at the high volume site (OR 2.9, $p<0.01$) and with independent reviewers measurements (OR 3.1, $p<0.01$). Size mismatch was not associated with 30-day mortality or major cardiovascular events.

CONCLUSION

CT reported annular measurements vary based on TAVR procedural volume, and are associated with mismatch between site predicted valve size and implanted valve size. Valve undersizing was associated with paravalvular leak.

CLINICAL RELEVANCE/APPLICATION

Adopting measurement strategies from high volume TAVR sites may help reduce variability in CT measurements of the aortic annulus.

SSE04-02 Quantification of Mitral and Tricuspid Regurgitation with Cardiac 4D Flow MRI

Monday, Nov. 28 3:10PM - 3:20PM Room: S504AB

Participants
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Marcus T. Alley, PhD, Stanford, CA (*Abstract Co-Author*) Research funded, General Electric Company; Research Consultant, Arterys Inc
Shreyas S. Vasanawala, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research collaboration, General Electric Company; Consultant, Arterys Inc; Research Grant, Bayer AG;
Anthony DeMaria, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
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Electric Company

PURPOSE

Quantification of the severity of mitral and tricuspid regurgitation is essential for determining the need for valve repair. Transthoracic echocardiography (TTE) has been shown to have poor interobserver reliability, and technical constraints limit availability of conventional MRI. This study seeks to assess the reliability of 4D Flow MRI for quantifying mitral and tricuspid regurgitation, in comparison to conventional phase-contrast (2D-PC) MRI.

METHOD AND MATERIALS

With IRB approval and HIPAA compliance, we retrospectively identified all patients who underwent cardiac MRI with 4D Flow for further quantification of inlet valvular regurgitation between April 2015 and February 2016. Thirteen adult patients (10 male, 3 female) with mitral and/or tricuspid regurgitation were identified. Regurgitant volumes (RVol) and fractions (RF) were calculated with (a) direct quantification of the regurgitant jets and (b) indirect quantification based on the difference between ventricular stroke volume and outlet valve flow for both 4D Flow and 2D-PC. Measurements were compared with Bland-Altman and Pearson correlation analysis.

RESULTS

4D Flow image data was successfully acquired in all thirteen patients referred for MRI quantification. RVol ranged from 0.5 – 14.5 L/min and RF ranged from 10-76%. 2D-PC was also obtained in eleven patients. Direct measurement of regurgitant volume had high concordance between both techniques (p=0.93), as did indirect measurements (p=0.96-0.99). Direct and indirect measurements within 4D Flow also demonstrated high concordance (p=0.92-0.99), whereas direct 4D Flow measurements were slightly less well correlated with indirect 2D-PC measurements (p = 0.88).

CONCLUSION

Cardiac 4D Flow MRI can be used to accurately quantify mitral and tricuspid regurgitant flow, relative to conventional 2D-PC. Because it is simpler to prescribe, 4D Flow MRI may be a more efficient method for assessing valvular disease in routine clinical practice.

CLINICAL RELEVANCE/APPLICATION

Cardiac 4D Flow MRI is a promising technique for direct quantification of mitral and tricuspid regurgitation and may improve availability of cardiac MRI to guide management of these patients.

SSE04-03 Differences in Aortic Valve Area Calculation in Severe Aortic Stenosis by Cardiac Computed Tomography and Transthoracic Echocardiography

Monday, Nov. 28 3:20PM - 3:30PM Room: S504AB

Participants
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Jose F Condado,, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to identify which factors affect the difference between aortic valve areas (AVAs) measured with planimetry on cardiac computed tomography (CCT) and continuity equation on transthoracic echocardiography (TTE).

METHOD AND MATERIALS

The 127 patients (median age 81 years, 57% women) who performed transcatheter aortic valve implantation (TAVI) were included in the study. All patients underwent TTE and CCT before TAVI. The AVA was deduced from the continuity equation on TTE and manual planimetry on CCT. CCT was used to measure left ventricular outflow tract (LVOT) diameter and area, aortic valve calcium score, severity of aortic valve and annular calcification. TTE was used to measure LV ejection fraction (LVEF), transvalvular mean pressure gradient, severity of aortic regurgitation (AR). Mean AVAs measured by each method were compared using paired t-test, Bland-Altman plot, and Pearson correlation coefficient, respectively. Relationships between difference in AVAs and variables were assessed with multiple regression model.

RESULTS

AVA obtained with CT planimetry (0.92±0.36 cm2) was significantly greater than that computed with TTE measurements (0.69±0.16 cm2). There was poor correlation between AVAs measured with CCT and TTE (r=0.2, p=0.03). Also there was significant difference (1.48±0.72 cm2, p<0.0001) between CCT (5.0±0.92 cm2) and TTE (3.52±0.77 cm2) measurements of LVOT area. Difference in AVAs was significantly associated with age (p=0.002), aortic valve calcification grade (0/1 vs. 3) (p=0.014), and LVOT area difference between CCT and TTE (p=0.01). On subgroup analysis, AVAs measured with CCT were not correlated with AVA by TTE in group with LVEF <50%, aortic valve calcium score ≥1651, LVOT eccentricity ≥0.8, presence of atrial fibrillation, insignificant calcification of aortic valve, and transvalvular pressure gradient ≤40 mmHg.

CONCLUSION

CT measured AVA is larger than AVA measured by TTE and the correlation of AVAs between two methods is poor in patients with severe AS. The discrepancy between CCT and TTE measurements of AVA needs to be considered for the accurate diagnosis on AVA measurement using TTE before TAVI.

CLINICAL RELEVANCE/APPLICATION

CCT can play a complementary role for AVA measurement using TTE before TAVI by providing variables which lead to discrepancies between CCT and TTE measurements of AVA.

SSE04-04 Cardiac Computed Tomography Angiography for Evaluation of Prosthetic Valve Dysfunction: A Multicenter Study (ProHeartVD-registry)

Monday, Nov. 28 3:30PM - 3:40PM Room: S504AB

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PURPOSE

Imaging of prosthetic valve dysfunction (PVD) is a challenge by echocardiography. Delayed or misdiagnosis may have fatal consequences with a high mortality risk. Therefore the purpose of our multicenter study was to evaluate the accuracy of cardiac computed tomography angiography (CTA) for diagnosis of PVD in comparison with surgery and transesophageal echocardiography (TEE).

METHOD AND MATERIALS

84 patients (age, 66.6y, 30.9% females) with n=90 prosthetic devices (38 mechanical, 45 bioprostheses, 7 mitral annuloplasty-rings) were examined with retrospective-ECG-gated Cardiac CT-Angiography (CTA) between 2006 and 2015 were included into our multicenter registry consisting of 4 cardiac imaging reference centers (US/Canada/Europe). CTA was compared with intraoperative findings and transesophageal echocardiography (TEE). Receiver operating curve (ROC)-analysis was performed to detect differences in the diagnostic performance of CTA and TEE vs surgery, respectively. Device infection rate was 15 (29.4%). Time from CTA to surgery was mean 7.7y±5.2

RESULTS

The sensitivity and specificity of CTA for diagnosis of PVD as compared to surgery (in 51 patients) were 94.0% and 98.5% per-lesion; agreement was k=0.93. CTA detected 12/13 (92.3%) paravalvular leaks and 10 abscesses (4 false positives). For pseudoaneurysm (n=10), accuracy of CTA was c=1.0 (95%CI:0.93-1) and for TEE vs surgery c=0.80 (95%CI:0.66-0.90; p=0.014). 22/25 (88%) masses (13 thrombi/pannus;8 vegetations;1 other) were correctly identified by CTA while for TEE vs surgery accuracy was lower (c=0.935; 95%CI:0.81-0.98 vs c=0.761; 95%CI: 0.6-0.88; p=0.001). 6/17 (94.1%) structural bioprosthetic degenerations were identified by CTA. 12 (100%) dehiscences (c=1.0; 95%CI:0.91-1) were diagnosed by CTA while the accuracy of TEE vs surgery was lower with c=0.66 (95%CI:0.5-0.8; p=0.002). For CTA vs TEE (per-lesion), sensitivity was 95.6%, specificity 96.3% and PPV 85.7%, resp. (k=0.88; 95%CI:0.79–0.97).

CONCLUSION

Cardiac CTA is an accurate imaging modality for PVD detection, in particular for paravalvular pathologies and thrombus/pannus, and outperforms TEE for paravalvular involvement such as dehiscence and pseudoaneurysm.

CLINICAL RELEVANCE/APPLICATION

Cardiac CTA should be systematically integrated in the diagnostic work-up algorithm of patients with prosthetic valve dysfunction.

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/

Jonathon A. Leipsic, MD - 2015 Honored Educator

SSE04-05 CT Myocardial Extracellular Volume Fraction (ECV) Quantification in Patients Undergoing Evaluation for Transcatheter Aortic Valve Replacement

Monday, Nov. 28 3:40PM - 3:50PM Room: S504AB

Participants
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Susan Ullrich, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jill E. Jacobs, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Elliot K. Fishman, MD, Baltimore, MD (*Abstract Co-Author*) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company;
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PURPOSE

In patients with aortic stenosis (AS), chronically elevated left ventricular (LV) wall stress leads to myocyte damage and interstitial fibrosis. Greater extent of myocardial fibrosis from biopsy specimens in AS has been associated with reduced LV ejection fraction (EF) and worse long-term survival after valve replacement. Extracellular volume fraction (ECV) quantification with cardiac CT is an

emerging method for non-invasive measurement of myocardial fibrosis. Our purpose was to measure cardiac CT ECV in patients with severe AS undergoing evaluation for transcatheter aortic valve replacement (TAVR) and to correlate with severity of aortic stenosis and LV function by echocardiography.

METHOD AND MATERIALS

After informed consent, 37 consecutive patients with severe AS undergoing pre-TAVR CT were enrolled. Standard TAVR imaging as well as pre- and 10 minute post-contrast cardiac CT acquisitions were obtained on a dual source scanner in dual energy mode (90/150 kV; Siemens, Erlangen, Germany). Patients received 150 mL iodinated contrast for glomerular filtration rate (GFR) >60 mL/min/1.73m2 (n=20) and 100-120 mL for GFR<60 (n=17). To calculate ECV, 1 cm2 regions of interest (ROI) were placed in the mid ventricular septum and blood pool in matching locations on pre- and delayed post-contrast images. Focal myocardial scar was excluded from ROIs. ECV was calculated with the formula: ECV CT = (1−Hematocrit) × (ΔHUseptum/ΔHUblood) where HU is the mean Hounsfield unit measurement for each ROI.

RESULTS

Mean age of cohort was 83±5.9 years with median LV EF of 55% [interquartile range (IQR), 47-63] and aortic valve area of 0.68 cm2 (IQR, 0.39-0.97). Median myocardial ECV was 0.29 (IQR, 0.22-0.36). Myocardial ECV showed a significant negative correlation with echocardiographic LV EF (Spearman's rho = -0.36, p=0.03), but was not correlated with either peak aortic valve velocity, aortic valve area, or peak aortic valve gradient. Mean contrast dose was 1.8±0.5 mL/kg and was not significantly associated with ECV.

CONCLUSION

Increased myocardial ECV by cardiac CT is associated with reduced LV function in patients with aortic stenosis, suggesting more extensive diffuse (interstitial) fibrosis in these patients.

CLINICAL RELEVANCE/APPLICATION

Non-invasive measurements of ECV with cardiac CT may be able to identify aortic stenosis patients with a greater fibrosis burden, which could be useful for pre-operative risk stratification and prognosis.

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/

Stefan L. Zimmerman, MD - 2012 Honored Educator
Stefan L. Zimmerman, MD - 2015 Honored Educator
Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
Elliot K. Fishman, MD - 2016 Honored Educator

SSE04-06 Cardiac CT to Evaluate Risk of Coronary Compression in Candidate Patients for Percutaneous Pulmonary Valve Implantation

Monday, Nov. 28 3:50PM - 4:00PM Room: S504AB

Awards
Student Travel Stipend Award

Participants
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PURPOSE

To evaluate the relationship between the coronary arteries and pulmonary trunk/conduit assessing the risk of coronary compression in candidate patients for percutaneous pulmonary valve implantation (PPVI) with cardiac CT.

METHOD AND MATERIALS

A retrospective evaluation of candidate patients for PPVI who underwent CT prior to the procedure in our hospital was performed. Patient data were retrieved from electronic patient files and the reasons why PPVI was not performed were re-assessed with an experienced congenital cardiologist. The analysis of coronary arteries included the distance of the coronary arteries to the intended site of the future valve implantation in the pulmonary trunk as well as the length of the coronary segment involved.

RESULTS

CT analysis was performed for 52 patients. Thirty patients underwent PPVI after CT and 22 didn't. In 6 out of 22 patients the reason not to perform PPVI was high risk of CC when the distance between the coronary artery and the pulmonary trunk at CT was less than 2 mm, in particular it was 1 mm for RCA (1 patient), 1.8±0.47 mm for the LAD (4 patients) and 0 mm for the LCX (1 patient). In the other 16 patients not undergoing PPVI the main reason was a non suitable RVOT size (10/16 cases). The relationship between CA and PT for every coronary of the patients who safely underwent the procedure was compared with the group who didn't undergo PPVI because of a high CC risk. The distance between the RCA, LM, LAD and LCx and the site of future valve's implantation was 13.4±8.4 mm, 14.8±9.9 mm, 13.8±8.8 mm and 21.9±11.4 mm respectively for the patients who received PPVI. None of the patients that received PPVI experienced CC.

CONCLUSION

CT allows detection of coronary arteries at high risk of compression during PPVI. Therefore CT can be useful in pre-procedural

selection and planning by identifying which patients can be excluded from the procedure because they are unlikely to undergo a successful intervention.

CLINICAL RELEVANCE/APPLICATION

Cardiac CT could be helpful in planning for PPVI identifying which patients are at high CC-risk and which patients have a sufficient distance between the coronary arteries and pulmonary trunk.

SSE05

Chest (Emphysema and Airway Disease)

Monday, Nov. 28 3:00PM - 4:00PM Room: S402AB

CH CT

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

FDA Discussions may include off-label uses.

Participants
David A. Lynch, MBBCh, Denver, CO (*Moderator*) Research support, Siemens AG Scientific Advisor, PAREXEL International Corporation Consultant, Boehringer Ingelheim GmbH Consultant, Gilead Sciences, Inc Consultant, F. Hoffmann-La Roche Ltd Consultant, Veracyte, Inc
Santiago E. Rossi, MD, Capital Federal, Argentina (*Moderator*) Advisory Board, Koninklijke Philips NV; Speaker, Pfizer Inc; Speaker, Boehringer Ingelheim GmbH; Royalties, Springer Science+Business Media Deutschland GmbH

Sub-Events

SSE05-01 CT-Based Models for Prediction of Chronic Obstructed Pulmonary Disease and Smoking-related Morbidity in Cigarette Smokers

Monday, Nov. 28 3:00PM - 3:10PM Room: S402AB

Participants
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Eva M. Van Rikxoort, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Stockholder, Thirona BV; Co-founder, Thirona BV

PURPOSE

To predict COPD and smoking-related morbidity in cigarette smokers using quantitative CT (QCT) measures.

METHOD AND MATERIALS

1544 subjects were included from the COPDGene study. COPD was defined by a ratio of forced expiratory volume in 1 sec. (FEV1) and forced vital capacity (FVC) < 0.7. Smoking-related morbidity was defined as FEV1/FVC < 0.70 with either a St George's Respiratory Questionnaire score ≥ 25 or an exacerbation frequency ≥ 2/year.On inspiratory CT, multiple cross-sectional lumen perimeters and airway wall areas were extracted from the airways. Using linear regression, airway wall thickness was defined as the square root of wall area of an airway with a perimeter of 10mm (Pi10). Total lung capacity (TLC) and emphysema were measured on inspiratory CT, where emphysema was defined as the % of low-attenuation areas (LAA%) < -950HU (LAA%-950). Air-trapping was defined on expiratory CT as LAA% < -856HU (LAA%-856).Six logistic regression models were fitted for both the prediction of COPD and smoking-related morbidity using a random subset of 761 subjects. Model 1 included only age, gender, BMI, pack years, smoking status, and TLC, while models 2 to 6 additionally included: LAA%-950 (model 2), LAA%-856 (model 3), Pi10 (model 4), LAA%-950 + Pi10 (model 5), and LAA%-950 + LAA%-856 + Pi10 (model 6). The models were validated on a separate set (810 subjects) using the area under the receiver operating curve (AUC).

RESULTS

The validation set consisted of 369 subjects with and 441 without COPD. QCT measures were independent predictors of COPD in all models ($p<0.001$), with AUC values for models 1 to 6 of 0.77, 0.85, 0.90, 0.87, 0.91, and 0.93, respectively. The validation set consisted of 216 subject with and 594 without smoking-related morbidity. QCT measures were independent predictors of smoking-related morbidity in all models ($p<0.001$, except for LAA%-950 in model 5), with AUC values for models 1 to 6 of 0.72, 0.83, 0.87, 0.83, 0.88, and 0.89, respectively.

CONCLUSION

LAA%-950, LAA%-856, and Pi10 are independent predictors of COPD and smoking-related morbidity. The model including only inspiratory QCT predictors has similar predictive value to the model that also includes expiratory air-trapping.

CLINICAL RELEVANCE/APPLICATION

Since LAA%-950 and Pi10 can be readily extracted from inspiratory images, these measures may be useful to predict smoking related morbidity in lung cancer screening.

SSE05-02 Spectrum of Pulmonary Parametric Response Maps in Asthmatic Patients: A Promising Innovative Tool in Defining Asthma Subtypes

Monday, Nov. 28 3:10PM - 3:20PM Room: S402AB

Awards

Trainee Research Prize - Fellow

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PURPOSE

Pulmonary parametric response map (pPRM) was validated for quantitative densitometric phenotypization of COPD.Similar to COPD,asthma is a heterogeneous disease that could benefit from differentiation into subtypes.Thus we aimed to study the spectrum of densitometric classification of pPRM in a group of asthmatic patients.

METHOD AND MATERIALS

Between September 2014 and March 2015 25 patients with persistent asthma were enrolled after IRB approval.They underwent clinical evaluation,respiratory function tests (RFT),and spirometrically monitored chest CT:one scan at total lung capacity and one at residual volume.Images were analyzed by using specific software for airway analysis (Thoracic VCAR, GE) and specific software for pPRM (Imbio, MN),based on automated co-registration of paired inspiratory and expiratory scans.Co-registration analysis distinguished 3categories of lung parenchyma:normal lung (NL),persistent airway disease (pAD),and functional airway disease (fAD).Joint density histograms (JDH) were also obtained.Airway analysis was performed in each patient in 6proximal bronchi (2nd and 3rd generation).Correlations between quantitative imaging data and functional data were calculated.

RESULTS

Airway analysis and pPRM were obtained in all 25 patients,but 3/25 (12%) cases for incomplete segmentation.pPRM spectrum was 92.1±12.1% NL, 0.3±0.5% pAD, and 7.6±11.8% fAD. Correlation of fAD with FEV1/FVC and FEF25-75% was 0.68 and 0.63,respectively.Correlation of peak value of JDH with the same clinical parameters was higher (0.77 and 0.78).Peak values of JDH identified 2 different groups:severe asthma cases had less than 704HU vs mild-moderate asthma cases had greater than 704HU.Slope of major axis of JDH was lower in cases with mild-moderate asthma compared to severe cases.

CONCLUSION

This is the first study using pPRM in asthmatic patients.pPRM correlated strongly with RFT and clinical severity of asthma.A threshold of 704 HU in peak value on JDH distinguished cases of severe asthma from mild-moderate ones.Additional analysis on JDH parameters could further characterize patients with severe asthma,providing new insights into underlying disease mechanisms and evidence for forthcoming personalized treatments.

CLINICAL RELEVANCE/APPLICATION

pPRM is a fast and automated CT analysis to characterize patients with asthma. JDH parameters may offer new insights into asthma subtypes,helpful for forthcoming personalized treatments.

SSE05-03 Progression of Lobe-Specific Emphysema in Cigarette Smokers with and without COPD

Monday, Nov. 28 3:20PM - 3:30PM Room: S402AB

Participants
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PURPOSE

To evaluate whether the association between changes in emphysema and changes in forced expiratory volume in one second (FEV1) differ between lung lobes in cigarette smokers with and without chronic obstructive pulmonary disease (COPD).

METHOD AND MATERIALS

Subjects who participated in the Genetic Epidemiology of COPD (COPDGene) study and had completed the second phase at 5-year follow-up were included. All subjects underwent inspiratory computed tomography (CT). The amount of emphysema was evaluated with the adjusted lung density. This method is based on the 15th percentile method (Perc15: the Hounsfield Unit value of which below 15% of the lung voxels are distributed). After adding 1000 to Perc15 and adjusting for inspiration level, emphysema was quantified per lobe. Linear mixed models were used to test whether changes in FEV1 were associated with changes in epmhysema per lobe, while correcting for age, pack-years, BMI, gender, race, smoking status, scanner make, scanner model, and study center.

RESULTS

1,656 subjects were included. A total of 801 (48.4%) subjects had airflow obstruction. Average change of emphysema per lobe that is not accounted for by ageing or changes in other demographics from visit 1 to visit 2 was: -2.6% ($p<0.001$) in the left upper lobe (LUL); -2.8% ($p<0.001$) in the left lower lobe (LLL); -3.2% ($p<0.001$) in the right upper lobe (RUL); -3.7% ($p<0.001$) in the right middle lobe (RML); -3.2% ($p<0.001$) in the right lower lobe (RLL). The association of FEV1 decline with epmhysema progression was largest in LLL and RUL (LUL: decrease of 4.6% per 1L decline, $p=0.002$; LLL: decrease of 5.6% per 1L decline, $p<0.001$; RUL: decrease of 5.2% per 1L decline, $p=0.001$; RML: decrease of 1.6% per 1L decline, $p=0.26$; RLL: decrease of 4.5% per 1L decline, $p<0.001$).

CONCLUSION

Progression of emphysema was most prominent in the right lung, but the relationship between change in emphysema and FEV1 decline was largest in LLL and RUL. Therefore, evaluating lobe-specific progression of emphysema might have implications for treatment and prognosis.

CLINICAL RELEVANCE/APPLICATION

Understanding the difference in rates of progression of emphysema between lung lobes may be important in evaluating treatment and underlying pathophysiology.

SSE05-04 Combined Assessment of Emphysema, Air Trapping and Airway Wall Thickening at Lobar Level using CT of COPD: Studies on Inter-relation of each Measurement and Contribution of Parameters on Pulmonary Functional Loss

Monday, Nov. 28 3:30PM - 3:40PM Room: S402AB

Participants
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PURPOSE

To evaluate the relationships between quantitative CT measurements of emphysema, air trapping, and airway wall thickening in each lobe of the lung and to analyze the contribution of CT parameters with pulmonary function test (PFT) in chronic obstructive lung disease (COPD).

METHOD AND MATERIALS

Inspiratory and expiratory CT scans of 84 subjects in Korean obstructive Lung Disease (KOLD) cohorts were evaluated. Measures examined included emphysema (percentage of low attenuation areas ≤-950HU on inspiratory CT [LAA%]), dynamic air trapping (percentage of subtracted low-attenuation areas ≤60HU using inspiration CT and co-registered expiration CT [ATI]). After the segmentation of the whole airways in the lung and systemic assessment of all airway segments, square root of the wall area of a hypothetical airway of 10-mm internal perimeter (Pi-10) and wall area percent (WA%) were measured. Correlations between CT measurements at lobar level were assessed. Linear regression analysis was applied to evaluate the contribution of LAA%, ATI and WA% of both upper lobes (BUL) and both lower lobes (BLL) to PFT.

RESULTS

The significant correlations between CT measurements were different in each lobe (Table1). In BUL, LAA% showed significant correlation with both Pi-10 (r=-.172, p=.027) & WA% (r=-.285, p<.001). In BLL, both LAA% & ATI were significantly correlated with both Pi-10 (LAA%, r=-.235, p=.002; ATI, r=.2, p=.01) & WA% (LAA%, r=-.188, p=.016; ATI, r=.252, p<.001). The contribution of CT measurements in BUL and BLL differed per lung function parameter (Table2). For FEV1, LAA% of BLL and WA% of BUL were contributing factors, while for FEV1/FVC these were LAA% & WA% of BUL and LAA% & ATI of BLL. LAA% of both BUL & BLL were contributing factors for DLCO. For FEF 25-75%, LAA% of BUL and LAA% & ATI of BLL were contributing factors. RV and RV/TLC were influenced by LAA% of BUL and LAA%, ATI, WA% of BLL.

CONCLUSION

Relationship among CT measurements in each lobe was different and the contribution of the CT measurements differed per lung function parameter between BUL and BLL.

CLINICAL RELEVANCE/APPLICATION

Our study showed that CT measurements of emphysema, air trapping, and airways in COPD were different according to each lobe and the contribution of CT measurements differed per lung function parameter, probably due to the different dynamics and physiology in each lobe of the lung. Therefore, we emphasize the importance of the lobe-based analysis of CT parameters.

SSE05-05 Different Correlation between CT Parameters and FEV1 according to the Disease Severity in COPD

Monday, Nov. 28 3:40PM - 3:50PM Room: S402AB

Participants
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PURPOSE

To know whether the correlations between computed tomography (CT) parameters and forced expiratory volume in one second (FEV1) are different according to the disease severity in chronic obstructive pulmonary disease (COPD) and whether CT parameters can better explain severity of airflow limitation by subgroup analysis approach

METHOD AND MATERIALS

Study population included 370 COPD patients with various disease severity (GOLD criteria I; n=117, II; n=139, III; n=98 and IV; n=16). Those patients were divided into mild (GOLD I and II) and severe subgroups (GOLD III and IV). At inspiration volumetric CT, which were available in all patients, the volume fraction of voxels less than -950 Hounsfield unit (HU) in the lung (emphysema index,

EI) and relative wall thickening of both apical subsegmental bronchi (wall area percentage, WA%) were measured using in-house software. The correlation between the CT parameters (EI and WA%) and FEV1, which was assessed within 1 week from the CT examination, was assessed in the total patients, mild and severe subgroups using Pearson correlation method. Linear regression analysis with backward selection was followed to evaluate the relative contribution of each CT parameter to the change of airflow limitation.

RESULTS

The correlation coefficients between EI and FEV1 in the total, mild, and severe subgroups were -0.40, -0.15, and -0.46, respectively (all $p<0.05$). The correlation coefficients between WA% and FEV1 in the total, mild, and severe subgroups were -0.18, -0.14, and 0.01, respectively. In comparison to statistically significant correlation in the total patients and mild subgroup, the WA% values in severe subgroup did not correlate with FEV1. At linear regression analysis, while both EI and WA% were turned out to be independent contributors of airflow limitation in the total patients and mild subgroup, only EI was selected in severe subgroup.

CONCLUSION

Airway wall thickening and emphysema might relate and/or contribute differently to airflow limitation in COPD according to the disease severity.

CLINICAL RELEVANCE/APPLICATION

Combined analysis of EI and WA% followed by subgroup application can better explain pulmonary functional loss. Further study to build up nonlinear model would be of value to better understand the interrelations between morphological changes to functional loss in COPD patients.

SSE05-06 Xenon-Enhanced Area-Detector CT vs. Ventilation SPECT/CT: Utility of Functional and Morphological Assessments for Pulmonary Functional Loss and Disease Severity in Smokers

Monday, Nov. 28 3:50PM - 4:00PM Room: S402AB

Participants
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PURPOSE

To prospectively and directly compare the utility of xenon-contrast enhanced area-detector CT (Xe-ADCT) for pulmonary functional and disease severity assessments in smokers, when compared with ventilation SPECT/CT.

METHOD AND MATERIALS

46 consecutive smokers (32 male and 14 female; mean age, 68 year old) underwent prospective unenhanced and xenon-enhanced ADCTs, krypton ventilation SPECT/CT and pulmonary function tests. Xe-ADCT was generated from unenhanced and xenon-enhanced ADCT. According to pulmonary function test results, all smokers were divided into 4 groups as follows: 'Non-COPD', 'Mild COPD', 'Moderate COPD' and 'Severe or Very Severe COPD' groups. For each method, regional ventilation was assessed by 10-point scoring system on a per-lobe basis. Then, ventilated lung volume (VLV) on each method, functional lung volume (FLV) and wall area percent (WA%) in each subject were calculated according to past literatures. To evaluate the capability of each index for pulmonary functional loss assessment, all indexes were correlated with %FEV1 by univariate and step-wise regression analyses. To compare each index among all groups, Tukey's HSD test were performed.

RESULTS

All indexes had significant correlations with %FEV1 (VLV on Xe-ADCT: $r=0.67$, $p<0.00001$; FLV: $r=0.55$, $p<0.0001$; WA%: $r=-0.50$, $p=0.0004$; VLV on SPECT/CT: $r=0.59$, $p<0.0001$). In the step-wise regression test, %FEV1 ($r=0.62$, $p<0.00001$) was significantly affected by the following three factors: the first-step factor, VLV on Xe-ADCT; the second-step factor, WA%; the third-step factor, FLV. All indexes of 'Non-COPD' and 'Mild COPD' groups had significant difference with those of 'Severe or Very Severe COPD' groups ($p<0.05$), and all indexes except VLV on SPECT/CT had significant difference between 'Moderate COPD' and 'Severe or Very Severe COPD' groups. VLVs on Xe-ADCT and SPECT/CT had significant differences between 'Non-COPD' and 'Moderate COPD' groups ($p<0.05$).

CONCLUSION

Functional and morphological evaluations on xenon-enhanced ADCT had equal to or better capabilities for pulmonary functional and disease severity assessments in smokers as compared with ventilation SPECT/CT.

CLINICAL RELEVANCE/APPLICATION

Functional and morphological evaluations on xenon-enhanced ADCT had equal to or better capabilities for pulmonary functional and disease severity assessments in smokers as compared with ventilation SPECT/CT.

SSE06

Emergency Radiology (Thoracoabdominal Emergencies)

Monday, Nov. 28 3:00PM - 4:00PM Room: N227B

GI GU CT ER

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

Participants
Jamlik-Omari Johnson, MD, Atlanta, GA (*Moderator*) Research Grant, Koninklijke Philips NV; Royalties, Cambridge University Press
Stephan W. Anderson, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSE06-01 Absent Secondary Signs of Appendicitis When the Appendix is Not Visualized

Monday, Nov. 28 3:00PM - 3:10PM Room: N227B

Awards
Student Travel Stipend Award

Participants
Saad Hussain, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Vivek Patel, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Aditi Vyas, MD, Norwalk, CT (*Abstract Co-Author*) Nothing to Disclose
Mahan Mathur, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mike Spektor, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to determine the negative predictive value (NPV) of the sonographic secondary signs of appendicitis when the appendix is not visualized. The secondary signs of appendicitis seen on ultrasound (US) include free fluid, hyperemia, lymphadenopathy, and phlegmon formation.

METHOD AND MATERIALS

A retrospective review was completed looking for ultrasound images and reports that did not visualize the appendix in its entirety and also specifically stated that no secondary signs of appendicitis were visualized. The review spans 2013-2015. 130 studies were found meeting the inclusion criteria.

RESULTS

Of the 130 total studies, 95 did not have imaging follow up or surgery for appendicitis. Either the ultrasound revealed an alternate diagnosis (example: mesenteric adenitis) or the patient was discharged with an alternate clinical diagnosis (example: constipation). 35 studies had follow up imaging with CT (31), MRI (2) or US (2). Of the 31 follow up CTs, 4 did not visualize the appendix (and the patients were discharged) and the remaining 27 revealed normal appendices. The 2 MRI examinations showed normal appendices and the patients were discharged. One repeat ultrasound was negative and the patient was discharged. The other repeat ultrasound was positive and the patient was taken to surgery and had pathology proven appendicitis.The negative predictive value for absent secondary signs of appendicitis when the appendix is not visualized is 97%. CT, MRI, and repeat US that visualized a negative appendix were considered true negatives.

CONCLUSION

When the appendix is not visualized clinicians are often left to make a decision on whether or not to subject the patient (often pediatric) to ionizing radiation (CT), a lengthy MRI or a repeat US. It is important that radiologists and technologists look for the secondary signs of appendicitis when the appendix is not visualized. The radiologist should specifically mention the lack of secondary signs when appropriate. Based on the findings of this study, such a statement carries a high NPV. Armed with such information, the clinicians will be better suited in making the difficult decision in regards to further imaging or intervention.

CLINICAL RELEVANCE/APPLICATION

Secondary signs of appendicitis carry a high negative predictive value and should be evaluated for when the appendix is not visualized on ultrasound.

SSE06-02 Evaluation of the Diagnostic Value of a Venous Phase in CT Angiography of the Extremities in the Setting of Trauma

Monday, Nov. 28 3:10PM - 3:20PM Room: N227B

Participants
Zachary Masi, MD, Camden, NJ (*Presenter*) Nothing to Disclose
Kathryn Gussman, Camden, NJ (*Abstract Co-Author*) Nothing to Disclose
Joshua Hazelton, DO, Camden, NJ (*Abstract Co-Author*) Nothing to Disclose
Ron Gefen, MD, Camden, NJ (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Patients with traumatic injury to extremities are often evaluated at hospital trauma centers by computed tomography angiography (CTA) to evaluate for vascular injury, which can utilize arterial and venous phases. The purpose of this study is to assess whether the venous phase contributes added value to the diagnostic study.

METHOD AND MATERIALS

Institutional IRB approval was obtained. Retrospective analysis of a radiology information system at a level I trauma center identified adult patients evaluated for injury by upper or lower extremity CTA between September, 2014 and September, 2015 with both arterial and venous phases. Images were evaluated by a diagnostic radiologist for diagnosis of "no injury", "arterial injury", "venous injury" or "vasospasm", made by the arterial phase alone, or in conjunction with the venous phase. Statistical analysis utilized McNemar test and Kappa agreement values (a p value of < 0.05 was considered significant).

RESULTS

There were 157 studies performed on 154 patients, 131 (83%) male and 23 (17%) female (mean age 39). Studies comprised 49 upper and 108 lower extremities. Most common mechanisms of injury were gunshot wound (63), motor vehicle accident (26), and stab wound (13). There were 99 diagnoses of no injury, 35 arterial injuries, 16 vasospasms, and 7 venous injuries. Four diagnoses were changed between interpreting the arterial phase alone and both phases together: three venous injuries including one deep vein thrombosis, and one vasospasm. Only the case of deep vein thrombosis resulted in a change in clinical management. Overall there was no significant difference in diagnosis between the two methods ($p > 0.125$). There was high agreement for diagnosis of no injury (Kappa 0.99), arterial injury (0.96), and vasospasm (0.97), and moderate agreement in diagnosing venous injury (0.59) ($p < 0.001$).

CONCLUSION

The venous phase of CTA extremity studies for trauma does not add statistically significant value in diagnosing vascular injury and can be safely removed from the imaging protocol, thereby decreasing patient scan time and radiation dose.

CLINICAL RELEVANCE/APPLICATION

CT angiography studies of extremities for vascular trauma can be accurately performed with an arterial phase only and do not require a venous phase.

SSE06-03 Toward an MDCT-based Decision Support Tool for Bleeding Pelvic Fractures using Semi-automated Volumetric Hematoma Analysis and Probabilistic Modeling: Preliminary Results

Monday, Nov. 28 3:20PM - 3:30PM Room: N227B

Participants
David Dreizin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Nikki Tirada, MD, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose
Uttam Bodanapally, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Eliot L. Siegel, MD, Baltimore, MD (*Abstract Co-Author*) Board of Directors, Brightfield Technologies; Board of Directors, McCoy; Board of Directors, Carestream Health, Inc; Founder, MedPerception, LLC; Founder, Topoderm; Founder, YYESIT, LLC; Medical Advisory Board, Bayer AG; Medical Advisory Board, Bracco Group; Medical Advisory Board, Carestream Health, Inc; Medical Advisory Board, Fovia, Inc; Medical Advisory Board, McKesson Corporation; Medical Advisory Board, Merge Healthcare Incorporated; Medical Advisory Board, Microsoft Corporation; Medical Advisory Board, Koninklijke Philips NV; Medical Advisory Board, Toshiba Corporation; Research Grant, Anatomical Travelogue, Inc; Research Grant, Anthro Corp; Research Grant, Barco nv; Research Grant, Dell Inc; Research Grant, Evolved Technologies Corporation; Research Grant, General Electric Company; Research Grant, Herman Miller, Inc; Research Grant, Intel Corporation; Research Grant, MModal IP LLC; Research Grant, McKesson Corporation; Research Grant, RedRick Technologies Inc; Research Grant, Steelcase, Inc; Research Grant, Virtual Radiology; Research Grant, XYBIX Systems, Inc; Research, TeraRecon, Inc ; Researcher, Bracco Group; Researcher, Microsoft Corporation; Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG;
Daniel C. Mascarenhas, BS, Cinnaminson, NJ (*Abstract Co-Author*) Nothing to Disclose
Louis Bivona, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Edward H. Herskovits, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Consultant, BioClinica, Inc; Shareholder, Galileo CDS, Inc;

PURPOSE

No single CT sign, including intravenous contrast extravasation (ICE), predicts the need for angioembolization with sufficient accuracy. ICE is only up to 60% sensitive. Active bleeding on angio (AB) is often seen w/o ICE. Pelvic hematoma volumes are predictive of AB, but have not been validated for point of care use because time consuming slice-by-slice segmentation was employed. We aimed to developed a multivariate probabilistic model and online calculator incorporating rapid pelvic hematoma segmentation.

METHOD AND MATERIALS

A retrospective cohort of 116 patients were selected. Inclusion criteria: age > 18, blunt pelvic trauma; arterial phase MDCT prior to angio. Exclusion criteria: no angio was performed; CT only after angio. **Image review:** data collected: presence/absence of ICE; greatest diameter of contrast blush (mm); # vessels with blush; hematoma volumes from seeded region growing segmentation(mL); fractures of the obturator canal or greater sciatic notch; pubic diastasis; osteopenia; age; gender. Stepwise logistic regression with forward selection and backward elimination was performed to determine informative variables for AB at angio.

RESULTS

The variable with the strongest correlation with AB was hematoma vol ($p<0.001$). Age and the greatest diameter of blush were also explanatory and included in the model. Osteopenia; fractures and diastasis; and # of vessels dropped out during successive forward selection and backward elimination steps. Logit transformation was performed to derive a probabilistic formula: **$P=e[(0.027*age)+(0.004*hematoma\ vol)+(0.036*diameter\ largest\ blush)-3.014]/(1+e[(0.027*age)+(0.004*hematoma\ vol)+(0.036*diameter\ largest\ blush)-3.014])$.** A prototype online active bleed calculator was developed- age(yrs) diameter(mm), and hematoma vol(mL) is entered to determine probability of AB.

CONCLUSION

Prior work using manual segmentation found that hematoma vols<200mL result in 5% likelihood of AB, and vols> 500mL have 45% likelihood. Our model provides a greater degree of practicality because 1) rapid segmentation can be done at the point of care, and 2) the model is highly granular.For example, an intermediate sized hematoma of 321 mL, even without blush, results in high likelihood (56%) of AB in an elderly (73yo) victim of blunt trauma.

CLINICAL RELEVANCE/APPLICATION

The proposed model can be used at the point of care to guide trauma/ER radiologists, interventionalists, and trauma surgeons in determining the need for angio.

SSE06-04 Colonic Wall Thickening: Can Iodine Quantification Using Dual Source Dual Energy CT Differentiate Diverticulitis from Adenocarcinoma?

Monday, Nov. 28 3:30PM - 3:40PM Room: N227B

Participants
Kathryn Darras, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Sheldon J. Clark, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Heejun Kang, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Alison C. Harris, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Silvia D. Chang, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Mohammed F. Mohammed, MBBS, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Tim O'Connell, MD, Meng, Vancouver, BC (*Abstract Co-Author*) President, Resolve Radiologic Ltd Speake, Siemens AG
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Patrick D. McLaughlin, FFRRCSI, Vancouver, BC (*Presenter*) Speaker, Siemens AG

PURPOSE

To evaluate the role of iodine quantification in differentiating colonic diverticulitis from colonic adenocarcinoma.

METHOD AND MATERIALS

Institutional review board approval was obtained, with no informed consent required, for this retrospective analysis. 146 consecutive patients with acute diverticulitis were scanned using a standard protocol on a 128-section dual source, dual energy CT system (100/140 keV). Patients who did not have follow up colonoscopy, which served as the gold standard, or who received large volumes of positive oral contrast were excluded. This left 52 patients for analysis, 8 with proven colonic adenocarcinoma and 44 with diverticulitis. Using the virtual non-contrast application, iodine maps and virtual non-contrast datasets were created for all patients. The coloured iodine maps were superimposed onto the virtual non-contrast images to provide both iodine distribution and anatomic detail. The iodine concentration was recorded within the thickened bowel wall using a region of interest analysis (mg/ml). The two groups were compared using two tailed unpaired t tests and the sensitivity and specificity were established.

RESULTS

The average iodine concentration was 1.41±0.56 mg/ml (range 0.2-2.7 mg/ml) in bowel wall thickening due to diverticulitis and 3.15±0.57 mg/ml (range 2.5-4.3 mg/ml) in bowel wall thickening due to adenocarcinoma. This difference was statistically significant ($p < 0.0001$). Using a threshold of 2.5 mg/ml, the sensitivity for identifying adenocarcinoma was found to be 100% and the specificity 95.5%.

CONCLUSION

Using a threshold value of 2.5 mg/ml, dual energy CT iodine quantification was found to have a high sensitivity and specificity for distinguishing colonic wall thickening due to diverticulitis from thickening due to adenocarcinoma.

CLINICAL RELEVANCE/APPLICATION

Identifying the cause of colonic wall thickening, which is generally regarded as a nonspecific CT finding, will allow for appropriate patient referral and triage for colonoscopy.

SSE06-05 Evaluation of Pancreatic Injury: Correlation between Pancreas Injury Grade (PIG) Scoring on MDCT and Clinical Features and other Organ Injuries

Monday, Nov. 28 3:40PM - 3:50PM Room: N227B

Participants
Jung Hyun Noh, MD, Cheonan-si, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sang Wook Son, MD, Cheon-an, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Mi-Hyun Park, MD, Cheonan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young-Seok Lee, MD, Cheonan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Keum-Nahn Jee, MD, PhD, Cheonan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the correlation of radiological PIG scoring on MDCT and clinical features and other associated organ injuries retrospectively

METHOD AND MATERIALS

38 patients (mean age = 38.1, male to female ratio = 22 : 16), diagnosed as traumatic pancreatic injury by clinical and initial MDCT findings, were included from Mar. 2006 to Feb. 2016. Their imaging findings were analyzed about five-scale PIG scoring on MDCT based on AAST grade by consensus of two radiologists. Clinical records were reviewed about injury type, initial vital sign, hospitalization period, prognosis and treatment. Associated abdominal MDCT findings were analyzed about other hollow and solid visceral injury, vascular injury and injuries of other body parts. Evaluation of correlation between radiological PIG scoring on MDCT and other associated organ injuries, and clinical features was done using statistical analyses by Fisher's exact test and Kruskal-Wallis test.

RESULTS

Patients with PIG scoring scale from I to V on MDCT included 13, 5, 11, 7, and 2 patients. Among 38 patients, 23 patients (60.5%) had associated other organ injuries and 4 patients (10.5%) expired early due to unstable vital sign with active arterial bleeding in liver or abdominal cavity and their PIG scoring was grade I (n=2), grade III (n=1) and grade V (n=1). Their injury types were out car accident (n=3), in car accident (n=22), fall down (n=2) and blunt trauma (n=11). Patients with high PIG scoring had characteristics of associated duodenal injury, vascular injury, and treatment choice of operation with statistical significance ($p < 0.05$). And no statistical significant correlations were between PIG scoring and other associated organ injuries in abdomen except

duodenal and vascular injury, interventional treatment, and other clinical findings of initial vital sign, injury type, hospitalization period and death rate.

CONCLUSION

Patients with high PIG scoring have the characteristics of associated duodenal and vascular injuries, and treatment choice of surgery. Associated other organ injuries and mortality cases were not correlated with PIG scoring.

CLINICAL RELEVANCE/APPLICATION

Evaluation of correlation degree between PIG scoring scale and associated every other organ injury and various clinical findings can be clinically meaningful and these results could be considered as a reference of clinical evaluation of pancreatic injury patient despite of limitation of number of included patients.

SSE06-06 Focused Abdomino Pelvic CT in Children with Suspected Acute Appendicitis: Assessing Accuracy and Radiation Dose Reduction by Limiting the Scan Field

Monday, Nov. 28 3:50PM - 4:00PM Room: N227B

Awards
Student Travel Stipend Award

Participants
Andrew Fox, MD, Montreal, QC (*Presenter*) Nothing to Disclose
Christine Saint-Martin, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Imaging is widely used in cases of suspected appendicitis with ultrasound the most common first-line modality in pediatric patients. When sonography is non-diagnostic, a complete abdominopelvic CT is often used as an adjunct to rule in the diagnosis prior to OR. CT has diagnostic superiority over sonography but the associated radiation is a concern and thus methods to reduce radiation are of great interest. The concept of Z-axis limitation with combined analysis of accuracy and radiation dose reduction is yet to be studied in the pediatric population.

METHOD AND MATERIALS

Data was collected from PACS between January 2010-present. The upper limit of the appendix was correlated with the superior endplate of the corresponding vertebra. Subsequently, an upper limit Z-axis for interpretation was set based on the average location of the appendix in our series ($\mu - 2\sigma$), to include >97.5% of the visualized appendices. The studies were then revisited to assess diagnostic accuracy over this focused range, assessing detection of both primary pathology and incidental findings. Radiation dose reduction will be calculated using the Radimetrics software suite.

RESULTS

On the initial scans, the appendix was identified in 116/125 patients and not visualized in 9 patients. The average scan range was 438mm. 27 scans were positive for appendicitis and alternate pathology was identified in 17 patients. The average upper limit of the appendix minus 2 SD corresponded to the L2 vertebra. From L2 caudally, the appendix was completely visualized in 115 scans, and partially visualized in 1 scan. All of the positive appendicitis cases were diagnosed over the limited scan range. 10 alternate diagnoses were completely identified, and 2 were partially identified. 5 cases of pulmonary pathology were missed. The average Z-axis Delta was 141mm, corresponding to a 32% reduction in scan field. Radiation dose reduction is being calculated.

CONCLUSION

Focused abdominopelvic CT for appendicitis in the pediatric population reduces the scan range by approximately 32%, while maintaining 100% diagnostic accuracy for appendicitis (radiation dose reduction pending). Alternate abdominal pathology was either completely or partially identified over this limited range.

CLINICAL RELEVANCE/APPLICATION

By limiting the scanning range of CTs performed for appendicitis, we are hoping to significantly reduce radiation dose to the patient, while maintaining diagnostic accuracy.

SSE07

Gastrointestinal (Multi-modality)

Monday, Nov. 28 3:00PM - 4:00PM Room: E353A

GI CT MR

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

Participants
Michael A. Blake, MBBCh, Boston, MA (*Moderator*) Editor with royalties, Springer Science+Business Media Deutschland GmbH
Atif Zaheer, MD, Baltimore, MD (*Moderator*) Nothing to Disclose

Sub-Events

SSE07-01 Imaging in Patients with Crohn's Disease: Trends in Abdominal CT/MRI Utilization and Radiation Dose Considerations Over a 10-year Period

Monday, Nov. 28 3:00PM - 3:10PM Room: E353A

Participants
Hamed Kordbacheh, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Vinit Baliyan, MBBS, MD, Boston, MA (*Presenter*) Nothing to Disclose
Jessica Serrao, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Abstract Co-Author*) Nothing to Disclose
Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company; Medical Advisory Board, Allena Pharmaceuticals, Inc
Avinash R. Kambadakone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the trends in utilization of CT and MRI for diagnosis and follow up of patients with suspected Crohn’s disease and to evaluate changes in CT radiation dose over a 10-year period.

METHOD AND MATERIALS

In this IRB approved single institution retrospective study we included patients who underwent CT and MRI scans for diagnosis and follow up evaluation of Crohn’s disease between 2005 and 2014. The medical records and imaging data were reviewed to document patient demographics, scan indication, imaging findings and CT radiation dose. The patient cohort was categorized into 3-groups - <20 years, 20-50 years and >50 years. Trends in CT/MR utilization was assessed by comparing the volume of imaging studies performed each year. The changes in CT radiation dose over the study period were estimated and compared.

RESULTS

A total of 2578 CT scans and 1586 MR scans were performed in 2652 patients (mean age: 34.8±4.9 yrs, age range: 2-93 yrs) for initial diagnosis or follow-up of Crohn’s disease between 2005 and 2014. The annual combined CT/MR utilization demonstrated a 3-fold rise over the past decade (2005: n=267, 2014: n=677). Increased imaging utilization over this period was predominantly due to a substantial growth (30-fold increase) in the number of MR scans (2005: n=13, 2014: n=385, $p<0.001$), while CT scan volume did not show significant difference (2005: n=254, 2014: n=292, 15% increase, $p=0.84$). Increased utilization of MRI was seen across all age groups ($p<0.001$). Over this same period, there was a 54% reduction in mean CT radiation dose (2005: CTDI –17.26±12.4 mGy-cm, DLP- 885±378 mGy and 2014: CTDI-7.53±4.49 mGy-cm, DLP-403±226 mGy, $p<0.001$).

CONCLUSION

A three-fold rise was seen for cross-sectional imaging utilization in patients with Crohn’s disease between 2005 and 2014 with a substantial contribution to this growth from increase in MR scan volume. The trend of increasing imaging utilization paralleled a trend in reduction of CT radiation dose.

CLINICAL RELEVANCE/APPLICATION

Significant reduction in CT radiation dose exposure and increasing utilization of MRI has enabled enhanced role of imaging in diagnosis and management of patients with Crohn’s 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/

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

SSE07-02 Utilization Trends in Abdominal Imaging from 2002-2014

Monday, Nov. 28 3:10PM - 3:20PM Room: E353A

Awards
Student Travel Stipend Award

Participants
Sarah I. Kamel, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

David C. Levin, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, HealthHelp, LLC; Board of Directors, Outpatient Imaging Affiliates, LLC
Laurence Parker, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Vijay M. Rao, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze recent trends in the utilization of the various abdominal imaging modalities among the Medicare population.

METHOD AND MATERIALS

The Medicare part B databases for 2002 through 2014 were reviewed. All CPT codes pertaining to noninvasive imaging of the Abdomen were selected and grouped into six categories: CT, MR, Nuclear scans, Ultrasound (US), X-ray and Fluoroscopy. Yearly utilization rate per 1000 Medicare beneficiaries was determined. Medicare physician specialty codes were used to determine how many studies were performed by radiologists versus self-referring nonradiologist physicians. Trends over the 12 year period were studied.

RESULTS

Nonradiologists consistently performed 10-12% of all abdominal imaging throughout the study, mostly US. The following data refer to utilization rates per 1,000 Medicare beneficiaries among radiologists: CT increased from 177 in 2002 to peak at 272 in 2009 (+54%), then dropped to 267 in 2010. A large decline to 143 occurred in 2011 due to code bundling of CT of the abdomen and pelvis. Over the next 3 years a small increase to 149 occurred (+4%). US increased from 97 in 2002 to peak at 111 in 2010 (+14%), then declined slightly to 105 by 2014. MR increased steadily from 6 in 2002 to 12 in 2014 (+100%). Nuclear scans dropped from 12 in 2002 to 10 in 2014 (-17%). Plain x-ray dropped steadily from 123 in 2002 to 84 in 2014 (-32%). Fluoroscopy also dropped steadily from 41 in 2002 to 22 in 2014 (-46%). Overall totals increased from 456 in 2002 to peak at 531 in 2009 (+16%), declined to 526 the next year, and then dropped sharply to 398 in 2011 due to code bundling. A further decline to 383 occurred by 2014.

CONCLUSION

Abdominal imaging is now driven largely by CT and US. Code bundling in 2011 had a large impact on CT utilization rates. From 2011-2014, CT grew slightly while US dropped slightly. MR has a relatively small role but is increasing slowly. Nuclear also has a small role but is declining. Both plain x-ray and fluoroscopy declined substantially over the study period. Radiologists have strongly predominated in abdominal imaging and there is no evidence that this is changing.

CLINICAL RELEVANCE/APPLICATION

N/A

SSE07-03 Defining a "Healthy" Body Composition Profile using MRI: Normative Data Extracted from the UK Biobank Imaging Cohort

Monday, Nov. 28 3:20PM - 3:30PM Room: E353A

Participants
Theresa Tuthill, PhD, Cambridge, MA (*Presenter*) Employee, Pfizer, Inc
Joan Sopczynski, Collegeville, PA (*Abstract Co-Author*) Employee, Pfizer Inc
Yili Chen, Collegeville, PA (*Abstract Co-Author*) Employee, Pfizer Inc
Melissa Miller, Cambridge, MA (*Abstract Co-Author*) Employee, Pfizer Inc
Alexandra Dumitriu, Cambridge, MA (*Abstract Co-Author*) Employee, Pfizer Inc
Jennifer Linge, Linkoping, Sweden (*Abstract Co-Author*) Employee, AMRA AB
Olof Dahlqvist Leinhard, PhD, Linkoping, Sweden (*Abstract Co-Author*) Stockholder, AMRA AB; Employee, AMRA AB

PURPOSE

Understanding the relationship of fat distribution with metabolic disease can aid in risk assessment. To standardize MRI-derived body composition measurements with normative values, criteria for the definition of "healthy" must first be derived.

METHOD AND MATERIALS

Body composition data on a cohort of 3000 subjects (1452 males, 1548 females) ranging from 45 to 78 years was acquired from the UK Biobank imaging study. Images from a 1.5T MR-scanner were from a 6 minute 2-point Dixon imaging protocol covering neck to knee and a 10-point Dixon single axial slice protocol positioned within the liver. Using AMRA® Profiler research (AMRA AB, Sweden, the following parameters were extracted: Visceral adipose tissue volume (VAT), Total abdominal adipose tissue volume (ATAT), Total lean thigh muscle volume and liver proton density fat fraction (PDFF). Two sets of criteria were defined to identify healthy subjects. The first definition (relaxed) excluded subjects with liver disease or diabetes type 2, high alcohol consumption, and BMI > 25. The second definition (strict) excluded subjects with ICD10-codes captured in the definition of previously-defined PheWAS clinical phenotypes deemed incompatible with healthy individual. For each measurement, the median, 25%-percentile and 75%-percentile were calculated. The observed differences were tested using Mann–Whitney U test.

RESULTS

The relaxed definition included 928 subjects, and the strict had 748.The abdominal fat parameters, VAT and ATAT, in the strict group were 2.8 (1.7-3.9) (median, 25%-75%percentile) and 8.5 (5.9-11.7), respectively, and were significantly less than the other definition. The mean liver fat, PDFF, was 1.9 with a narrow range, (1.4-3.3). Using a cutoff of the 95th percentile, a liver fat fraction cutoff for healthy subjects was 5%, with males having a slightly larger cutoff than females.

CONCLUSION

A strict definition of healthy controls, regardless of BMI but taking disease history into account, results in lower VAT, ATAT, and liver fat compared to more relaxed definitions. These normative body compositions values can be used in the context of risk assessment for various diseases.

CLINICAL RELEVANCE/APPLICATION

Ranges for "normal" values of body composition parameters determined through imaging will aid the the risk assessment of diseased

subjects.

SSE07-04 Clinically Acceptable, Optimized Dose Reduction in CT Imaging of Necrotizing Pancreatitis

Monday, Nov. 28 3:30PM - 3:40PM Room: E353A

Participants
Tracy A. Jaffe, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Xiaoyu Tian, durham, NC (*Abstract Co-Author*) Nothing to Disclose
Mustafa R. Bashir, MD, Cary, NC (*Presenter*) Research support, Siemens AG; Research support, Guerbet SA; Research support, General Electric Company; Imaging Core Lab, NGM Biopharmaceuticals; Imaging Core Lab, TaiwanJ Pharma
Daniele Marin, MD, Durham, NC (*Abstract Co-Author*) Research support, Siemens AG
Bhavik N. Patel, MD,MBA, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Lisa M. Ho, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Ehsan Samei, PhD, Durham, NC (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Siemens AG

PURPOSE

To determine potential radiation dose reduction of contrast enhanced CT (CECT) for imaging of patients with necrotizing pancreatitis (NP) using a novel noise addition tool.

METHOD AND MATERIALS

Through a HIPAA-compliant, IRB approval retrospective search of electronic records, 73 patients were identified who had undergone at least 1 abdominopelvic CECT for NP within a 2 year period using a routine abdomen pelvis protocol. Demographic data, number of CECTs associated with NP episode, dose length product (DLP), and effective dose (ED) were recorded. A subset (60) consecutive CECT scans were selected as reference routine radiation dose (100%) datasets. A noise addition software algorithm was used to simulate 4 additional datasets of increased noise by 10 HU increments. 3 radiologists independently reviewed 300 datasets and rated confidence (1-100, with a score of 75 noted as threshold of perceptual acceptability) for identifying (i) clinically relevant anatomic structures, (ii) complications of NP, and (iii) overall diagnostic acceptability. Observer data were analyzed to identify noise and dose levels associated with acceptability threshold and levels where observer scores were statistically indistinguishable from full dose results.

RESULTS

43 men and 30 women (average age 54 years) underwent an average of 6 CECT scans per episode of NP with average DLP and ED values of 966 mGy-cm and 16.4 mSv, respectively. Observers' perception of image quality tasks decreased progressively with linear increase in noise ($p<0.05$ for all tasks) with an average slope of -0.4 HU-noise/score. Both acceptability and statistical analysis indicated that noise can be increased from an average of 10 HU to 25 HU, corresponding to an average of 86% reduction in dose with observer perception unchanged within 95% confidence interval ($p<0.05$).

CONCLUSION

Imaging NP frequently involves multiple CT scans. Higher image noise levels may be tolerated during interpretation of CECT examinations in patients with NP, allowing significant reduction in patient radiation exposure. It is possible to add increased noise in CT images corresponding to 86% reduction in radiation dose while maintaining clinically acceptable image quality.

CLINICAL RELEVANCE/APPLICATION

Our study suggests the feasibility of significant reduction in radiation exposure during CECT of NP, which may significantly decrease the cumulative radiation burden in this patient population.

SSE07-05 Diagnostic Performance of MRI for Pregnant Patients with Clinically Suspected Appendicitis

Monday, Nov. 28 3:40PM - 3:50PM Room: E353A

Participants
Dae Jung Kim, MD, Seongnam-si, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the accuracy of MRI (appendix protocol) in the diagnosis of acute appendicitis in pregnant patients with clinically suspected appendicitis, the ability of additional DWI and the incidence of appendicitis mimicking conditions.

METHOD AND MATERIALS

One hundred twenty-five pregnant patients with clinically suspected appendicitis, who underwent 1.5T MRI for diagnosing/excluding acute appendicitis, were enrolled on this study between May 2011 and January 2016. During this period, two radiologists with more than 10 years of experience in MRI interpretation prospectively predicted appendicitis on MR, during daily interpretation. We retrospectively reviewed clinical records and radiological results were correlated with surgical pathology and clinical outcomes. We calculated sensitivity, specificity and accuracy of MRI for diagnosing of acute appendicitis. We performed additional DWI between August 2014 and January 2016 and we calculated sensitivity, specificity and accuracy of MRI with/without DWI. We reviewed incidence of appendicitis mimicking conditions, which was commented on MRI with appendicitis negative result, and correlated with clinical outcome.

RESULTS

Twenty nine patients underwent surgery and twenty five cases were pathologically diagnosed as acute appendicitis. The sensitivity, specificity and accuracy of MRI (n=125) for acute appendicitis were 100%, 95% and 96%, respectively. The sensitivity, specificity and accuracy of MRI without DWI (n=72); with DWI (n=53) were 100%, 94.7% and 95.8%; 100%, 95% and 96%. The incidence of commented appendicitis mimicking conditions on MRI was 20.8% (20/96) and eleven cases (ureteral stone-4, uterus rupture-1, small bowel obstruction-1, enteritis-2, lymphoma-1, ovarian hyperstimulation syndrome-1, organizing hematoma-1) were clinically diagnosed.

CONCLUSION

MRI has high accuracy for diagnosis of acute appendicitis in pregnant patients with clinically suspected appendicitis and additional

DWI improves accuracy.

CLINICAL RELEVANCE/APPLICATION

MRI with DWI may be acceptable for use as a first line diagnostic test for patients with clinically suspected appendicitis and helpful for looking pathologic processes outside the appendix.

SSE07-06 Infected versus Sterile Abdominal Fluid Collections in Postoperative CT - A Scoring System Based on Clinical and Imaging Findings

Monday, Nov. 28 3:50PM - 4:00PM Room: E353A

Participants
Christoph Radosa, MD, 01307 Dresden, Germany (*Presenter*) Nothing to Disclose
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Verena Plodeck, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Ralf-Thorsten Hoffmann, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Laniado, MD, Dresden, Germany (*Abstract Co-Author*) Reviewer, Johnson & Johnson
Andreas M. Volk, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To implement a scoring system for discrimination between infected and sterile postoperative abdominal fluid collections in CT and to compare it with a published scoring system.

METHOD AND MATERIALS

In a retrospective study (May-November 2015), all patients with portal-venous abdominal CT within 24 hours before CT-guided aspiration/drainage of abdominal fluid collections were included. Two radiologists independently analyzed fluid collections for Hounsfield units (HU), entrapped gas (yes/no) and wall enhancement (yes/no). C-reactive protein (CRP) ≤ 24h before intervention was obtained from electronic patient files. Imaging data and CRP were correlated with microbiology of fluid collections. The same inclusion criteria were applied to a second patient cohort (December 2015 - March 2016) to retrospectively compare our scoring system with a published scoring system which uses HU, entrapped gas, CRP and diabetes (Gnannt R et al. Invest Radiol 2015; 50: 17-23).

RESULTS

From May to November 2015, 50 patients were included. On binary logistic regression analysis, each of the four parameters was associated with the presence of infected fluid collections. A scoring system consisting of nominal categorization of the four variables was developed based on scores from 0 to 11 (CRP

CONCLUSION

The proposed scoring system provides good discrimination between infected and sterile postoperative abdominal fluid collections in CT. It shows slightly better results compared to a recently published scoring system by Gnannt et al.

CLINICAL RELEVANCE/APPLICATION

The new scoring system is a helpful tool to discriminate between infected and sterile fluid collections in postoperative abdominal CT. It might help to prevent unnecessary interventions.

SSE08

Gastrointestinal (Gall Bladder and Biliary Imaging)

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

GI MR US

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

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

Sub-Events

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

Monday, Nov. 28 3:00PM - 3:10PM Room: E353C

Participants
Tae Won Choi, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Sang Joon Park, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Su Joa Ahn, Seoul , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ijin Joo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

Statistically common findings for neoplastic polyp included single, larger size, sessile shape, lobular surface, vascular core, heterogenous echo, hypoechoic polyp, and non-hyperechoic foci ($P<0.05$). Single (OR, 3.680-3.856, $P<0.05$) and larger size (OR, 1.450-1.477, $P<0.001$) were independently associated with neoplastic polyp. Using polyp >14mm as a cutoff level, diagnostic accuracy to differentiate neoplastic polyp was 80.9-81.6%. To differentiate GB carcinoma from adenoma, sessile shape (OR, 9.485-41.257, $P\leq0.001$) and larger size (OR, 1.267-1.303, $P\leq0.001$) in HRUS, and higher skewness (OR, 6.382, $P=0.006$) and lower grey level co-occurrence matrices (GLCM) contrast (OR, 0.963, $P=0.006$) in texture parameters were significant predictors for GB carcinoma. Using polyp >21mm as a cutoff level, diagnostic accuracy to differentiate GB carcinoma was 73.1-79.5%. Among four significant predictors for GB carcinoma, if polyp showed at least one texture feature (skewness >0.24 or GLCM contrast <24.7) and one HRUS finding (polyp>21mm or sessile shape), diagnostic accuracy to differentiate carcinoma was increased to 89.7-91.0%.

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

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

Monday, Nov. 28 3:10PM - 3:20PM Room: E353C

Participants
Kazuto Kozaka, MD, Kanazawa, Japan (*Presenter*) Nothing to Disclose
Toshifumi Gabata, MD, PhD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
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Yasunori Sato, Kanazawa city, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Kobayashi, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Hidehiro Tajima, Kanazawa city, Japan (*Abstract Co-Author*) Nothing to Disclose
Seigo Kinuya, Kanazawa city, Japan (*Abstract Co-Author*) Nothing to Disclose
Kenichi Harada, Kanazawa City, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuo Ohta, Kanazawa city, Japan (*Abstract Co-Author*) Nothing to Disclose
Osamu Matsui, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recently, intrahepatic cholangiocellular carcinoma (ICC) can be divided by the origin of biliary tree. Bile ductular carcinoma (BDC) is considered to arise from small bile ducts such as septal, interlobular bile ducts and ductal carcinoma (DC) is considered to arise from large bile ducts. The usefulness of 18F-FDG PET/CT in ICC is well-known but some ICCs doesn't show uptake of 18F-FDG. The aim of this study was to assess the 18F-FDG accumulation and glucose metabolism in mass forming type of intrahepatic cholangiocarcinoma (M-ICC) with sub-classification into BDC and DC.

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

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

Monday, Nov. 28 3:20PM - 3:30PM Room: E353C

Participants
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PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

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

Monday, Nov. 28 3:30PM - 3:40PM Room: E353C

Participants

Sonja Kinner, MD, Madison, WI (*Presenter*) Nothing to Disclose
Tilman B. Schubert, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Adnan Said, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
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Scott B. Reeder, MD, PhD, Madison, WI (*Abstract Co-Author*) Institutional research support, General Electric Company Institutional research support, Bracco Group

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

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

Monday, Nov. 28 3:40PM - 3:50PM Room: E353C

Awards
Student Travel Stipend Award

Participants
Kristy Lee, MD, Boston , MA (*Presenter*) Nothing to Disclose
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Koenraad J. Mortele, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

Of all patients with a new dilated CBD without any identifiable cause on US, approximately 50% underwent MRCP as per the

recommendation. Of those, 67% of patients will have a specific PB cause for the dilation. The incidence of PB malignancy was found in 10% of all cases. Biochemical or additional US features are not reliably consistent at predicting which patients are more likely to have disease.

CLINICAL RELEVANCE/APPLICATION

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

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

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

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

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

SSE09

Gastrointestinal (Loco-regional Therapy Imaging)

Monday, Nov. 28 3:00PM - 4:00PM Room: E350

GI CT MR

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

FDA Discussions may include off-label uses.

Participants
Debra A. Gervais, MD, Boston, MA (*Moderator*) Nothing to Disclose
Ronald S. Arellano, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSE09-01 Ultrasound-Guided Therapeutic Modulation of Hepatocellular Carcinoma Using Complementary microRNAs

Monday, Nov. 28 3:00PM - 3:10PM Room: E350

Participants
Sayan Mullick Chowdhury, MSc,PhD, Belmont, CA (*Presenter*) Nothing to Disclose
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Sunitha Bachawal, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
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Rammohan Devulapally, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Ramasamy Paulmurugan, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Juergen K. Willmann, MD, Stanford, CA (*Abstract Co-Author*) Research Consultant, Bracco Group; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company; Advisory Board, Lantheus Medical Imaging, Inc; Advisory Board, Bracco Group

PURPOSE

Treatment options for hepatocellular carcinoma (HCC) are limited and new strategies to successfully treat this deadly disease are critically needed. The aim of this study was to evaluate treatment effects of two miRNAs of complementary function (microRNA-122 and antimicroRNA-21) encapsulated in biodegradable poly (lactic-co-glycolic acid) nanoparticles (PLGA-NP), co-administered by an ultrasound (US) guided and microbubble (MB)-enhanced localized delivery approach in doxorubicin resistant and non-resistant HCC.

METHOD AND MATERIALS

An US-guided drug delivery apparatus optimized for PLGA-NP delivery in cancers was used for the experiments. Lipid-shelled MB were used. For US-guided drug delivery, 1.8 MHz US pulses were used, generated by an array transducer connected to a research platform (V1, Verasonics, Redmond, WA). Proliferation and invasiveness of human HCC cells were assessed in vitro. Confocal microscopy and qRT-PCR were used to quantitate intracellular miRNA-loaded PLGA-NP delivery. Modulation of miRNA downstream targets, multidrug resistance proteins and extent of apoptosis were assessed in vivo in treated human HCC xenografts in mice.

RESULTS

Compared to single miRNA therapy, co-treatment of complementary miRNAs resulted in significantly ($P<0.05$) stronger therapeutic effects with higher resensitization to doxorubicin in HCC cells. US-guided delivery significantly ($P=0.0001$) increased (>5-fold) miRNA delivery in human HCC xenografts compared to controls (no US treatment) and electronic microscopy confirmed the internalization of PLGA-NP into tumor cells. In both resistant and non-resistant HCC, western blot analysis established down-regulation of anti-apoptotic proteins after complementary miRNA treatment while ex vivo assays confirmed that the delivered miRNAs could significantly improve sensitivity of HCC to doxorubicin.

CONCLUSION

Ultrasound-guided delivery of complementary miRNAs is highly efficient in treating doxorubicin-resistant and non-resistant HCC and can be further developed to aid better treatment of patients with HCC.

CLINICAL RELEVANCE/APPLICATION

Therapeutic complementary miRNA modulation under ultrasound guidance has the potential to fulfill the current therapeutic void for patients with drug resistant advanced HCC and/or poor hepatic reserve.

SSE09-02 Detection of Residual Hepatocellular Carcinoma after Locoregional Treatment by MRI: A Comparative Study between Extracellular Gadolinium and Gadoxetic Acid

Monday, Nov. 28 3:10PM - 3:20PM Room: E350

Participants
Jordi Rimola, MD, Barcelona, Spain (*Presenter*) Consultant, Robarts Clinical Trials
Matthew S. Davenport, MD, Cincinnati, OH (*Abstract Co-Author*) Royalties, Wolters Kluwer nv; ;
Peter S. Liu, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Theodore Brown, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Barbara McKenna, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Hero K. Hussain, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic accuracy of extracellular gadolinium-based contrast-enhanced MRI (Gd-MRI) and gadoxetic acid-

enhanced MRI (EOB-MRI) for the assessment of hepatocellular carcinoma (HCC) response to locoregional therapy (LRT) using explant correlation as the reference standard.

METHOD AND MATERIALS

IRB approval was obtained for this retrospective cohort study. Forty-nine subjects with cirrhosis and HCC treated with LRT who underwent liver MRI using either Gd-MRI (n=26) or EOB-MRI (n=23) within 90 days of liver transplantation were included. Four radiologists (two independent, two in consensus) reviewed the MR images blinded to histology to determine the size and percentage of viable residual HCC compared to the pre-treatment tumor volume using a per-lesion explant reference standard. Sensitivities, specificities, and areas under the receiver operating characteristic (ROC) curves for the detection of any viable tumor were calculated. Agreement (percent viable HCC on MRI vs. histology) was assessed with intra-class correlation coefficients.

RESULTS

Gd-MRI had greater agreement with histology (ICC: 0.98 [0.95-0.99] vs. 0.80 [0.63-0.90]) and greater sensitivity for viable HCC (76% [13/17 50-93%] vs. 58% [7/12; 28-85%]) than EOB-MRI; specificities were similar (84% [16/19; 60-97%] vs. 85% [23/27; 66-96%]). Areas under ROC curves for detecting residual viable tumor were 0.80 (0.64-0.92) for Gd-MRI and 0.72 (0.55-0.85) for EOB-MRI. Gd-MRI had greater inter-rater agreement than EOB-MRI for determining the size (mm) of residual viable HCC (ICC: 0.96 [0.92-0.98] vs. 0.85 [0.72-0.92]).

CONCLUSION

Gd-MRI may be more accurate and repeatable than EOB-MRI for the assessment of viable HCC following LRT.

CLINICAL RELEVANCE/APPLICATION

Imaging assessment of hepatocellular carcinoma response to loco-regional therapy is critical for patient management.

SSE09-03 A Cost-effectiveness Analysis of the Diagnostic Imaging Strategies in Decision Making of Curative Treatment for Early Stage Hepatocellular Carcinoma: Dynamic Contrast Enhanced CT vs. Adding Gadoxetic Acid-enhanced MRI

Monday, Nov. 28 3:20PM - 3:30PM Room: E350

Participants
Chong Hyun Suh, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kyung Won Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, DONGKOOK Pharmaceutical Co, Ltd

PURPOSE

We evaluated a cost-effectiveness of two different diagnostic imaging strategies in decision making of curative treatment for early stage hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

We developed a decision analytic model used as its starting point cohort of patients aged 55 years with HCC within the Milan criteria detected on dynamic contrast-enhanced CT and Child-Pugh A cirrhosis. The model compared two main diagnostic imaging strategies on the initial workup, (1) conventional CT strategy using dynamic contrast-enhanced CT only, (2) EOB-MRI strategy using additional the gadoxetic acid-enhanced MRI. A Markov cohort model was developed to simulate a cohort of patients after undergoing curative and/or adjuvant treatment, and followed up over their remaining life expectancy. We analyzed the mean life-years gain, quality-adjusted life-years (QALYs), costs per person, and incremental cost-effectiveness ratios (ICERs). To evaluate the robustness of the results of the model, we performed one-way, two-way, and probabilistic sensitivity analyses.

RESULTS

The mean life-years gain of the conventional CT strategy was 7.22 years and the EOB-MRI strategy was 7.79 years. The QALY of the conventional CT strategy was 5.08 and the EOB-MRI strategy was 5.52. The total expected costs were $99,770 for the conventional CT strategy, and $105,025 for the EOB-MRI strategy in the U.S.A. In the cost-effectiveness analysis, the ICER of the EOB-MRI strategy was $11,957 compared to the conventional CT strategy, which was lower than cost-effectiveness threshold of %50,000/QALY. One-way, two-way, and probabilistic sensitivity analyses showed unchanged results over an acceptable range.

CONCLUSION

The EOB-MRI strategy is the cost-effective strategy for detecting additional HCC in patients with early stage HCC compared to the conventional CT strategy. This cost effectiveness of EOB-MRI should be considered in the management of patients with early stage HCC during staging process.

CLINICAL RELEVANCE/APPLICATION

The gadoxetic acid-enhanced MRI should be considered in the management of patients with early stage HCC during staging process.

SSE09-04 Validation of Clinical Scoring Systems ART and ABCR after Transarterial Chemoembolization of Hepatocellular Carcinoma

Monday, Nov. 28 3:30PM - 3:40PM Room: E350

Participants
Roman Kloeckner, MD, Mainz, Germany (*Presenter*) Nothing to Disclose
Michael B. Pitton, MD, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Christoph Dueber, MD, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Irene Schmidtmann, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter R. Galle, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Sandra Koch, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcus A. Worns, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose

Arndt Weinmann, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Transarterial Chemoembolization (TACE) is the standard of care for intermediate stage hepatocellular carcinoma (HCC). It remains challenging to decide whether to repeat treatment. Hence, we performed external validations of two scoring systems recently developed to evaluate TACE: the ART (assessment for retreatment with TACE) and the ABCR (alpha fetoprotein [AFP], Barcelona clinic liver cancer [BCLC] stage, Child-Pugh score, and treatment response) and compared their prognostic value.

METHOD AND MATERIALS

From 2000 to 2015, 871 patients with HCC underwent TACE at our tertiary referral hospital. We acquired baseline data on BCLC-stages and AFP levels, and data measured before the second TACE on Child-Pugh scores, aspartate aminotransferase levels, and radiologic tumor responses. Overall survival for the different score groups (ART: 2 groups, ABCR: 2 and 3 groups) was calculated. Scores were validated and compared with Harrell´s C-index, the integrated Brier score (IBS), and prediction error curves.

RESULTS

176 patients were included. Low and high ART scores predicted median survivals of 20.8 and 15.3 months, respectively. Low and high ABCR scores (2 groups) predicted median survivals of 20.2 and 9.8 months, respectively. Low, intermediate, and high ABCR scores (3 groups) predicted median survivals of 24.5, 15.8, and 5.8 months, respectively. For the ART score Harrell´s C-index was 0.572. For the ABCR score Harrell´s C-index yielded 0.543 (2 groups) and 0.608 (3 groups). IBS were 0.135, 0.136, and 0.128 for ART and ABCR, respectively. For both scores, an increase in Child Pugh ≥2 points and a radiological response independently predicted survival.

CONCLUSION

Both ART and ABCR scores provided some indication of which patients had a dismal prognosis, and were unlikely to benefit from repeated TACE. The ABCR score with 3 groups had slightly greater predictive value compared to the ART score and the ABCR score with only 2 groups.

CLINICAL RELEVANCE/APPLICATION

Neither score was sufficient to support clear-cut clinical decisions. Further effort is necessary to determine criteria for valid predictions.

SSE09-05 The Role of Perfusion-CT as an Early Predictor of Survival in Patients with Advanced Hepatocellular Carcinoma Treated with Sorafenib

Monday, Nov. 28 3:40PM - 3:50PM Room: E350

Awards
Student Travel Stipend Award

Participants
Giulia Querques, MD, Monza, Italy (*Presenter*) Nothing to Disclose
Davide Ippolito, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Cammillo R. Talei Franzesi, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Pietro A. Bonaffini, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Sandro Sironi, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the role of quantitative perfusion-CT (pCT) as a diagnostic tool for the early prediction of survival in patients with advanced hepatocellular carcinoma (HCC) treated with Sorafenib.

METHOD AND MATERIALS

Between 2012 and 2015, 22 cirrhotic patients (n.19 M, n.3 F) with biopsy proven multifocal HCC underwent MDCT and pCT examinations before and every 3 months after Sorafenib administration. pCT technique is based on the acquisition of 16 dynamic slices/scan per 40 scans, performed on a 256-slice MDCT scanner, after iv bolus injection of 50 ml of iodinated contrast agent (350 mgI/ml) at a flow rate of 5 ml/s. According to mRECIST, patients were stratified in complete (CR) or partial response (PR), stable (SD) or progressive disease (PD). The following pCT parameters were calculated: hepatic perfusion (HP, ml/s/100g), arterial perfusion (AP, ml/s), and percentage variation (Δ) of HP and AP, before and 3 months after treatment. Kaplan-Meier analyses estimated the time to survival in the overall population and after stratifying patients into mRECIST.

RESULTS

A significant reduction ($p<0.01$) in mean ΔHP of 79.1% vs 51.7% vs 20.8% was observed in CR vs PR vs SD, respectively. Conversely, ΔHP increased of 22.2% among PD. Similarly, a significant reduction ($p<0.003$) in mean ΔAP of 82.8% vs 56.8% vs 18.6% was observed in CR vs PR vs SD, respectively, while ΔAP increased of 16.0% among PD. Median follow-up was 14 months with an overall survival rate of 31.0% at 18 months follow-up. When patients were stratified into mRECIST, the overall survival rate was 50% (CR) vs 30% (PR) vs 28% (SD) vs 20% (PD).

CONCLUSION

ΔHP and ΔAP significantly differ among mRECIST categories, showing good correlation with overall survival. These parameters might represent prognostic indicators of response to anti-angiogenic therapy, thus permitting the selection of patients who will benefit from treatment.

CLINICAL RELEVANCE/APPLICATION

pCT represents a feasible non-invasive technique for the quantitative assessment of hemodynamic changes related to Sorafenib in patients with advanced HCC, allowing for early prediction of HCC outcome.

SSE09-06 Ablation Therapy for Partially Responded Multi-Nodular HCCs after TACE Improves Achievement of Complete Response and Clinical Outcome

Monday, Nov. 28 3:50PM - 4:00PM Room: E350

Participants
Dong Ho Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Grant, Guerbet SA; Support, Siemens AG; Grant, Bayer AG; Grant, General Electric Company; Grant, STARmed Co, Ltd; Grant, RF Medical Co, Ltd; Grant, Toshiba Corporation; Grant, Samsung Medical Healthcare

PURPOSE

Ablation therapy can be used for residual hepatocellular carcinomas (HCCs) after transarterial chemoembolization (TACE). We retrospectively evaluated the role of ablation therapy for patients with multinodular HCCs initially treated by TACE.

METHOD AND MATERIALS

A total of 168 patients who underwent TACE for 2 to 5 HCCs≤5cm were included. After initial TACE, 'on-demand' re-treatment was done using repeated TACE or ablation therapy. Initial, best response was evaluated using modified Response Evaluation Criteria in Solid tumors. According to achievement and time of complete response (CR), patients were classified into three groups: initial CR, subsequent CR and persistent non-CR. Overall survival (OS) was estimated using Kaplan-Meier method. Cox-regression analysis was performed to find out significant predicting factors.

RESULTS

Achieving CR as best response was significant predicting factor better OS (hazard ratio=6.09 [3.09-12.0], P<0.001). The 5-year OS was 17.0% in 32 patients of persistent non-CR group and significantly poorer than that in 79 patients of initial CR group (50.9%) (P=0.001) or in 57 patients of subsequent CR group (56.3%) (P<0.001). The CR rate of ablation therapy (77.8%) as second session treatment was significantly higher than that of repeated TACE (41.1%) (P=0.004). OS of ablation group was also significantly better than that of repeated TACE group (P=0.003), due to higher CR rate.

CONCLUSION

Achieving CR as best response was a significant predictor for better OS in patients with 2 to 5 nodular HCCs≤5cm initially treated by TACE, and ablation therapy for residual tumor after initial TACE can improve achievement of CR and OS.

CLINICAL RELEVANCE/APPLICATION

Achieving CR as best response was a significant predictor for better OS in patients with 2 to 5 nodular HCCs≤5cm initially treated by TACE, and ablation therapy for residual tumor after initial TACE can improve achievement of CR and OS.

SSE10

Science Session with Keynote: Genitourinary (MR and CT of Urothelium)

Monday, Nov. 28 3:00PM - 4:00PM Room: E351

CT GU MR

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

Participants
Harris L. Cohen, MD, Memphis, TN (*Moderator*) Nothing to Disclose
Elaine M. Caoili, MD, MS, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SSE10-01 Genitourinary Keynote Speaker: The Role of Urothelial Imaging in Hematuria and Urothelial Tumors

Monday, Nov. 28 3:00PM - 3:10PM Room: E351

Participants
Elaine M. Caoili, MD, MS, Ann Arbor, MI (*Presenter*) Nothing to Disclose

SSE10-02 Diagnostic Yield of a Hematuria Protocol CT in Young Patients with Hematuria in a Military Population

Monday, Nov. 28 3:10PM - 3:20PM Room: E351

Participants
Robert M. Marks, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Terrel L. Galloway, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Laura R. Mace, DO, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Andrew Ma, BS, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Richard S. Montgomery, MD, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose
Ryan Rockhill, MD, Chula Vista, CA (*Abstract Co-Author*) Nothing to Disclose
William W. Reynolds JR, MD, Camp Pendleton, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the diagnostic yield of a computed tomography (CT) hematuria protocol in patients less than 50 years of age with a history of military service; who are at increased risk of urological malignancies secondary to harmful practices and work-related exposures.

METHOD AND MATERIALS

One hundred and thirty-seven consecutive patients less than 50 years of age with a history of military service who underwent a hematuria CT between 2013 and 2014 for new onset of hematuria were included in this IRB-approved single-center retrospective study with waiver of informed consent.Initial review of the clinical interpretations of the hematuria studies grouped the studies into negative and positive exams for any urological findings. Review of the patients' medical records and subsequent radiology studies determined micro vs. gross hematuria at presentation and any findings after their hematuria CT consistent with a urological malignancy on follow-up evaluation.The positive exams were reviewed by second readers, blinded to the clinical interpretation of the hematuria CT, who first read the unenhanced images. The readers characterized findings as visible on non-contrast CT alone or they requested and read the contrast enhanced images. Each urological finding was recorded for each patient.

RESULTS

Of the 137 included patients, 106 had microscopic hematuria and 33 had gross hematuria. There were a total of 99 negative examinations of the 137 included patients. Of the 38 patients with urological findings, 17 had nephrolithiasis which was visible on the non-contrast study alone. Contrast was requested 14 times which confirmed 12 benign cysts and 2 congenital UPJ obstructions. The readers found no evidence for a urological malignancy in any of the patients. Record reviews confirmed that no urological malignancies were later diagnosed in any of the 137 included patients.

CONCLUSION

An unenhanced CT may be appropriate to evaluate new onset microscopic, and possibly gross hematuria, in patients younger than 50, even in patients with an increased risk of urologic cancer. Further prospective trials are needed to confirm our findings.

CLINICAL RELEVANCE/APPLICATION

An unenhanced CT alone may be appropriate in the initial evaluation of hematuria in patients 50 years of age and younger, even in those at increased risk for urologic malignancy. The lack of a contrast enhanced phase decreases radiation exposure and eliminates the risk of contrast reactions.

SSE10-03 Detection of Bladder Cancer: Diagnostic Strategy of CT Urography as a Prior Examination-A Prospective Study1

Monday, Nov. 28 3:20PM - 3:30PM Room: E351

Participants
See Hyung Kim, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Leehi Joo, Daegu, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To prospectively assess diagnostic strategy of CT urography to flexible cystoscopy (FC) as a priority examination for detecting

To prospectively assess diagnostic strategy of CT urography to flexible cystoscopy (FC) as a priority examination for detecting bladder cancer.

METHOD AND MATERIALS

The institutional review board approved our study, with a waiver of informed consent. 3280 CT urograms in 3050 consecutive patients (1967 men, mean age, 60±15.1 years, range; 40–88 years; 1083 women, mean age, 54±14.9 years, range; 40–83 years) assessed for patients with over 35 years with gross hematuria, persistent microhematuria, or a history of urothelial tumor, were included in the study. We examined CT urography as two prior methods. First, patients with definite lesion by CT urography are referred directly for rigid cystoscopy (RC), and patients with negative or probable lesion referred for FC. Second, patients with definite lesion by CT urography are referred directly for RC, probable lesion referred for FC, and negative lesion referred for clinical follow–up. Performance characteristics for both methods were determined by using the standard reference. Ninety–five percent confidence intervals were estimated for each test characteristic.

RESULTS

The overall sensitivity, specificity, accuracy, positive predictive value, and negative predictive value (NPV) for detecting bladder cancer were 95.2% (141/148), 95.4% (1374/1439), 95.4% (1515/1587), 69.1% (141/204) and 99.2% (1374/1384) for first method and 93.4% (143/153), 93.3% (1437/1540), 93.3% (1580/1693), 61.1% (143/234) and 98.4% (1437/1459) for second method. The NPVs were higher in patients assessed for persistent microhematuria (99.7%, 517/519; 99.3%, 590/594). However, accuracies was considerably lower in patients with a prior urothelial tumor (90.6%, 165/182; 85.7%, 145/1696).

CONCLUSION

CT urography as a prior examination is accurate for detecting bladder cancer in patients at high–risk. The high NPVs in persistent microhematuria may obviate the supplemental use of FC.

CLINICAL RELEVANCE/APPLICATION

CT urography as a prior examination is recommended for detecting bladder cancer in patients at high–risk.

SSE10-04 CT Urography: Are We Getting Better at Detecting Bladder Cancer?

Monday, Nov. 28 3:30PM - 3:40PM Room: E351

Awards
Student Travel Stipend Award

Participants
Tony W. Trinh, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Daniel I. Glazer, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Cheryl A. Sadow, MD, Weymouth, MA (*Abstract Co-Author*) Nothing to Disclose
V. Anik Sahni, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stuart G. Silverman, MD, Brookline, MA (*Abstract Co-Author*) Author, Wolters Kluwer nv

PURPOSE

To compare current CT urography (CTU) performance characteristics in the detection of bladder cancer to that performed from 2000-2005, shortly after introduction of the technique into clinical practice.

METHOD AND MATERIALS

A retrospective medical record review of patients undergoing 1,049 CT urograms at our institution for hematuria or a history of urothelial cancer between 7/1/2011 and 12/31/2013 was conducted in this IRB-approved, HIPAA-compliant study. Of these, 607 had cystoscopy performed within 6 months for correlation and were included. 442 examinations were excluded due to lack of cystoscopy (n=346), prior cystectomy (n=85), and poor image quality (n=11). Surgical pathology or at least 2 years of clinical follow-up was used as the reference standard. Performance characteristics were calculated and compared to a similar cohort from 2000-2005.

RESULTS

A total of 76 bladder cancers were detected in the study with prevalence varying based on indication (history of urothelial cancer: 42%, gross hematuria: 12%, microscopic hematuria: 3%). Overall, CTU yielded a sensitivity of 83.5% (76/91), a specificity of 91.2% (468/513), a positive predictive value of 62.8% (76/121), and a negative predictive value of 96.9% (468/483). Sensitivity and specificity varied based on indication (history of urothelial cancer: 83.6% and 89.3%, gross hematuria: 79.0% and 87.3%, microscopic hematuria: 60.0% and 97.0%). Similar analysis of the 2000-2005 cohort demonstrated a sensitivity and specificity of 79% (117/149) and 94% (649/689), respectively.

CONCLUSION

CT urography remains an accurate non-invasive test for diagnosing bladder cancer with test characteristics not significantly changing over time.

CLINICAL RELEVANCE/APPLICATION

Given the high negative predicative value of CTU, cystoscopy may not be necessary in patients presenting with hematuria and no prior history of urothelial cancer.

SSE10-05 Optimization of B-value in iShim Diffusion-weighted MR Imaging of the Bladder: To Improve the Visualization of Bladder Cancer and T Staging Accuracy

Monday, Nov. 28 3:40PM - 3:50PM Room: E351

Participants
Mengchao Zhang, Changchun, China (*Presenter*) Nothing to Disclose
hongyi li, Changchun, China (*Abstract Co-Author*) Nothing to Disclose
Hong Zeng, MD, PhD, Changchun, China (*Abstract Co-Author*) Nothing to Disclose

Lin Liu, Changchun, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the optimal b-value of diffusion-weighted imaging in the bladder acquired using a prototype ss-epi sequence for integrated slice-specific dynamic shimming (iShim) for visualizing bladder cancer and making accurate T staging at 3.0-T.

METHOD AND MATERIALS

Fifty-five patients (37 males, 18 females, mean age 62±3.52) with bladder cancer confirmed by pathology underwent iShim-DWI with seven b-values (200, 400, 600, 800, 1000, 1500, and 2000 s/mm2) at 3.0 T scanner (MAGNETOM Skyra, Siemens AG, Erlangen, Germany). For each b value, the iShim-DWI findings of bladder cancer (type1=clear hyperintensity relative to the surrounding bladder , type2=hyperintensity with an unclear distal border, and type3=isointensity) were retrospectively evaluated and image quality {subjective scoring：4= excellent (no problems were noticed in the image and the bladder cancer was clearly shown), 3 =good (the image suffered from only minor degradation and was suitable for the evaluation of the cancer), 2=moderate (image quality was not good but usable for the evaluation of the cancer), and 1 = poor (image quality precluded assessment of the cancer and the pancreas was barely shown)},measured tumor-to-bladder signal intensity (SI) ratios and,T staging of bladder cancer. DWI findings, image quality, tumor-to-bladder SI ratios and T staging were compared between the seven b-values.

RESULTS

There was a significantly higher incidence of tumors showing clear hyperintensity on iShim-DWI with b-value of 800 s/mm2 than on that with b-value of 200, 400, 600, 1000, 1500, 2000 s/mm2（P<0.01）. The image quality was decreased when b-values increased from 800 to 2000 s/mm2 or decreased from800 to 200s/mm2 (P< 0.001). The highest scores of image quality were observed with b-value of 2000 s/mm2. There were highest signal intensity ratios (4.22±0.62,4.33±0.62,5.56±0.33, 3.98±0.11) between the bladder cancer and bladder wall around the cancer, distal bladder wall，cavity of bladder and the Muscle with b-value of 800 s/mm2. Diagnostic performance in overall accuracy for diagnosis of tumor staging and differentiation of T1 from T2 to T4 were best (Table4, 5)

CONCLUSION

The using of b =800 s/mm2 in iShim-DWI of the bladder can improve the delineation of bladder cancer and the accuracy of T staging at3.0T.

CLINICAL RELEVANCE/APPLICATION

The iShim sequences is recommended to make diagnosis of bladder cancer more accurate.

SSE10-06 Fused High-B-Value Diffusion-Weighted Imaging and T2-Weighted Imaging Helps Evaluate Depth of Invasion in Bladder Cancer: Preliminary Results

Monday, Nov. 28 3:50PM - 4:00PM Room: E351

Awards
Student Travel Stipend Award

Participants
Minsu Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sung Yoon Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Taik Oh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Dae Chul Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Su-Jin Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Nam Hoon Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Deuk Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate diagnostic performance of fused high-b-value diffusion-weighted imaging (DWI) and T2-weighted imaging (T2WI) to evaluate depth of invasion in bladder cancer.

METHOD AND MATERIALS

Consecutive 62 patients with surgically confirmed urothelial carcinoma in the urinary bladder were included. The patients underwent preoperative 3T magnetic resonance imaging including high-b-value DWI. An experienced genitourinary radiologist analyzed the depth of invasion (e.g., T-stage, < 2 versus ≥ 2) by using T2WI, DWI, fused DWI and T2WI, and contrast-enhanced T1-weighted imaging (CE-T1WI), respectively. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were investigated. The univariate and multivariate logistic regression tests were conducted to analyze which imaging techniques are useful to assess the depth of invasion.

RESULTS

The rate of patients with surgically confirmed T-stage of 2 or greater were 41.9% (26/62). The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were 50.0%, 55.6%, 44.8%, 60.6%, and 53.2% with T2WI, 57.7%, 77.8%, 65.2%, 71.8%, and 69.4% with DWI, 80.8%, 77.8%, 72.4%, 84.8%, and 79.0% with fused DWI and T2WI, and 73.1%, 66.7%, 61.3%, 77.4%, and 69.4% with CE-T1WI, respectively. In univariate analysis, the use of DWI, fused DWI and T2WI, and CE-T1WI were significant for the detection of T-stage of 2 or greater (p< 0.05), while fused DWI and T2WI was the only significant imaging technique in multivariate analysis (odds ratio= 10.549; p= 0.004).

CONCLUSION

Fused high-b-value DWI and T2WI may be useful to assess the depth of invasion in bladder cancer.

CLINICAL RELEVANCE/APPLICATION

Fused MRI may be the useful noncontrast MR imaging technique to evaluate the depth of tumor invasion, and it could help to decide surgical approach and extent in bladder TCC patients.

SSE11

Genitourinary (Gynecology and Genitourinary Ultrasound)

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

GU US

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

FDA Discussions may include off-label uses.

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

Sub-Events

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

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

Awards
Student Travel Stipend Award

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

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

Honored Educators

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

Katherine E. Maturen, MD - 2014 Honored Educator

SSE11-02 Ultrasound (US) of Indeterminate Adnexal Cysts: Incidence of Ovarian Cancer

Monday, Nov. 28 3:10PM - 3:20PM Room: E353B

Participants
Elizabeth B. Maddox, Madison, WI (*Presenter*) Nothing to Disclose
Elizabeth A. Sadowski, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Krupa Patel-Lippman, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Ashish P. Wasnik, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Viktoriya Paroder, MD,PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Sarah Averill, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Lisa Barroilhet, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Laura Huffman, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Katherine E. Maturen, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Alexander D. Blaty, BS, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Jessica B. Robbins, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Most ovarian lesions can be characterized on ultrasound (US) as benign appearing or worrisome for malignancy, and appropriately triaged. However, when cystic lesions have avascular septations and/or solid components or are larger than 5cm they are incompletely characterized by US and considered sonographically indeterminate (Ekerhovd E et al. Am J Obstet Gynecol 2001). The rate of ovarian cancer development in ovarian lesions characterized as benign or potentially malignant is well documented; however there is a paucity of data on the incidence of ovarian cancer in US indeterminate ovarian lesions. The goal of our study was to determine the incidence of ovarian cancer in sonographically indeterminate lesions.

METHOD AND MATERIALS

This is an IRB approved retrospective review of transvaginal US studies performed consecutively at 3 institutions from January to June 2011. Adnexal cystic lesions were considered indeterminate if they met one of the following criteria: presence of septations or soft tissue elements without Doppler vascularity, or cyst size >5 cm. Surgical pathology or resolution on follow-up were the inclusion criteria end-points. The incidence of benign and malignant ovarian neoplasms was calculated.

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

Determining the incidence of ovarian cancer in sonographically indeterminate adnexal lesions is an important step in the formulation of appropriate recommendations for follow up of these lesions.

Honored Educators

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

Katherine E. Maturen, MD - 2014 Honored Educator

SSE11-03 A Comparative Study between the use of Transvaginal Ultrasound (TVUS) and Saline Infusion Sonohysterogram (SIS) for Diagnosis of Endometrial Polyps

Monday, Nov. 28 3:20PM - 3:30PM Room: E353B

Participants
Shaimaa A. Fadl, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Ahmed S. Sabry, MD, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Amal Al Obadli, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose
Theodore J. Dubinsky, MD, Seattle, WA (*Abstract Co-Author*) Stockholder, Global Cancer Technology; Grant, Toshiba Corporation

PURPOSE

To determine the level of confidence in detecting endometrial polyps on TVUS in patients with abnormal uterine bleeding or infertility and to determine if SIS is necessary when the level of confidence is high.

METHOD AND MATERIALS

A retrospective study of 152 consecutive patients who underwent both TVUS and SIS for evaluation of abnormal uterine bleeding and infertility. TVUS images were obtained by Philips and GE machines and were reviewed by two independent observers who were blinded to the outcome. For each patient, a grade was given for the diagnosis of endometrial polyp. Grade 0: Negative for polyp, Grade: I when the diagnosis of polyp is equivocal and grade II positive for polyp. SIS was performed within three months using GE, Voluson E8. The imaging criteria included for the diagnosis of polyps are: well circumscribed echogenic lesion, stalk flaw pattern, the presence of cysts in an endometrial echogenic lesion. The results of the TVUS were compared with that of the SIS and then correlated with the hysteroscopy results which were considered the gold standard for the final diagnosis. Statistical

analysis was performed. Confidence intervals were computed using generalized estimating equations to account for repeated measurements per patient.

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

Honored Educators

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

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

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

Monday, Nov. 28 3:30PM - 3:40PM Room: E353B

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

CONCLUSION

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

Background

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

Evaluation

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

Discussion

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

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

Monday, Nov. 28 3:40PM - 3:50PM Room: E353B

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

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

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

Monday, Nov. 28 3:50PM - 4:00PM Room: E353B

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

PURPOSE

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

METHOD AND MATERIALS

Women were recruited from a large gynecology practice at a tertiary medical center after being scheduled for a pelvic ultrasound. Women were instructed to drink 32 oz of water 1 hour prior to the ultrasound. They then underwent a trans-abdominal ultrasound. Bladder volume (mL) and multiple thickness (mm) measurements were obtained of the anterior and posterior bladder neck, then, SWE was performed to measure shear-wave velocity (m/s) in multiple regions of the bladder neck (Figure 1). The average shear-wave velocity was used to calculate the Young's modulus (E) of each region of the bladder using the equation: $E = 3\rho c^2$, where c is shear wave velocity and ρ is tissue density (1000 cm3). Descriptive statistics, including means, medians, standard deviations, and ranges were obtained. The relationship between bladder elasticity and age, gravidity, parity, BMI, bladder neck thickness, and bladder volume were assessed using Spearman's correlation coefficients. Statistical analysis was performed using Stata, version 14.0.

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

SWE may be a useful adjunct for evaluation of mechanical and physiologic bladder disorders.

SSE12

Science Session with Keynote: Health Service, Policy and Research (Economic Analyses/Utilities)

Monday, Nov. 28 3:00PM - 4:00PM Room: S102D

HP

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

Participants
Christoph I. Lee, MD, Los Angeles, CA (*Moderator*) Research Grant, General Electric Company
Pari Pandharipande, MD, MPH, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSE12-01 Health Service, Policy and Research Keynote Speaker: Measuring Value in Imaging

Monday, Nov. 28 3:00PM - 3:10PM Room: S102D

Participants
Pari Pandharipande, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose

SSE12-02 Cost-Effectiveness of Endovascular Therapy in Acute Ischemic Stroke: A Meta-Analysis-Based Patient Subgroup Evaluation

Monday, Nov. 28 3:10PM - 3:20PM Room: S102D

Awards
Trainee Research Prize - Resident

Participants
Wolfgang G. Kunz, MD, Munich, Germany (*Presenter*) Nothing to Disclose
M.G. Myriam Hunink, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Sebastian E. Beyer, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Wieland H. Sommer, MD, Munich, Germany (*Abstract Co-Author*) Founder, QMedify GmbH
Kolja M. Thierfelder, MD,MSc, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Endovascular therapy in addition to IV thrombolysis (EVT+IVT) has been proven to be more effective compared to IV thrombolysis alone (IVT alone) in acute ischemic large vessel occlusion stroke within 6 hours of symptom onset. Our aim was to determine cost-effectiveness of the two approaches depending on the patient's initial ASPECTS, NIHSS score, time from symptom onset, and occlusion location.

METHOD AND MATERIALS

A decision analytic model based on Markov simulations estimated the lifetime costs and quality-adjusted life years (QALY) associated with both approaches (model overview provided in Figure 1). The analysis was performed in a United States setting from a societal perspective. Model input parameters were obtained from recently published literature (base-case values and references provided in Table 1), in particular a meta-analysis of 5 randomized clinical trials (MR CLEAN, ESCAPE, REVASCAT, SWIFT PRIME, EXTEND IA). Probabilistic sensitivity analyses (PSA) using 10.000 Monte Carlo simulation runs were performed to estimate the overall uncertainty of model results. The net monetary benefit (NMB), incremental costs (IC), incremental effectiveness (IE) and incremental cost-effectiveness ratios (ICER) were derived from PSAs. The willingness to pay (WTP) was set to 50.000$/QALY.

RESULTS

Overall, EVT+IVT was cost-effective compared to IVT alone (IC: 4569$, IE: 1,59 QALYs, ICER: 2876$/QALY) in 100% of simulation runs and therefore very robust within our model. Across all patient subgroups, EVT+IVT led to gained QALYs and the mean ICERs were considered cost-effective below the WTP threshold (results provided in Table 2). However, the subgroups of patients with ASPECTS ≤5 or with M2 occlusions showed considerably higher ICERs (14,281$/QALY and 25,278$/QALY) and only reached suboptimal acceptability in the PSAs (75.6% and 60.7%). All other subgroups had an acceptability in the PSAs between 93% and 100%.

CONCLUSION

Endovascular therapy in addition to IV thrombolysis is likely to be cost-effective across most patient subgroups. In patients with ASPECTS ≤5 or with M2 occlusions EVT+IVT reached suboptimal acceptability in the PSAs and therefore cost-effectiveness remains uncertain in these subgroups.

CLINICAL RELEVANCE/APPLICATION

EVT is not only an effective but in general a highly cost-effective therapy of acute ischemic stroke. Larger studies are required to determine cost-effectiveness in unfavorable patient subgroups.

SSE12-03 ICD-10 Implementation: Initial Report of Its Impact on Radiology A Large Multi-Hospital Radiology Practice

Monday, Nov. 28 3:20PM - 3:30PM Room: S102D

Participants
Margaret Fleming, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Richard Duszak JR, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

Dan MacFarlane, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Last year's conversion of the nation's International Classification of Diseases (ICD) coding system from 14,025 ICD-9 to 69,823 ICD-10 codes was projected to result in a 6-fold increase in codes used by radiology practices. We aimed to determine the actual code conversion magnitude and the revenue impact of ICD-10 on a large multi-hospital practice that diligently prepared for this transition.

METHOD AND MATERIALS

Using billing data stripped of all patient identification, we studied all 232,798 professional claims for 118 radiologists at a large health system for the first 5 months after ICD-10 implementation on October 1, 2015. Primary ICD-10 codes for the top 90th percentile of all radiology examinations were identified, both overall and by subspecialty division. Using ICD-9 codes for the entirety of 2014 and previously described methodology, we calculated code conversion impact factors (number of applicable ICD-10 codes ÷ number of applicable ICD-9 codes). To assess the impact of the ICD-10 implementation on cash flow, average monthly claims days in accounts receivable status both before and after October 1, 2015 were compared.

RESULTS

For all 232,798 radiology service claims, 5,135 ICD-10 codes were used as primary diagnoses, but only 540 codes (11% of all) comprised the top 90% of all claims. By comparison, 348 ICD-9 codes accounted for the top 90% of all claims in 2014. This translates to a code conversion impact factor of 1.6 for the department as a whole, far less than the literature predicted 6-fold increase. The code conversion impact for individual divisions ranged from 0.5 (breast) to 3.3 (musculoskeletal). All other divisions saw impact factors in the 1.5-2.0 range. The average monthly number of days claims were in accounts receivable status ranged from 33 to 39 days both before and after ICD-10 implementation. Monthly averages for the 7 months prior to and the 5 months after ICD-10 conversion were similar (35.0 vs. 35.2, p=0.86).

CONCLUSION

For large radiology groups adhering to "best practice" ICD-10 implementation planning guidelines, the impact of last year's widely feared ICD-10 transition, both with regard to code conversion magnitude and delays in cash flow, was negligible.

CLINICAL RELEVANCE/APPLICATION

For well-prepared radiology practices, the coding and revenue impact of last year's widely feared national ICD-10 transition was minimal.

SSE12-04 Association between Repeat MR Imaging for Benign Lumbar/Cervical Conditions and Imaging Management Fee: An Analysis of Japanese Health Insurance Claims Database

Monday, Nov. 28 3:30PM - 3:40PM Room: S102D

Participants
Kanako K. Kumamaru, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Yukiko Sano, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiken Ri, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Michimasa Suzuki, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaaki Hori, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Kamagata, Tyuuouku, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryusuke Irie, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakanishi, MD, PhD, Bunkyo-ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigeki Aoki, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Japanese universal health care insurance coverage system employs two-level additional "imaging management fee" system aside from technical fees: level-1) 700JPY/exam reimbursed for exams performed at facilities with fulltime radiologist(s): level-2) 1800JPY/exam reimbursed for those performed at facilities with fulltime radiologist(s) in charge of all imaging studies and writing timely reports. The purpose of the study was to evaluate if facilities reimbursed these imaging management fees are associated with increased exams based on financial incentives, or with reduced exam volume under the radiologist's strict control of appropriateness.

METHOD AND MATERIALS

This HIPAA-compliant, IRB-waived retrospective cohort study used unlinkable anonymized insurance claims data (2013-14) provided by the Japan Medical Data Center. Working-age (<65 years) subjects who underwent at least one outpatient MR imaging for benign lumbar/cervical conditions were included. The outcome was repeat outpatient MR exam without any surgical intervention/admission. A two-level hierarchical logistic regression models with patient-level (demographics, co-morbidities) and hospital-level covariates were developed to compare outcomes across three different facilities: (1) qualified to receive level-1 fee, (2) qualified to receive level-2 fee, and (3) not receiving imaging management fee.

RESULTS

A total of 23688 subjects were included (16838 undergoing lumbar MR (mean age 38.8±15.4 years) and 6850 undergoing cervical MR (45.0±11.7 years)). During the 2-year period, 9.5% and 7.3% of the subjects underwent another MR exam for benign lumbar and cervical conditions, respectively. The hierarchical model showed higher odds of repeat exams at facilities that were reimbursed imaging management fees compared to other facilities: adjusted odds ratio of facilities (1) and (2) vs (3): 1.42 (95%CI:1.16-1.75) and 1.29 (1.11-1.49) for lumbar and 1.87 (1.37-2.55) and 1.46 (1.13-1.88) for cervical).

CONCLUSION

At facilities which are qualified for additional reimbursement per exam, repeat MR exam for benign lumbar/cervical conditions in working-age subjects was more frequent compared to other facilities.

CLINICAL RELEVANCE/APPLICATION

At facilities which are qualified for additional reimbursement per exam, repeat MR exam for benign lumbar/cervical conditions in working-age subjects was more frequent compared to other facilities.

SSE12-05 Cost Effectiveness of MRI for Detection of Prostate Cancer

Monday, Nov. 28 3:40PM - 3:50PM Room: S102D

Awards
Trainee Research Prize - Fellow

Participants
Shivani Pahwa, MD, Clevelnad, OH (*Presenter*) Research support, Siemens AG
Nicholas K. Schiltz, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Lee E. Ponsky, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Ziang Lu, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Mark A. Griswold, PhD, Cleveland, OH (*Abstract Co-Author*) Research support, Siemens AG Royalties, Siemens AG Royalties, General Electric Company Royalties, Bruker Corporation Contract, Siemens AG
Vikas Gulani, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Research support, Siemens AG

PURPOSE

To evaluate the cost-effectiveness of MRI guided strategies versus transrectal ultrasound guided (standard) biopsy strategy for detection of prostate cancer

METHOD AND MATERIALS

A decision analysis model was created using base case of hypothetical biopsy-naïve men in three age groups (41-50 years, 51-60 years, and 61-70 years), with a biopsy indicated based on clinical criteria. The strategies evaluated were: 1) Standard biopsy. 2) A diagnostic MRI exam followed by MRI targeted biopsy using either of the following techniques if a lesion is detected: (a) Cognitive guided biopsy; (b) MRI-ultrasound fusion biopsy; (c) in-gantry MRI biopsy; no further biopsy is performed if no lesion is seen on MRI. 3) A diagnostic MRI exam followed by one of the MRI targeted biopsy techniques; a standard biopsy is performed even when MR does not depict suspicious lesions. Each strategy was further examined with and without Gadolinium contrast. Parameters as prevalence of cancer, sensitivity and specificity of each technique, procedure costs, and Quality Adjusted Life Years (QALY) values for each strategy were derived from the literature and other published sources. Incremental cost effectiveness ratio (ICER) per QALY for each strategy was calculated using standard biopsy strategy as the common comparator group.

RESULTS

The strategy of using a non-contrast MRI exam to detect lesions, followed by cognitive MR biopsy, and foregoing standard biopsy if no suspicious lesion is seen, was most cost-effective with an ICER of $2095; in-gantry biopsy strategy yielded the highest gain in QALY with an ICER of $6675. Other MRI strategies were also cost effective with ICER ranging from $2485-$15816.

CONCLUSION

MRI guided strategies for detection of prostate cancer are cost-effective.

CLINICAL RELEVANCE/APPLICATION

The simple strategy of performing an MRI exam to detect lesions, followed by cognitive guided biopsy could be easily adopted in clinical practice. Advanced MRI methods that improve disease characterization could further improve cost-effectiveness of MRI in detecting aggressive prostate cancers.

SSE12-06 2005-2014 CT and MRI Single Market Utilization Trends with a Non-Denial Prior Authorization Program

Monday, Nov. 28 3:50PM - 4:00PM Room: S102D

Participants
Adam C. Powell, PhD, Houston, TX (*Presenter*) Researcher, HealthHelp, LLC; President, Payer+Provider Syndicate; Co-founder, ArxViva, Inc
David C. Levin, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, HealthHelp, LLC; Board of Directors, Outpatient Imaging Affiliates, LLC
Erin M. Kren, Houston, TX (*Abstract Co-Author*) Employee, HealthHelp, LLC
Roy A. Beveridge, MD, Louisville, KY (*Abstract Co-Author*) Employee, Humana Inc
James W. Long, Louisville, KY (*Abstract Co-Author*) Employee, Humana Inc.
Amit K. Gupta, Houston, TX (*Abstract Co-Author*) Employee, HealthHelp, LLC

PURPOSE

Reducing unnecessary testing may benefit patients, as some computed tomography (CT) and magnetic resonance imaging (MRI) exposes patients to contrast, and all CTs expose patients to radiation. This study assessed shifts in CT and MRI utilization over a 9-year period after a private health insurer's implementation of a non-denial, consultative prior authorization program. As the insurer had previously experienced 10% annual utilization growth, the program was devised to improve patient safety.

METHOD AND MATERIALS

Normalized rates of exams per 1,000 members were plotted over 2005-2014 for people with commercial and Medicare Advantage health plans in one Southwest market, with utilization during 2005 set as the baseline. The prior authorization program was implemented at the start of 2006. CT and MRI utilization changes were compared with changes in plain film and ultrasound utilization. Changes were examined separately for health maintenance organization (HMO) and preferred provider organization (PPO) plans. Normalized utilization rates in 2006 and 2014 were reported.

RESULTS

Growth in imaging utilization decelerated or reversed during the study period among people with plans from the private insurer.

Contemporaneous low-tech imaging trends were mixed. By 2006, CT utilization dropped to being 76% to 90% of what it had been in 2005, depending on the plan. In 2014, it was 52% to 88% of its initial level. MRI utilization declined to 86% to 94% of its initial level in 2006, and further to 50% to 75% in 2014. Plain film radiography was between 74% and 88% of its initial level in 2006, depending on the plan, and then 60% to 88% of its initial level in 2014. Ultrasound utilization was 67% to 95% of its initial level in 2006, and 84% to 125% of its initial level in 2014.

CONCLUSION

There was a decline in CT and MRI utilization in the market after the introduction of the non-denial prior authorization program. The mixed trends in low-tech imaging suggest that a factor other than a decline in low-tech imaging contributed to the decline. The immediate declines suggest that the program may have contributed to the change, rather than an external factor.

CLINICAL RELEVANCE/APPLICATION

Both immediate and long-term decreases in CT and MRI utilization can occur after the implementation of a non-denial prior authorization program.

SSE13

Informatics (3D Printing)

Monday, Nov. 28 3:00PM - 4:00PM Room: S404CD

IN

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

Participants
Rasu B. Shrestha, MD, MBA, Pittsburgh, PA (*Moderator*) Advisory Board, General Electric Company; Editorial Advisory Board, Anderson Publishing, Ltd; Advisory Board, KLAS Enterprises LLC; Advisory Board, Peer60; Board, Pittsburgh Dataworks; Board, Omnyx, LLC;
Safwan Halabi, MD, Stanford, CA (*Moderator*) Nothing to Disclose
David J. Harvey, MBBCh, Swansea, United Kingdom (*Moderator*) Shareholder, Medical Connections Ltd; Managing Director, Medical Connections Ltd

Sub-Events

SSE13-01 A 3D Printed Simulator for Training Thoracoscopic Surgery for Esophageal Atresia with or without Trachea-Esophageal Fistula (EATEF) with Volumetric CT and Patient Specific Modelling

Monday, Nov. 28 3:00PM - 3:10PM Room: S404CD

Participants
Haekang Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Guk Bae Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Jin San Bok, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Semyeong Jang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

This 3D printed simulator used for effective training and planning VATS on EATEF. It is obvious to have advantages to resolve limitations of non-patient specific and unrealistic simulator with a difficult access. Moreover, the 3D printed simulator could be extended to adult patients and other diseases that require VATS.

Background

Esophageal atresia with or without trachea-esophageal fistula (EATEF) is found shortly after birth. Even though noble techniques and instrumentations for endoscopic surgery, such as video-assisted thoracoscopic surgery (VATS), have been introduced, surgical operation for neonates remain difficult. Thus, we fabricated a patient-specific thoracoscopic simulator for training VATS for EATEF by 3D printed phantom modelling from pediatric chest volumetric CT and for planning a demanding surgery effectively.

Evaluation

A 3-years old patient with EATEF underwent pediatric chest CT. Skin, muscle, bone, esophagus lumen, airway and lung, which were semi-automatically segmented by a region growing method and thresholding, were reconstructed into 3D model (fig. 1) of STL (Stereolithography) format (A-view, Asan Medical Center, Seoul). The wall of the airway and esophagus was modeled by outside offset of 2mm and the fistula invisible on CT was created using Meshmixer (Autodesk, Inc., Toronto, Canada). Subsequently, 7 holes among each rib (3rd~ 8th) were built for VATS ports. The scale of model was reduced to 80% for matching with that of 9-12 month old baby in Korea and the port-hole diameter was set as 12 mm. EATEF simulator was fabricated with Object 500 Connex 3 (Stratasys, CO, USA). The mechanical properties of all components were evaluated by two surgeons in consensus (fig. 2).

Discussion

To modify softness of the organs, mixtures of soft and hard materials were tested with varying the proportion of soft material from 60% to 100% with 10% increment (Table 1). Hard materials with colors were used to distinguish the anatomic components, while the soft material was semi-transparent. The simulator was used for training VATS on EATEF by two surgeons and qualitatively assessed as being very useful for training and reflecting clinical situation than the conventional simulator (fig.3).

SSE13-02 Implementation of a Radiology 3D Printing Quality Control Program

Monday, Nov. 28 3:10PM - 3:20PM Room: S404CD

Awards
Student Travel Stipend Award

Participants
Anish Ghodadra, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Elliott K. Gozansky, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Rakesh K. Varma, MBBS, MD, Monroeville, PA (*Abstract Co-Author*) Nothing to Disclose
Nikhil B. Amesur, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Ernesto Santos, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

As 3D printing expands in Radiology, implementation of a robust quality control program can ensure high repeatability and reliability in the manufacture of patient-specific models for procedure planning and education.

Background

The advent of low-cost, consumer-grade printers has made 3D printing practical for day-to-day clinical use. However, as Radiology

The advent of low-cost, consumer-grade printers has made 3D printing practical for day to day clinical use. However, as Radiology begins to expand into manufacturing of patient-specific models for procedure planning and education, care must be taken to establish a quality control system to ensure the fidelity of this complex process. Here, we present our implementation of the engineering principles of design verification and validation in a Radiology 3D printing program.

Evaluation

High quality 3D printing in Radiology begins with a consistent process for high quality image acquisition. This includes proper contrast bolus timing, signal to noise ratio and resolution. Second, a consistent process for training regarding segmentation must be established. Ideally, the final segmentation should be approved by a Radiologist to ensure relevant anatomy is properly segmented. Next, a proper protocol for creation of a 3D model file, or STL, must be established. Subsequently, the steps performed in model refinement and mesh repair should be assessed and standardized. Prior to printing, virtual measurements of the final model must be performed and compared to the original imaging. Finally, validation of final 3D printed model dimensions must be confirmed with the original imaging. On a regular basis, the process chain from CT scan to final 3D printed model must be assessed with standard phantoms.

Discussion

We discuss our implementation of the above system as well as the optimal parameters for each step of the manufacturing process. We present our refined standard operating protocol to ensure that 3D printed models of patient anatomy are created in a reproducible and reliable way. We also discuss our implementation of quality control at the various steps in the 3D printing process. Finally, we present challenges and opportunities for improvement in the manufacturing chain.

SSE13-03 Post-processing Guidelines for Clinical 3D Printing: Process Overview, Fabrication Constraints, and Ordinal Modeling Considerations

Monday, Nov. 28 3:20PM - 3:30PM Room: S404CD

Awards
Student Travel Stipend Award

Participants
James Shin, MD, MSc, Stony Brook, NY (*Presenter*) Nothing to Disclose
George L. Shih, MD, MS, New York, NY (*Abstract Co-Author*) Consultant, Image Safely, Inc; Stockholder, Image Safely, Inc; Consultant, MD.ai, Inc; Stockholder, MD.ai, Inc;
Mark E. Schweitzer, MD, Stony Brook, NY (*Abstract Co-Author*) Consultant, MMI Munich Medical International GmbH Data Safety Monitoring Board, Histogenics Corporation

CONCLUSION

Taking print service limits as targets for model complexity, suggested post-processing guidelines are: Avoid upstream smoothing whenever possible to limit defeaturing and shrinkage. Initial iso-surface decimation should only be applied when necessary to facilitate post-processing, and not fall below service limits. Remeshing should be considered a repair tool, and not be used in service to aesthetics or polygon counts.

Background

Clinical 3D printing entails several independently complex processes, bridging expertise for which is uncommon. Streamlining this concatenated toolchain is necessary for process efficiency and accessibility, and identification of existing constraints is the point of origin from which this effort extends.

Evaluation

Hardware and processing times are not considered here. The primacy of representational accuracy is maintained irrespective of cost or time efficiency.

Discussion

Constraints on model complexity are predominantly practical. Large models from unprocessed DICOM exceeding tens of millions of polygons are extremely taxing on workstations, without necessarily contributing to accuracy. Iso-surfaces extracted from smaller regions of interest however may never approach this level of complexity.Print service constraints are a relevant and practical point of reference. Several services include Shapeways (64MB / 1,000,000 polygons), Sculpteo (50MB / 1,000,000 polygons), and i.materialise (100MB). Many provide simplification tutorials prompting use of mesh decimation, a process inversely complementary to interpolation whereby a surface contour is filtered and downsampled. Several techniques offer file size or polygon count as target parameters, limiting undue compromise to accuracy. Decimation is also commonly applied with initial iso-surface extraction to facilitate post-processing. Remeshing is an alternate simplification akin to shrink-wrapping contours with a lower polygon mesh, and more commonly a CAD tool.Unlike decimation and remeshing which aim to preserve topology, smoothing improves aesthetics by minimizing topological irregularities. This can lead to small feature loss and shrinkage. Smoothing can be applied to 2D label maps, extracted iso-surfaces, and in innumerable CAD implementations.

SSE13-04 Structural Considerationsfor 3D Printing the Skeletally Immature Craniocervical Junction

Monday, Nov. 28 3:30PM - 3:40PM Room: S404CD

Participants
James Shin, MD, MSc, Stony Brook, NY (*Presenter*) Nothing to Disclose
C. Douglas Phillips, MD, New York, NY (*Abstract Co-Author*) Stockholder, MedSolutions, Inc Consultant, Guerbet SA

CONCLUSION

Skeletal immaturity can present segmentation and modeling challenges not present for adults. Structural integrity of non-contiguous ossified components can be achieved with basic CAD techniques, however variable ossification patterns must be anticipated and carefully considered in order to apply them appropriately, as areas of inadequate fusion or subtle non-contiguity may be inapparent on a digital model. Familiarity with potential ossification patterns is thus critical to ensuring structural integrity of a 3D printed bone model, especially so at the craniocervical junction.

Background

Robust segmentation and iso-surface extraction algorithms have facilitated maturation of 3D printing workflows using CT image data. While these techniques are extensible to the immature skeleton, achieving structural integrity of non-contiguous osseous anatomy requires additional structural geometries. This represents a significant departure from routine post-processing. In addition to familiarity with basic CAD tools, understanding the full range of potential ossification patterns and their variable progression is critical to fabrication of a patient model representative of anatomic position, as imaged.

Evaluation

De-identified CT images of a skeletally immature skull base were processed in 3D Slicer (4.5) using standard threshold segmentation and iso-surface extraction algorithms. An initial threshold was chosen to ensure contiguity of the segmented skull base. A subsequent lower threshold was chosen to segment the spine more inclusively. Support rods were fused by Boolean addition at a diameter of 3.5mm in Meshmixer (11.0), determined by trial and error with a bias toward minimization.

Discussion

Type 3a anterior/type B posterior C1 arches were identified. This represents a non-typical ossification pattern, and could introduce additional structural requirements that may be subtle depending on stage of maturation, though not in this case. 5 ossification centers of C2 were partially fused and structurally adequate by analysis of the digital model, with the exclusion of the chondrum terminale. Midline supports from C2 to C5, and anterior arch C1 to dens, were added. Lateral masses were anchored to the occipital condyles and C2 lateral neural arches.

SSE13-05 The Impact of 3D Printed Bone Neoplasm Models on Surgical Excision Planning

Monday, Nov. 28 3:40PM - 3:50PM Room: S404CD

Awards
Student Travel Stipend Award

Participants
Leonid Chepelev, MD, PhD, Ottawa, ON (*Presenter*) Nothing to Disclose
Adnan M. Sheikh, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Taryn Hodgdon, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the impact of the use of patient specific 3D printed bone neoplasm models on surgical planning for bone neoplasm excision, specifically the nature of the procedure, surgeons' confidence, and patient satisfaction with consent.

METHOD AND MATERIALS

We evaluated a total of 20 patients whose assessment was requested by orthopedic surgeons for operative planning of bone neoplasm resection. Diverse neoplasms were included, with metastatic and primary bone lesions. CT images with IV contrast were acquired for all patients and reconstructed with isotropic voxels and axial slice thickness of 1.25mm. Resultant DICOM images were segmented using Materialize software (Leuven, Belgium) to identify neoplasms, as well as to delineate the involved neurovascular structures. Models produced in this segmentation were printed using Objet260 printer (Stratasys, Eden Prairie MN). Two orthopedic surgeons with no prior knowledge of the patients were then asked to provide a preliminary resection plan using only PACS software and rate their confidence, followed by exposure to a 3D printed model. They were then asked to rate their confidence on a Likert scale after modifying their plan, if necessary. All surgical plans were then computationally converted to resection volumes and digitally compared. Finally, in obtaining informed consent for neoplasm excision, patients were asked to rate their satisfaction with consent before and after exposure to 3D models of their disease, on a Likert scale.

RESULTS

A total of 20 diverse neoplasm models, including metastatic (n=15) and primary (n=5), were successfully fabricated and used in preoperative planning. Exposure to 3D printed models significantly increased surgeons' confidence in their plans and substantially altered surgical plans in all cases as identified by volume comparison. Patients exposed to 3D models of their disease reported overall higher satisfaction.

CONCLUSION

Within the limits of this study, tangible, interactive 3D printed models of bone neoplasms in the context of vital proximal neurovascular structures were demonstrated to have a significant objective and subjective impact on improving surgical planning.

CLINICAL RELEVANCE/APPLICATION

Traditional bone neoplasm resection planning may benefit from the guidance provided by 3D printed models of patient-specific disease while improving patient satisfaction with informed consent.

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 J. Rybicki III, MD, PhD - 2016 Honored Educator

SSE13-06 Metal Artifact Reduction Techniques for 3D Printing of Patient Models with Dental Fillings

Monday, Nov. 28 3:50PM - 4:00PM Room: S404CD

Participants
Roy Marcus, MD, Rochester, MN (*Presenter*) Institutional research agreement, Siemens AG; Research support, Siemens AG

Jane S. Matsumoto, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
James A. Kelly, DDS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vrieze, RT, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Ahmed Halaweish, PhD, Rochester, MN (*Abstract Co-Author*) Employee, Siemens AG
Lifeng Yu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the optimal combination of metal artifact reduction techniques for 3D printing of patient models with dental fillings.

METHOD AND MATERIALS

A denture incorporating metal fillings was placed in a 20 cm water phantom mimicking the attenuation of the head. Data were acquired on a 128-slice CT scanner (SOMATOM Edge, Siemens) at 120kV, 135 quality reference mAs and 128x0.6mm collimation; an additional scan was performed at 140 kV. The phantom was positioned using the following settings/positions: 1. Horizontally; 2. Tilted by 15°; 3. Horizontally with a synthetic spacer placed between the upper and lower jaw; 4. Tilted by 15° with the jaw spacer in place. Images were reconstructed with filtered-back-projection (FBP) and iterative metal artifact reduction (iMAR) with 8 settings. Image quality was evaluated in consensus.

RESULTS

The use of iMAR enhanced the overall image quality by effectively reducing metal artifact, compared to standard FBP. Among 8 settings, one setting (dental) provided the best image quality in the sense of metal artifact reduction. Increasing the tube voltage to 140 kV did not improve the image quality compared to 120 kV. The separation of both jaws by the introduced spacer resulted in a splitting of the artifacts, enabling a more dedicated evaluation of non-affected areas and easier segmentation between the jaws. Tilting the head led to a reduced number of metal objects scanned on the same plane, hence additionally reducing the severity of metal artifacts.

CONCLUSION

Methods such tilting the head, introducing a jaw spacer, and using a dedicated metal artifact reduction algorithm reduce metal artifacts and enhanced the image quality in CT of the mandible/maxilla. This image quality improvement substantially improve the accuracy of segmentation, consequently the accuracy of 3D printed models. In addition, substantial time savings are expected without having to perform time-consuming manual steps to remove metal artifacts.

CLINICAL RELEVANCE/APPLICATION

Metal artifact reduction techniques improve efficiency and accuracy of image segmentation in 3D printing.

SSE14

Science Session with Keynote: Musculoskeletal (All About Nerves)

Monday, Nov. 28 3:00PM - 4:00PM Room: E450B

MK MR

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

Participants
Darryl B. Sneag, MD, Plainview, NY (*Moderator*) Institutional research agreement, General Electric Company
Avneesh Chhabra, MD, Dallas, TX (*Moderator*) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

Sub-Events

SSE14-01 Musculoskeletal Keynote Speaker: Future Direction of Nerve Imaging and Intervention

Monday, Nov. 28 3:00PM - 3:10PM Room: E450B

Participants
Avneesh Chhabra, MD, Dallas, TX (*Presenter*) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

SSE14-02 MR Neurography and Diffusion Tensor Imaging as a Potential Biomarker of Chemotherapy Induced Peripheral Neuropathy

Monday, Nov. 28 3:10PM - 3:20PM Room: E450B

Participants
Lana H. Gimber, MD, Tucson, AZ (*Presenter*) Nothing to Disclose
Linda Garland, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Krupinski, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Tyson S. Chadaz, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Kevin J. Johnson, Chicago, IL (*Abstract Co-Author*) Employee, Siemens AG
Michael Schwenk, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Bijan Najafi, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Mihra S. Taljanovic, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Peripheral neuropathy is seen in up to 75% of individuals undergoing chemotherapy and can drastically limit treatment and affect quality of life. Clinical and electrodiagnostic testing for PN has many pitfalls. MR neurography (MRN) and diffusion tensor imaging (DTI) show promise in the workup of peripheral nerves. These techniques, not previously studied in chemotherapy induced peripheral neuropathy (CIPN), have promise as a biomarker of onset and severity of CIPN and an aid to evaluating preventive strategies. We investigated a possible relationship between DTI and CIPN.

METHOD AND MATERIALS

Cancer patients with and without CIPN were evaluated using vibratory perception threshold (VPT) testing. VPT score of >25Volts defined presence of CIPN. The posterior tibial nerve and branches in both feet were imaged using MRN and DTI. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) values were measured at the posterior tibial, medial plantar and lateral plantar nerves. Measurements for the CIPN group were compared to without CIPN by VPT cut-off. Correlations and possible relationships between DTI parameters and CIPN were analyzed.

RESULTS

Nine patients were enrolled; a total of 15 feet were imaged (8 feet with CIPN, 7 feet without CIPN). Average age was 60.6±13.4 years (range=33-74). Posterior tibial nerve ADC values were significantly lower than the medial plantar nerve ADC values in all feet ($F=3.50$, $p=0.04$). We found a correlation with FA and ADC values at specific nerve locations with CIPN, with the left medial plantar nerve FA value and left lateral plantar nerve ADC value demonstrating the strongest positive correlations (0.73 and 0.62, respectively).

CONCLUSION

This pilot study provides preliminary data showing correlations between FA and ADC measurements with CIPN. A larger, more definitive study of MRN with DTI as an objective biomarker and possible early predictor for CIPN is warranted.

CLINICAL RELEVANCE/APPLICATION

MRN with DTI shows promising results as a potential objective biomarker of chemotherapy induced peripheral neuropathy.

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/

Lana H. Gimber, MD - 2016 Honored Educator
Mihra S. Taljanovic, MD - 2016 Honored Educator

SSE14-03 The "Bull's-Eye" Sign on MRI:A Harbinger of 'Hourglass Constrictions' of Peripheral Nerves in

Patients with a Clinical Diagnosis of Parsonage-Turner Syndrome

Monday, Nov. 28 3:20PM - 3:30PM Room: E450B

Participants
Darryl B. Sneag, MD, Plainview, NY (*Presenter*) Institutional research agreement, General Electric Company
Eliana Saltzman, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
David Meister, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Joseph Feinberg, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Steve K. Lee, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Scott Wolfe, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To illustrate the role of MRI in identifying sites of severe nerve narrowing, termed 'hourglass constrictions' (HGCs), in affected peripheral nerves or individual nerve fascicles in patients with a clinical diagnosis of Parsonage-Turner Syndrome (PTS).

METHOD AND MATERIALS

IRB-approval was granted. Six patients over a 3-mo. period diagnosed with PTS by history and physical, and with absent recovery (axonal regeneration) by electrodiagnostic testing, were included. Patients underwent 3.0 T MRI (GE Discovery MR750) of the brachial plexus, arm, elbow and/or forearm, targeting involved nerves. Surgical exploration was then performed at pathologic sites identified on MRI.

RESULTS

The mean age of the six patients (4 male) was 43 ± 16.0 yrs. All had unilateral symptoms affecting the dominant arm in 3/6 cases. Time between MRI and surgery was 1.3 ± 0.6 mos. Nerves involved included the suprascapular, radial, and posterior interosseous, as well as the anterior interosseous and pronator teres fascicles of the median nerve trunk. A total of 11 affected nerves and 23 constriction sites were identified. On MRI, the number of involved nerves per patient ranged from 1-3, and number of involved fascicles per affected nerve ranged from 1-2. Within each affected nerve and/or fascicle, there were 2.3 ± 1.2 sites of constriction. In almost all involved nerves or fascicles, the narrowing site was heralded immediately proximally by a 'bull's-eye' sign of the nerve, manifested as peripheral signal hyperintensity and central hypointensity on PD-weighted and/or T2-weighted fat suppressed images, orthogonal to the longitudinal nerve axis (Fig. 1). In all cases, intra-operative findings confirmed the precise location of narrowing identified on MRI.

CONCLUSION

High-resolution peripheral nerve MRI is a reliable pre-operative tool to accurately localize HGCs in patients with a clinical diagnosis of PTS, with absent nerve recovery. HGCs are heralded by a "bull's eye" appearance of the nerve on cross-sectional MRI just proximal to the affected site, findings not previously reported. The causes of HGCs and the "bulls-eye sign" are yet unknown. It remains unclear if these changes are unique to PTS, or exist in other peripheral neuropathies.

CLINICAL RELEVANCE/APPLICATION

MRI can accurately identify sites of severe nerve narrowing (hourglass constriction) in affected peripheral nerves or individual nerve fascicles in patients with a clinical diagnosis of PTS.

SSE14-04 High Resolution Metal Artifact Reduction MR Neurography of the Lumbosacral Plexus in Patients with Metallic Implants

Monday, Nov. 28 3:30PM - 3:40PM Room: E450B

Participants
Shivani Ahlawat, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Alan Belzberg, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

PURPOSE

To assess the diagnostic quality of magnetic resonance neurography (MRN) of the lumbosacral (LS) plexus using high resolution metal artifact reduction sequences (MARS) in patients with metallic implants and suspected LS neuropathy.

METHOD AND MATERIALS

Following IRB approval, 19 consecutive patients (37% women; mean age, 52 years; range, 31-78 years) with a clinical diagnosis of LS plexus neuropathy following pelvic instrumentation or hip arthroplasty were prospectively enrolled between 2015-16. The MARS MRN protocol included axial intermediate-weighted and STIR turbo spin echo sequences that extended from L5 to the ischial tuberosity. Clinical data including electrodiagnostics were recorded. MRN studies were independently reviewed by two musculoskeletal radiologists. The visibility of the LS trunk, as well as sciatic, femoral, lateral femoral cutaneous (LFCN), and obturator nerves were rated using equidistant 5-point Likert scales and the presence of nerve abnormalities including discontinuity, bulbous enlargement, perineural fibrosis, architectural distortion, deviation of course, signal hyperintensity and skeletal muscle denervation were evaluated. Descriptive and diagnostic performance statistics and intraclass correlation coefficient (ICC) observer agreement were applied.

RESULTS

Clinical indications included LS plexopathy (n=3), sciatic (n=10), femoral (n=3), and LFCN (n=3) neuropathy. The visibility scores of the LS trunk, sciatic, femoral, LFCN and obturator nerves were 4.3±1.4, 4.7±0.7, 4.9+0.4, 4.7±1.7, and 4.7±1.1, respectively with good to excellent interobserver agreement (ICC=0.65-0.94). The diagnostic accuracy of MRN MARS based on 13 patients with confirmed diagnosis on a per nerve basis showed a sensitivity, specificity, positive likelihood ratio (LR), and negative LR of 92% (95%CI=64-99%), 92% (95%CI=82-98%), 12 (95%CI=4.6-31) and 0.08 (95%CI=0.01-0.6), respectively.

CONCLUSION

MARS MRN of the LS plexus yields high image quality and diagnostic accuracy for the assessment of LS neuropathies in patients

MARS MRN of the L5 plexus yields high image quality and diagnostic accuracy for the assessment of L5 neuropathies in patients with metallic implants of the pelvis and hips.

CLINICAL RELEVANCE/APPLICATION

Metal artifact reduction sequences permit high quality MRN in patients with metallic implants of the pelvis and hips, and in addition to electrodiagnostic studies can serve as a useful tool for the diagnosis of peripheral neuropathies and operative planning.

SSE14-05 Evaluation of the Effectiveness of a Simplified CT-Guided Infiltration of the Greater Occipital Nerve in the Treatment of Refractory Cranion-Facial Pain Syndromes other than Occipital Neuralgia in 52 Patients

Monday, Nov. 28 3:40PM - 3:50PM Room: E450B

Participants
Alexandra Ricquart, Besancon, France (*Presenter*) Nothing to Disclose
Adrian I. Kastler, MD,PhD, Grenoble, France (*Abstract Co-Author*) Nothing to Disclose
Bruno A. Kastler, MD, PhD, Besancon, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the effectiveness of a simplified greater occipital nerve (GON) infiltration guided by CT in the treatment of refractory facial pain syndromes other than occipital neuralgia

METHOD AND MATERIALS

52 patients (mean age 50 –range 28 to 75) suffering from refractory craniofacial pain syndromes were included between april 2014 and august 2016. Infiltration was performed at the intermediate site of the GON, at its first bend between obliqus capitis inferior and semispinalis capitis muscles with local anestetics and cortivazol. Patients suffered from migraine (M) in 21 cases, trigeminal neuralgia (TN) in 14 cases and cluster headaches (CH) in 13 cases. Clinical efficacy at day one, 1 and 3 months, was defined by a decrease of at least 50% of VAS scores.

RESULTS

Mean pain value before procedure was 8,6/10 (VAS). After procedure, clinical success was achieved in 79% of patients (41/52 patients) with a mean VAS score of 2.5/10, $p<0.001$). At 3 months follow up, 65 % of patients presented a persisting benefit of infiltration with a mean VAS score of 3.6/10 ($p<0,001$). Efficacy in the subgroups were as follows : M group : 77% of patients at 1 and et 63% at 3 months, CH 71% and 58% and TN: 57 % & 47%. No complication occured during or after procedure.

CONCLUSION

Infiltration at the intermediate site of GON under CT guidance appears as an effective mini invasive treatment for cranio facial pain syndromes especially in cases of cluster headaches and migrains .It presents a simplified approach to the previously described infiltration at the emergence of GON technique, and should be considered as an alternative management option

CLINICAL RELEVANCE/APPLICATION

Management of chronic cranio facial pain and migrains is a difficult task. GON infiltration has proven to be effective in occipital neuralgia. However, this simplified technique of GON infiltration also appears to be effective in patients with cluster headaches, migrains and trigeminal neuralgia

SSE14-06 Ultrasound-guided Anesthetic/steroid Injection of the Brachial Plexus in the Management of Neurogenic Thoracic Outlet Syndrome: Initial Experience

Monday, Nov. 28 3:50PM - 4:00PM Room: E450B

Participants
Matthew J. Winfeld, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Jared Pisapia, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Eric Zager, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Viviane Khoury, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Neurogenic thoracic outlet syndrome (nTOS) is a painful condition. Treatment options include physical therapy, pain medication, and surgery. Ultrasound is a powerful tool in the evaluation of the brachial plexus and a means of image-guided interscalene triangle medication injection. We provide a retrospective review of our initial experience with this technique.

METHOD AND MATERIALS

A search for ultrasound-guided injections of the brachial plexus with anesthetic and corticosteroid was done using an internal search engine. Radiology and chart reviews were performed and the following recorded: history and physical exam findings at presentation, attempted prior interventions, imaging findings, impact of injection, and outcome of surgery if performed.

RESULTS

Twenty-nine patients (age 16-65, average 26.5y, 11M and 18F) received ultrasound-guided brachial plexus injections between 3/2014 and 12/2015. All patients were diagnosed with nTOS after clinical evaluation by a neurosurgeon who specializes in the condition. Twenty-nine (100%) complained of pain in the affected extremity, with 25 (86%) patients describing a radiating nature of the pain with associated numbness and/or tingling and 14 (48%) reporting an inciting injury. No complications of the procedure were reported. Fourteen patients (48%) had at least some relief after the injection, and five patients (17%) were lost to follow-up. One patient reported worse symptoms after intervention. Eleven patients (38%) went on the have surgery (anterior scalene resection and neurolysis), with surgery recommended but not performed in two patients. Of the patients who had surgery, 6 had reported at least some relief after the injection. Six patients who had relief after the injection did not have surgery, with one patient opting for more injections.

CONCLUSION

Ultrasound-guided injection of the brachial plexus is a safe and minimally-invasive intervention that may temporarily relieve symptoms of nTOS in some patients and may help identify those who could benefit from surgery.

CLINICAL RELEVANCE/APPLICATION

Ultrasound-guided brachial plexus injection is a technique that can relieve symptoms of nTOS and identify those patients who might benefit from surgery, thus expanding applications of interventional ultrasound and potentially modifying the neurosurgical algorithm for nTOS treatment.

SSE15

Musculoskeletal (Trauma)

Monday, Nov. 28 3:00PM - 4:00PM Room: E451B

MK CT MR

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

Participants
Corrie M. Yablon, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Cree M. Gaskin, MD, Keswick, VA (*Moderator*) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc; Research Grant, Carestream Health, Inc; ;

Sub-Events

SSE15-01 Primary Cross Sectional Imaging for Occult Hip Fractures: CT or MRI?

Monday, Nov. 28 3:00PM - 3:10PM Room: E451B

Awards
Student Travel Stipend Award

Participants
Stephen Sammut, MBChB, Stoke-on-Trent, United Kingdom (*Presenter*) Nothing to Disclose
Suchi Gaba Sr, MD, FRCR, Stoke-On-Trent, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The National Institute of Health and Care Excellence, UK guidance recommends MRI as the investigation of choice for suspected hip fractures not demonstrated on plain radiographs. This study was conducted to establish the utilization of CT scans as first line investigation for occult hip fractures at our Major Trauma Centre and the rate of detection of occult fractures that impacted on patient management.

METHOD AND MATERIALS

A retrospective review was conducted of all CT and MRI scans performed at our institution during the year 2015, where the keyword "fracture" was used within the report. This identified 843 scans, of which 519 were initially excluded as not specifically questioning hip or proximal femoral fractures. Of the remaining 324 scans, a further 56 scans were excluded as they were performed for operative planning or suspected bleeding in patients with visible fractures on plain radiographs.

RESULTS

The average age was 76 years and female to male ratio was 69%:31%. 262 (98%) of patients had CT scan performed only following equivocal radiographs. 4 patients had an MRI scan performed following a CT, confirming a possible fracture in one of these cases. Only 2 patients had an MRI scan performed directly, following plain radiographs. 115 patients had fracture confirmed with cross-sectional imaging: most commonly pubic rami, acetabular and neck of femur (NOF) fractures. 24 patients (9%) had a subsequent operation following confirmation of a fracture; in 22 cases for a NOF fracture. Thus, the overall pick-up rate for occult fractures was 43%, though the majority of these were managed conservatively. In only one instance MRI confirmed a NOF fracture where CT was equivocal.

CONCLUSION

CT is an effective modality for diagnosing occult hip fractures. It can be utilised in units where MRI is not readily available or have high demand on MRI.

CLINICAL RELEVANCE/APPLICATION

Although MRI is recommended for the detection of occult hip fractures, our study has shown that CT is an effective modality. CT can often be performed more quickly, avoiding unnecessary delay in confirming the diagnosis; MRI can also be problematic in the elderly and paediatric population and where it is contraindicated. MRI should still be considered following a negative CT scan in patients who remain symptomatic and in the younger population.

SSE15-02 The Importance of Perfusion for Union: An Analysis of the Relationship Between Acute Lower Extremity Vascular Injury and Fracture Healing Time in the Setting of High-energy Trauma

Monday, Nov. 28 3:10PM - 3:20PM Room: E451B

Participants
Michael S. Roux, MD, Boston, MA (*Presenter*) Nothing to Disclose
Anthony S. Armetta, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jean Paul Colon Pons, MD, Ponce, PR (*Abstract Co-Author*) Nothing to Disclose
Remy Ngwanyam, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Royalties, Reed Elsevier
Ali Guermazi, MD, PhD, Boston, MA (*Abstract Co-Author*) President, Boston Imaging Core Lab, LLC Research Consultant, Merck KgaA Research Consultant, Sanofi-Aventis Group Research Consultant, TissueGene, Inc Research Consultant, OrthoTrophic Research Consultant, AstraZeneca PLC
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the significance of concomitant acute arterial injury on the healing of traumatic lower extremity fractures.

METHOD AND MATERIALS

At a major urban Level 1 Trauma Center, 246 instances of acute lower extremity fracture were identified from the past 10 years, for which a CT-angiogram of the ipsilateral lower extremity was also acquired at the time of injury. Of these fracture instances, 126 met the inclusion criteria which included CTA diagnostic adequacy, presence of complete fracture, and serial radiographic follow-up sufficient to assess for fracture union, delayed union, or nonunion. Radiographs were re-evaluated for number of weeks until fracture union, or for delayed or non-union, with subspecialty musculoskeletal radiology faculty review of cases with potential ambiguity. Acute arterial injuries were also recorded, including presence of stenosis, occlusion, extravasation, pseudoaneurysm, AV fistula, or dissection, within the superficial femoral, popliteal, anterior tibial, posterior tibial, and peroneal arteries. Relevant demographic data was also recorded.

RESULTS

T-test analysis reveals a statistically-significant prolonged mean fracture union time of 39.0 weeks when there is concomitant vascular injury, as compared with 18.7 weeks in the absence of vascular injury (p=0.0009), exclusive of cases with no radiographic evidence of eventual union. Fisher's Exact Test was used for categorical assessment of united and non-united fractures, with and without vascular injury, revealing a statistically-significant association between vascular injury and fracture non-union (p=0.0029).

CONCLUSION

Acute arterial injury at the time of traumatic lower extremity fracture is correlated with prolonged fracture healing, approximately doubling the mean time required to achieve fracture union.

CLINICAL RELEVANCE/APPLICATION

Traumatic lower extremity arterial injury is associated with prolonged fracture healing time and non-union.

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/

Ali Guermazi, MD, PhD - 2012 Honored Educator
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Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

SSE15-03 Evaluation of Paraspinal Fat Pad as An Indicator of Posterior Ligamentous Complex Injury in Cervical Spine Trauma

Monday, Nov. 28 3:20PM - 3:30PM Room: E451B

Participants
Sebastien Moliere, MD, Strasbourg, France (*Presenter*) Nothing to Disclose
Stephane Kremer, MD, PhD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Marie Le Minor, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Guillaume Bierry, MD, PhD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if the obliteration of a cervical space, the "paraspinal fat pad" (PFP) can be used as an indicator on CT of an injury of cervical spine posterior ligamentous complex (PLC).

METHOD AND MATERIALS

Our retrospective study was approved by our institutional board review; written informed consent was obtained from healthy subjects, and waived for patients.First, PFP appearance was evaluated in an anatomic specimen and in 10 healthy subjects spine CT by three radiologists (1,2 and3) working in consensus.Then, in 85 patients with suspicion of cervical spine trauma following high velocity accident, readers 2 and 3 reviewed in consensus the cervical spine CT (reference for fracture and luxation) and MRI (1.5 T; T1, T2, and STIR sequences; reference for ligament and disk injuries, and contusion or occult fracture) for traumatic injuries.PFP CT appearance was independently analyzed by readers 1 and 2, and interobserver agreement (kappa weighted) was calculated.Relationships between PFP changes and injuries and descriptive analysis were calculated.

RESULTS

The PFP could be identified as a well-circumscribed fatty area between cervical spine and posterior muscles. Interobserver agreement was 0.76.An abnormal PFP was associated to PLC (p<0.001) and arch (p=0.006) injuries but not to body (p=0.06), longitudinal ligaments (p=0.4) or disk (p=0.66) injuries.Sensitivity, specificity, positive and negative predictive values for PLC injuries were 55% (11/20), 97% (38/39), 92% (11/12) and 81% (38/47), respectively.

CONCLUSION

PFP changes on CT are significantly associated to injuries of PLC in patients with spine cervical trauma.

CLINICAL RELEVANCE/APPLICATION

The disappearance of the paraspinal fat pad fatty density should alert the radiologist to the possibility of posterior ligamentous complex injury.

SSE15-04 MR-Based Edema Grading of the Psoas and Paraspinal Back Muscles: Is it Helpful for Diagnosing Fractures of the Lumbar Transverse Process?

Monday, Nov. 28 3:30PM - 3:40PM Room: E451B

Participants

Hyunseok Jeong, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Yong Sung Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Jong Yun, Cheongwon-gun, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Young Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yunkyung Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Seon Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyung Nam Ryu, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the reliability of edema grading at the psoas and paraspinal back muscles based on axial T2-weighted images (T2WI) for assessment of lumbar transverse process (TP) fractures (Fxs).

METHOD AND MATERIALS

Institutional review board approval was obtained. Retrospective review and analyses of lumbar spine MR images from 58 patients was performed by two radiologists in consensus. TPFx was confirmed on lumbar spine CT (time interval between CT and MR imagings, 0–7 days). On axial T2WI of the disc level, muscles around the spine were classified as four compartments – right psoas (RA), left psoas (LA), right paraspinal back (RP), and left paraspinal back (LP) muscles. Muscle edema grading was performed at each compartment (grade 0 to 3). For one leveled TP evaluation in one side, two leveled (two disc levels, just cranial and caudal to a targeted TP) edema grades were summed. Finally, grades for RA, RP, RAP (RA + RP), LA, LP, LAP (LA + LP), and T (RAP+LAP) were taken for each TP.

RESULTS

A total of 245 TPs (TP with Fx, 22; TP without Fx, 223) of 58 patients was evaluated. Muscle edema grade was significantly higher in cases with TPFxs than in cases without TPFx, and also was moderately correlated with the presence of TPFx (ρ=0.446). ROC graph showed a sensitivity of 72.7% and specificity of 90.1% at a total grade > 2.50. The odds of muscle edema grade showed significant higher probability of the presence of TPFx (RAP- OR, 1.679; 95% CI: 1.351, 2.085; P=0.000/ LAP- OR, 1.982; 95% CI: 1.391, 2.825; P=0.000).

CONCLUSION

Mulsce edema grade was strongly correlated with TPFx. Therefore, edema grading of the psoas and paraspinal back muscles at the lumbar spine is a helpful tool for predicting possibility of neighboring TPFxs.

CLINICAL RELEVANCE/APPLICATION

Edema grading of the psoas and paraspinal back muscles at the lumbar spine on axial T2WI is a helpful tool for not overlooking TPFx and predicting the presence of TPFx, especially, when a level of the transverse process was not scanned on axial MR images.

SSE15-05 Dual-Energy CT for Detection of Bone Marrow Edema in Vertebral Compression Fractures: Visual and Quantitative Analysis at 3rd Generation Dual-Source CT with Comparison to MRI

Monday, Nov. 28 3:40PM - 3:50PM Room: E451B

Participants
Bernhard Petritsch, Wurzburg, Germany (*Presenter*) Nothing to Disclose
Anke Heidemeier, MD, Wuerzburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernhard Krauss, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Richard J. Wagner, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose
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Tobias Gassenmaier, MD, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Uwe Malzahn, PhD, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Thorsten A. Bley, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Aleksander Kosmala, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively assess the diagnostic performance of dual-energy computed tomography (DECT) virtual non-calcium (VNC) technique in the detection of bone marrow edema in vertebral compression fractures on a 3rd generation dual-source CT system with MRI as a reference standard.

METHOD AND MATERIALS

Fourteen consecutive patients with 24 thoracic and/or lumbar vertebral compression fractures were included in this IRB-approved prospective study. All patients underwent both DECT (90/Sn150 kV; Sn indicates the use of a 0.4 mm tin filter) and MRI (3 Tesla; sagittal T1-weighted and STIR images). Two independent readers visually evaluated all vertebrae (n=97) for the presence of abnormal marrow attenuation on VNC images by using color-coded maps and in addition performed a quantitative evaluation of CT numbers on virtual non-calcium images. MR images served as the reference standard. CT numbers were subjected to receiver-operating characteristic (ROC) analysis to calculate cut-off values.

RESULTS

MR imaging depicted 18 edematous and 6 non-edematous vertebral compression fractures. In the visual analysis, DECT VNC images had an overall sensitivity of 77.8%, specificity of 98.7%, and accuracy of 94.8%. The inter-observer agreement was k=0.91. In the quantitative analysis significant differences in virtual non-calcium CT numbers between edematous and non-edematous vertebral compression fractures were found (AUC ROC 0.915; p<0.0005). Use of a cut-off value of -22 to differentiate edematous vertebral bodies provided sensitivity of 72.2%, specificity of 100%, and accuracy of 94.8%.

CONCLUSION

VNC images generated from 3rd generation DECT allow for accurate depiction of trauma-related bone marrow edema in vertebral compression fractures on both visual and quantitative evaluation, revealing the acute nature of the fracture.

CLINICAL RELEVANCE/APPLICATION

Dual-energy CT holds the potential for accurate diagnosis of bone marrow edema in vertebral compression fractures, which becomes from particular interest in patients with contraindications for MRI.

SSE15-06 A New Technique For Detecting Acute Bone Marrow Edema in Vertebrae Using a Dual-Energy CT Virtual Noncalcium Technique

Monday, Nov. 28 3:50PM - 4:00PM Room: E451B

Participants
Guobin Hong, MD, PhD, ZHUHAI, China (*Presenter*) Nothing to Disclose
Lingjing Gu, Zhuhai, China (*Abstract Co-Author*) Nothing to Disclose
Yijie Fang, Zhuhai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study aimed to assess the feasibility and clinical applicability of a dual-energy computed tomography (DECT) virtual noncalcium (VNC) imaging technique for diagnosing vertebral bone marrow lesions.

METHOD AND MATERIALS

A total of 19 patients with acute spinal trauma were enrolled in this study. All patients underwent DECT and magnetic resonance imaging (MRI) within 3 weeks after injury. The interval between the DECT and MRI was approximately 0 to 1 day. DECT data were post-processed using a three-material decomposition algorithm to generate VNC images and color-coded maps. Both MR and noncalcium images were independently scored by two doctors using a three-point system (2=a distinct bone marrow lesion, 1=a suspicious bone marrow lesion, and 0=no lesion); the doctors were blinded to one another's scores.Subsequently, the Hounsfield numbers in the noncalcium images were evaluated by a third reader based on contrast MR images of normal and abnormal bone marrow,which served as the reference standard. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for the detection of bone bruises using VNC images were calculated. A consistency check was performed using kappa statistics. A one-way analysis of variance was used to analyze the Hounsfield numbers in the bone marrow lesions.

RESULTS

The DECT VNC images had an overall sensitivity and PPV of 92%,and relatively low specificity and NPV for the identification of the distinct bone marrow lesions.Inter-reader agreement was high for the qualitative grading of the DECT images (K=0.650).The Hounsfield numbers in the VNC images gradually declined from the thoracic to the lumbar vertebrae ($P<0.05$).The Hounsfield numbers for the positive regions were higher than for the negative regions ($P<0.05$). Statistically significant differences in the Hounsfield numbers were identified in regions that had bone marrow lesions with different classifications (thoracic levels:$F=136.690$, $P=0.000$; lumbar levels:$F=92.689$, $P=0.000$).

CONCLUSION

The DECT VNC images that combined the Hounsfield number measurements based on the VNC can reveal fine bony anatomical details of the spine and allow for the early detection of bone marrow lesions.

CLINICAL RELEVANCE/APPLICATION

This new technique has tremendous clinical significance and potential applications.

SSE16

Nuclear Medicine (Cardiovascular Imaging)

Monday, Nov. 28 3:00PM - 4:00PM Room: S505AB

CA CT NM

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

Participants
Amir H. Khandani, MD, Chapel Hill, NC (*Moderator*) Consultant, Progenics Pharmaceuticals, Inc; Consultant, WorldCare International, Inc
Andrew C. Homb, MD, Louisville, KY (*Moderator*) Nothing to Disclose

Sub-Events

SSE16-01 Suppression of Myocardial 18F-FDG Uptake through Prolonged High-fat, High Protein and Very Low-carbohydrate Diet before FDG-PET/CT for Evaluation of Patients with Suspected Cardiac Sarcoidosis

Monday, Nov. 28 3:00PM - 3:10PM Room: S505AB

Participants
Yang Lu, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Christopher Grant, MD, chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Karen Xie, DO, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Nadera Sweiss, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We hypothesized that a 72-hour high-fat, high protein and very low-carbohydrate (HFHPVLC) diet preparation can suppress physiologic myocardial uptake of FDG, which is the limiting factor in using FDG-PET/CT for cardiac sarcoidosis (CS) .

METHOD AND MATERIALS

This retrospective study included 215 FDG-PET/CT tests from 207 patients with biopsy proven sarcoidosis and clinical suspicion for CS between July 2014 and December 2015. These patients were classified into 2 groups. Group 1 includes 12 FDG PET/CT scans from 12 patients who had 24-hour or less pretest HFHPVLC diet preparation. Group 2 includes 203 FDG PET/CT scans with 72-hour HFHPVLC diet before FDG-PET/CT. All patients were given detailed instructions about diet preparation. Diet adherence were verified by imaging physician during test. Nonadherent patients and patients with coexisting cancer were excluded. Patterns of cardiac FDG uptake were classified into: "none " and "ring like diffuse at base" (negative for CS); "focal" (positive for CS); and "diffuse" (indeterminate for CS). Quantitative cardiac FDG uptake was measured. Final diagnoses were made with consensus among physicians in view of all available comprehensive clinical information, other imaging and diagnostic test results, with reference to modified Japanese Ministry of Health and Welfare criteria.

RESULTS

In group 1, there were 1(1/12, 8.3%) positive, 5 (5/12, 41.7%) indeterminate, and 6 (6/12, 50.0%) negative for CS. In group 2, 10 patients were excluded (6 due to noncompliance diet, 2 with concurrent diagnosis of cancers, 2 due to insulin and steroid use within 4hr before PET/CT); the remaining 185 patients had 193 FDG PET/CT tests (8 repeats), of which there were 19 (19/193, 9.8%) positive, 5 indeterminate (5/193, 2.6%), and 169 (169/193, 87.6%) negative for CS. The SUVmax of PET positive CS lesions range from 3.4 to 12.5, while mediastinal blood pool SUVmean range from 1.1 to 3.6. The indeterminate rate is significantly lower in group 2 compared with group 1 ($p < 0.001$). The NPV and PPV in group 2 are 100% and 94.7% respectively.

CONCLUSION

The 72-hr HFHPVLC diet preparation protocol successfully suppresses physiological myocardial FDG uptake with minimal nondiagnostic rate. This patient preparation protocol may permit a more sensitive and accurate method of diagnosing active CS.

CLINICAL RELEVANCE/APPLICATION

Effective FDG-PET/CT protocol for CS.

SSE16-02 Long Fasting with Low-carbohydrate Diet is All That is Needed for Suppression of Physiological FDG Uptake in the Heart: Results from a Randomized-control Study

Monday, Nov. 28 3:10PM - 3:20PM Room: S505AB

Participants
Masao Miyagawa, MD, PhD, Toon, Japan (*Presenter*) Nothing to Disclose
Rami Tashiro, Ehime, Japan (*Abstract Co-Author*) Nothing to Disclose
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Tomoyuki Kido, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Teruhito Kido, MD, PhD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Kurata, PhD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Teruhito Mochizuki, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Physiological uptake of F-18 fluorodeoxyglucose (FDG) in the heart interferes with the diagnosis of inflammatory diseases such as cardiac sarcoidosis (CS). Although various methods for suppressing it have been proposed, the complete suppression in all patients (pts) has yet been reported. The present study aimed to compare the effects between a more than 18-h long fasting (LF) with

a low-carbohydrate diet (LCD) and that with an additional unfractionated heparin (UFH) injection.

METHOD AND MATERIALS

Thirty healthy, non-diabetic volunteers (16 males, age: 56±5.5 y.o.) were participated in this randomized-control study. They were divided into 2 groups: 15 subjects with more than 18-h fast with LCD (less than 4 g) preparation (group A) and the other 15 subjects with an additional injection of UFH (50 IU/kg) 15 min prior to FDG injection (group B). At the 4 time points of 3-h before, just before, 15 min after, and 1-h after UFH injection, blood samples were obtained to measure free fatty acid (FFA), immunoreactive insulin (IRI), and plasma glucose (FPG) level. Cardiac spot and whole body PET/CT imaging started 60 min after FDG injection. Imaging data were analyzed visually and quantitatively using a standard uptake value (SUV), and compared with pooled data of biopsy-proven CS (n=37) and non-CS (n=18) pts.

RESULTS

All subjects were well tolerated the protocol. Fasting durations of group A and B were 1160±48 and 1160±66 min, respectively. There were also no significant difference in serum levels of FPG and IRI. Although the FFA levels of 15 min after UFH injection significantly increased in group B as compared to group A (1.55 ± 0.49 vs. 1.97 ± 0.58 mEq/L, P=0.039), there was no difference in left ventricular (LV) SUVmax (1.57±0.27 vs. 1.59±0.26, P=0.84). There was no FDG uptake visually in the LV of all subjects. In addition, each LV SUVmax was lower than that of the liver (1.58±0.26 vs. 1.91±0.33, P<0.0001). Finally, it is obviously higher in CS pts than those in the other 3 groups (p<0.0001, **Figure**).

CONCLUSION

The complete suppression of physiological FDG uptake in the LV myocardium is visually and quantitatively achieved by means of more than 18-h LF with LCD preparation protocol. Under these circumstances, the use of UFH brings no added value to the suppression.

CLINICAL RELEVANCE/APPLICATION

The low-carbohydrate diet of the day before FDG PET together with a fasting more than 18-h completely suppresses physiological FDG uptake in the heart.

SSE16-03 Recent Nationwide Trends in Utilization of Standard and PET Myocardial Perfusion Imaging: Is There Growth or Contraction?

Monday, Nov. 28 3:20PM - 3:30PM Room: S505AB

Participants
David C. Levin, MD, Philadelphia, PA (*Presenter*) Consultant, HealthHelp, LLC; Board of Directors, Outpatient Imaging Affiliates, LLC
Laurence Parker, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Charles M. Intenzo, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Vijay M. Rao, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The development of PET myocardial perfusion imaging (PET MPI) has been somewhat controversial. It has certain technical advantages over the standard SPECT techniques (STD MPI) but is much more expensive. Our purposes were to see how rapidly PET MPI is growing relative to STD MPI and to study utilization trends among radiologists and cardiologists.

METHOD AND MATERIALS

Nationwide Medicare Part B fee-for-service databases from 2002 through 2014 were used. They provide volume data for all CPT codes. The codes for primary STD MPI and PET MPI were selected. No add-on codes were included. Medicare specialty codes were used to identify radiologists, cardiologists, and all other physicians as a group. Medicare place-of-service codes were used to identify exams done in hospital inpatients, hospital outpatient departments (HOPDs), private offices, and emergency departments (EDs).

RESULTS

Medicare STD MPI volume increased from 2,456,043 in 2002 to 3,136,573 in 2006 (+28%). Thereafter it declined every year, reaching 2,092,102 in 2014 (-33% vs peak). That year, cardiologists did 77% of the studies, radiologists 18%, others 5%. Medicare PET MPI volume was 9,563 in 2005 (the first year a CPT code was available), increasing almost every year thereafter, and reaching 100,619 in 2014 (+952%). That year, cardiologists did 86% of PET MPIs, radiologists 8%, others 6%. In 2014, PET MPI constituted 4.6% of all MPI exams. In 2014, there were 1,029,699 STD MPIs done in private offices; 792,332 in HOPDs; 244,836 in hospital inpatients; 23,356 in EDs; and 1,879 elsewhere. Also in 2014, there were 74,038 PET MPIs done in private offices; 20,343 in HOPDs; 4,570 in hospital inpatients; 281 in EDs; and 1,387 elsewhere.

CONCLUSION

The use of STD MPI has contracted substantially in recent years. This is likely due to large reductions in reimbursement, leading to closure of many cardiology private offices. At the same time, PET MPI has grown substantially, although by 2014 it still constituted less than 5% of all MPI exams. The rapid growth of PET MPI should continue to be monitored, as it is an expensive exam and is done mostly by cardiologists who could be in a position to self-refer.

CLINICAL RELEVANCE/APPLICATION

n/a

SSE16-04 Usefulness of F-18 FLT PET/CT for Detection of Active Cardiac Sarcoidosis: Comparison With F-18 FDG PET/CT

Monday, Nov. 28 3:30PM - 3:40PM Room: S505AB

Participants
Takashi Norikane, Kita-gun, Japan (*Presenter*) Nothing to Disclose
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Yukito Maeda, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Takahisa Noma, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

F-18 fluorodeoxyglucose (FDG) PET has been proposed to play a role in the diagnosis of sarcoidosis including cardiac involvement. However, its specificity is relatively low. 3'-deoxy-3'-F-18 fluorothymidine (FLT) has been investigated as a promising PET tracer for evaluating tumor proliferative activity. The purpose of this study was to investigate the usefulness of FLT PET/CT for the detection of active cardiac sarcoidosis, compared with FDG PET/CT.

METHOD AND MATERIALS

The study evaluated 25 patients who were suspected of having cardiac sarcoidosis. The patients fasted for at least 18 hrs before FDG PET studies, although no special dietary instructions were given to them before FLT PET studies. PET emission scanning of the cardiac region with a 10-min acquisition was performed 60 min after each radiotracer injection. For visual analysis, FLT PET images were classified into 2 patterns: no and focal uptake. FDG PET images were classified into 4 patterns: no, diffuse, focal, and focal on diffuse uptake. A focal FLT uptake and focal or focal on diffuse FDG uptake were defined as an active pattern. For semiquantitative analysis, the myocardium-to-blood cavity ratio (MBR) was calculated by dividing the maximal standardized uptake value (SUV) in myocardium by the mean SUV in blood cavity.

RESULTS

Twelve patients were found to have active sarcoidosis (group A); 8, non-active sarcoidosis (group B); and 5, heart failure without sarcoidosis (group C). In group A, all 12 showed an active pattern on both PET studies. In group B, 3 of 8 showed diffuse uptake on FDG PET but all 8 showed no uptake on FLT PET. In group C, 3 showed diffuse uptake and 2 showed focal uptake on FDG PET but all 5 showed no uptake on FLT PET. A significant correlation was observed between FDG MBR and FLT MBR. The mean FLT MBR in group A was significantly higher than that in groups B and C. The area under the receiver operating curve value of FLT MBR was significantly higher than that of FDG MBR for detection of active cardiac sarcoidosis.

CONCLUSION

These preliminary results suggest that FLT PET/CT is a potentially useful tracer for detecting active cardiac sarcoidosis, being especially more specific than FDG PET/CT.

CLINICAL RELEVANCE/APPLICATION

FLT PET/CT is a potentially useful tracer for detecting active cardiac sarcoidosis, being especially more specific than FDG PET/CT.

SSE16-05 Myocardial Ischemia Detected by Myocardial Perfusion Single-photon Emission Computed Tomography (SPECT) in Obese Patients: Prevalence and Clinical Correlates

Monday, Nov. 28 3:40PM - 3:50PM Room: S505AB

Participants
Andrea R. Lorenzo, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose
Ronaldo Lima, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the prevalence and clinical correlates of myocardial ischemia detected by myocardial perfusion single-photon emission computed tomography (SPECT) in obese patients.

METHOD AND MATERIALS

5563 patients (26.6% obese) were evaluated. A 1-day, rest/stress protocol was used, with injection of 222-370 MBq of Tc-99m sestamibi at rest and 666-1110 MBq at stress. SPECT was performed either with a dual-head Ventri camera (GE Healthcare) or a CZT-SPECT system (Discovery 530, GE Healthcare). Images were reconstructed on a dedicated Xeleris workstation (GE Healthcare). Semiquantitative 17-segment visual interpretation of the gated myocardial perfusion images was performed using a standard 5-point scoring system. Summed stress and rest scores (SSS and SRS) were calculated and their difference was recorded as summed difference score (SDS). Patients with a SDS>1 were considered to have ischemic MPS. Categorical variables were expressed as number and percentage and compared by chi-square or Fisher´s exact test. A p-value <0.05 was considered statistically significant.

RESULTS

The prevalence of ischemia was not significantly different between obese or nonobese patients with ≤1 cardiovascular risk factor (10.9% vs 9.1%, p=0.3), but was higher for those with body mass index (BMI) ≥40 kg/m2 (21.9% vs 9.9% in the nonobese, p=0.02). Patients with hypertension, diabetes or dyslipidemia also had higher rates of myocardial ischemia (16% for the obese and 10.3% for the nonobese, p<0.05). Image quality was good/excellent in 94.5% of the obese patients.

CONCLUSION

Myocardial ischemia was more frequent in patients with hypertension, diabetes or dyslipidemia, or in patients with BMI ≥40 kg/m2 even without other risk factors.

CLINICAL RELEVANCE/APPLICATION

Obesity is a limitation for several imaging methods, but myocardial perfusion SPECT has been increasingly feasible in these patients due to new gamma-camera systems, offering high-quality images with relevant clinical information.

SSE16-06 Prognostic Value of a New Ultrafast, Low-radiation Myocardial Perfusion SPECT Protocol in a CZT Camera

Monday, Nov. 28 3:50PM - 4:00PM Room: S505AB

Participants

Ronaldo Lima, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose
Thais Peclat, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Filipe P. Carvalho, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Clerio F. Azevedo, MD, PhD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Andrea R. Lorenzo, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Myocardial perfusion SPECT (MPS) is one of the most used imaging methods for the evaluation of patients for coronary artery disease (CAD) due to its diagnostic and prognostic value. Two of its main limitations are radiation use and scan duration. However, new CZT cameras (CZT-C) have allowed tracer dose and scan timereductions. However, the prognostic value of these new protocols is not known. Objective: To determine the prognostic value of a new, ultrafast, low dose protocol in a CZT-C.

METHOD AND MATERIALS

Patients with suspect CAD undergoing MPS from 11/2011 to 6/2012 were studied. They had a 1-day 99m-Tc-MIBI protocol starting with rest study (5 mCi dose) followed by stress (15 mCi). Acquisition times were 6 and 3 minutes respectively. MPS studied were classified as normal or abnormal and perfusion scores (SSS, SRS and SDS) were calculated. Patients were accompanied by 6-month phone calls. Events were defined as death, nonfatal myocardial infarction and late revascularization (>60 days after MPS) and analyzed with the Cox method.

RESULTS

2936 patients were followed for 922 ± 226 days. Age was 64.7 ± 12.1 years, 53.5% were male and BMI was 27.1 ± 5.1. Hypertension was the most frequent risk factor (61.6%), followed by hypercholesterolemia (52.1%) and diabetes (22.7%). Exercise was used in 1705 patients (58.1%). 2274 (77.4%) MPS studies were normal. Mean dosimetry was 5.5 mSv and mean scan time, 48 ± 13 minutes. During FU, there were 62 deaths, 28 nonfatal infarctions, 147 angioplasties and 22 coronary artery bypass surgeries. Annual hard event rate was higher in patients with abnormal MPS (3.64% vs. 0.72% P <.001), as well as the frequency of patients undergoing late revascularization (16.8% vs 2.5%, P <.001). SSS and SDS were higher in patients with hard events compared to those without events (5.0 ± 6.3 vs 2.6 ± 5.0, p<0.001; 1.7 ±3.4 vc 0.7 ±1.9, P <.001) and among revascularized patients compared to non-revascularized (SSS: 6.05±6.83 vs 2.45±4.74 , p<0.001/ SDS: 2.57±3.75 vs 0.57±1.71, p<0.001). Hard events and revascularization occurred 2 and 5.5 times more in patients with extensive ischemia.

CONCLUSION

A new MPS protocol in a CZT-C allowed faster, lower radiation studies without compromising the prognostic ability of this imaging method.

CLINICAL RELEVANCE/APPLICATION

This new protocol for Cardiac SPECT in new CZT cameras demonstrated an excellent prognostic value using half of the radiation dose and ultrafast acquisition lasting < 1 hour.

SSE17

Neuroradiology (Functional MRI)

Monday, Nov. 28 3:00PM - 4:00PM Room: N228

NR MR

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

FDA Discussions may include off-label uses.

Participants
Joshua S. Shimony, MD, PhD, Saint Louis, MO (*Moderator*) Nothing to Disclose
Edson Amaro Junior, MD, PhD, Sao Paulo, Brazil (*Moderator*) Nothing to Disclose

Sub-Events

SSE17-01 Standardized Brain Function Test: Making Functional MRI Standardized, Fast, and Physician Friendly

Monday, Nov. 28 3:00PM - 3:10PM Room: N228

Participants
Conrad C. Gibby, MD, Houston, (*Presenter*) Nothing to Disclose
Steve T. Cvetko, PhD, American Fork, UT (*Abstract Co-Author*) Vice President, Novarad Corporation
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PURPOSE

Major brain dysfunction can exist, even if the brain looks structurally normal. Functional magnetic resonance imaging (fMRI) can detect subtle abnormalities that range from conditions such as traumatic brain injury, autism, ADD, psychiatric illnesses, and senile dementia. Despite its potential, few applications exist outside of pre-surgical planning.Widespread use of (fMRI) is hampered by lack of standards and poor control data. Technical challenges like noise and complex multi-step processing are other challenges. Good results have required immense physician time commitments.

METHOD AND MATERIALS

Well developed, standard neuropsychological tests such as the Matrix Reasoning (part of WAIS); Trail Making; Boston Naming; Facial and Verbal Memory; and Verbal Fluency tests were used in a 1.5T MRI scanner. Statistical analyses included the usual random field theory for functional imaging, with the addition of restricted maximum likelihood (REML), cubic spline interpolation, and on-the-fly thresholding of t-maps. Software was developed to run the statistics on a 2GB gaming GPU (approximately 1000x improvement in speed). Scalp stripping and motion-reduction techniques were used.

RESULTS

fMRI tests with t-test activation at 1.5T were applied on 23 patients in an attempt to form a control population. Patient data then underwent auto segmentation of the brain into a high resolution brain atlas to standardize the activation anatomy onto which the data was mapped. This data was then used to create high-resolution images to qualitatively assess brain activation. Average values and standard deviation (SD) were calculated using the 23 patients. Picture Naming tests as an example: average activation of the fusiform gyrus 1.75 with a standard deviation (SD) of 1.24; primary visual cortex activation 1.92 with a SD of 1.31; visual association cortex 3.04 with SD 1.07; medial frontal gyrus 0.84 with SD of 0.85, and inferior frontal gyrus 1.33 with SD of 1.18.

CONCLUSION

A standardized battery of brain function tests will help clinicians to assess individual patients and researchers to study abnormal brain function with useful and objective control data.

CLINICAL RELEVANCE/APPLICATION

A streamlined, standardized battery of fully integrated fMRI neuropsychological tests, combined with up-to-date fMRI techniques, helps to decrease the time of each fMRI test to about 2 min/test.

SSE17-02 Aberrant Executive Control Network Functional Connectivity in the Patients with End-Stage Renal Disease: A follow-up Resting-State Functional MR Imaging Study

Monday, Nov. 28 3:10PM - 3:20PM Room: N228

Participants
Lin Wang, MD, Nanjing, China (*Presenter*) Nothing to Disclose
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PURPOSE

To determine whether functional connectivity of Executive Control Network (ECN) separated by Independent Component Analysis (ICA) can be used to detect and monitor the executive dysfunction in End-Stage Renal Disease (ESRD) patients

METHOD AND MATERIALS

Forty-five patients (51.6 ± 8.6 years old) with ESRD and 38 age-, sex- and education- matched healthy volunteers (51.9 ± 10.4 years old) were recruited. All the subjects who were without a history of neurologic or psychiatric disease underwent a resting-state functional MR imaging at 3T and a set of neuropsychological tests. Among the ESRD patients, 15 patients (52.2 ± 6.3 years old) with ESRD experienced a same process after one year follow-up. Group ICA was used to separate the ECN. To compare the

functional connectivity in the ECN, the intensity values in the spatial map were converted to z scores. Maps of the ECN were compared between each group using student t test, and person correlation analysis was implemented to correlate the abnormal functional connectivity in the ECN and neuropsychological tests scores

RESULTS

Functional connectivity in ECN of the ESRD patients were significantly reduced in mid-cingulate gyrus, bilateral inferior parietal cortex and inferior temporal gyrus (FDR correction, p < o.o5) compared to normal volunteers (Figure 1). Besides, functional connectivity of the mid-cingulate was positively correlated with Semantic similarity test scores (r= 0.372, p= 0.036) and clock drawing test scores (r= 0.355, p= 0.043), indicating that the impairment of the ECN in patients was associated with reduced performance on neuropsychological tests. ECN of the 15 ESRD patients did not show significant changes after one year follow-up and corresponded with the results of neuropsychological tests, but there was a trend that the functional connectivity in left inferior parietal cortex would be further impaired

CONCLUSION

Functional connectivity in the ECN is aberrant in patients with ESRD and correlated to the neuropsychological tests results which maybe as a clinical biomarker to evaluate the executive functional state in these patients in the future

CLINICAL RELEVANCE/APPLICATION

Compared to neuropsychological tests, ECN separated by ICA can provide an objective evaluation of executive functional state and can repeat measurement without memory effect in the follow-up. Those executive dysfunction patients should be paid more attentions to their medication noncompliance behaviors

SSE17-03 Associations between Whole Brain Network Connectivity and Cognitive Function in African Americans with Type 2 Diabetes Mellitus: A Resting-state Functional MRI Graph Theoretical Analysis

Monday, Nov. 28 3:20PM - 3:30PM Room: N228

Awards
Student Travel Stipend Award

Participants
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PURPOSE

The purpose of this study was to determine the relationship between functional magnetic resonance imaging (fMRI) measures of brain network connectivity and executive function in the understudied African American (AA) population with type 2 diabetes (T2D) enrolled in the NIH funded African American-Diabetes Heart Study MIND (AA-DHS MIND) (R01 NS075107). We hypothesized that lower whole brain connectivity would be associated with diminished performance on measures of executive function.

METHOD AND MATERIALS

Unrelated AAs with T2D (n=395) were scanned on a 3T-Siemens Skyra MRI using a high-resolution 20 channel head/neck coil (Siemens Healthcare, Erlangen, Germany) for collection of structural anatomic and RS-fMRI BOLD data. All data were motion-corrected and normalized to a standard template using SPM. A binarized adjacency matrix for each subject was generated at a range of network costs (0.05 – 0.4) from which graph theory metrics (smallworldness, global efficiency, and local efficiency) were computed. Executive function was evaluated in all subjects with the Stroop test. Linear models were fitted to test for associations between Stroop performance (independent variables) and brain MRI measures (dependent variables).

RESULTS

There was a statistically significant linear association between smallworldness and Stroop Interference at a cost of 0.05 ($p<0.05$), with lower smallworldness associated with more interference. There was no statistically significant relationship between local or global efficiency and Stroop.

CONCLUSION

Concordant with our hypothesis, whole brain measures of brain connectivity were associated with performance on tests of executive function. These data suggest that T2D has global effects on brain connectivity that may underlie critical cognitive functions known to be disrupted by this devastating disease.

CLINICAL RELEVANCE/APPLICATION

Whole brain measures of functional connectivity may represent sensitive biomarkers of the brain end-organ effects of T2D in the understudied AA population.

SSE17-04 Realtime-fmri Neurofeedback in Tobacco Dependent Patients: Effect on Long-term Smoking Cessation

Monday, Nov. 28 3:30PM - 3:40PM Room: N228

Participants
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PURPOSE

To evaluate the effect of realtime(rt)-fmri neurofeedback in patients with tobacco dependency with respect to long-term smoking cessation success.

METHOD AND MATERIALS

43 tobacco-dependent patients went through three rt-fmri neurofeedback sessions each within a period of 4 weeks after professionally assisted smoking cessation. Patients were randomized into two groups receiving either real feedback (n=26) of an individualized addiction associated brain region (anterior cingulate cortex, insula, dorsolateral prefrontal cortex) or sham feedback (n=17). The aim was to reduce neural activity in the region of interest during nicotine cue exposure. Additionally, resting state fmri was performed before and after neurofeedback. Preprocessing and statistical analysis of functional images were conducted in BrainVoyagerQX (feedback data) and in FSL using an ICA-based approach (resting state data). Statistical analysis was performed taking patients' smoking status after 6 months into account (persistent tobacco abstinence or relapse). Clinical data were assessed by established questionnaires (QSU, BDI, BIS, FTND).

RESULTS

The preliminary fixed effect analysis of 13 patients with known smoking status after 6 months (real feedback, group) revealed different activation patterns in abstinent patients (n=5) compared to relapsed patients (n=8): In abstinent patients, a group analysis comparison of the 3rd neurofeedback run versus the 1st neurofeedback run showed extensive patterns of reduced activity, mainly in the dorsolateral prefrontal cortices, the right insula, the ACC bilaterally as well as the right temporal lobe in the 1st session and increased activity in the right ACC in the 3rd session while in relapsed patients only slight or no differences could be seen in corresponding areas ($p < 0.05$, Bonferroni corrected).

CONCLUSION

A success in long-term smoking cessation may be related to a success in conducting effective rt-fmri neurofeedback in individual addiction associated brain regions.

CLINICAL RELEVANCE/APPLICATION

Neurofeedback based on rt-fmri may be an additional option in the therapy of tobacco dependent patients and probably useful as a biomarker.

SSE17-05 Presurgical Brain Mapping of the Language Network in Patients With Brain Tumors Using Resting-State fMRI: Comparison With Task fMRI

Monday, Nov. 28 3:40PM - 3:50PM Room: N228

Participants
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PURPOSE

Evaluate concordance of language networks derived from task-fMRI with resting-state fMRI in patients with brain tumors using seed-based, AMPLE and ICA analysis.

METHOD AND MATERIALS

Seed and language networks identified for patients presenting for presurgical fMRI mapping between 1/1/2009 and 7/1/2015. 79 patients were analyzed of which 49 met the inclusion criteria (presence of brain tumors without history of prior brain surgery, adequate task-fMRI performance). Rs-vs-task-fMRI concordance was measured using Dice coefficients across varying fMRI thresholds before and after noise removal. Multi-thresholded Dice coefficient volume under the surface (DiceVUS) and maximum Dice coefficient (MaxDice) were calculated. One-way Analysis of Variance (ANOVA) was performed to determine significance of DiceVUS and MaxDice between the ICA vs Seed, AMPLE vs ICA and AMPLE vs Seed. Age, sex, handedness, tumor side, tumor size, tumor WHO grade, number of scrubbed volumes, image intensity root mean square (iRMS), and mean framewise displacement (FD)

were used as predictors for VUS in a linear regression.

RESULTS

Artificial elevation of rs-fMRI vs task-fMRI concordance is seen at low thresholds due to noise. Noise-removed group-mean DiceVUS and MaxDice improved in AMPLE, seed-based and analyses. ANOVA demonstrated statistically significant difference between the AMPLE threshold of 20% to 90% when compared to ICA and demonstrated statistically significant difference between AMMPLE threshold of 40% to 90% when compared to seed based analyses. When the various AMPLE thresholds for statistically significant difference, optimal correlation was noted for AMPLE thresholds of 60%, 70% and 80%.

CONCLUSION

Overall there is good correlation between rs-vs-task fMRI language network when using AMPLE, seed-based, and ICA correlation. Concordance between seed-based and AMPLE and ICA and AMPLE is optimal at AMPLE threshold of 60%, 70% and 80%.

CLINICAL RELEVANCE/APPLICATION

AMPLE threshold analysis of RS-fMRI can over some of the variables negatively affecting task-fMRI and can be utilized to reliably identify neuronal language networks on pre-operative studies, especially in patient who are unable to perform all the tasks required in conventional task-fMRI.

SSE17-06 Taking fMRI to the Next Level: Integrated Dynamic High-Resolution Neuro Anatomic Atlas for Comparison to Control Data

Monday, Nov. 28 3:50PM - 4:00PM Room: N228

Awards
Student Travel Stipend Award

Participants
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PURPOSE

Functional (fMRI) as a technology has great promise to evaluate brain dysfunction. However, one of the significant limitations is the lack of quantitation and the lack of direct comparison to comtrol data. Current technology utilizes the Talarach Atlas which was developed from a single brain with 5 mm thick slices by a French Neurosurgeon in the 1960's. Furthermore anatomic imaging is now performed with 1mm3 resolution or less. Because there is considerable variation between individuals in both location of cortical structures and skull morphology, this is an inaccurate estimate at best. In order to compare apples with apples, the brain must be segmented into finite anatomic regions. Ideally, we should warp all brains to a standard configuration before comparison.

METHOD AND MATERIALS

A data set of 152 right-handed high resolution images of normal brains was obtained from the Montréal Neurologic Institute (MNI 152). We created an atlas utilizing this data set to map standard cortical regions of the brain excluding deeper white matter with a resolution of 1 mm. Utilizing automated scalp stripping and both afine and deformable auto registration the atlas is then used to segment both control data sets and patient data sets giving accurate anatomic areas of the brain for comparison purposes. The control data sets with statistical t maps are compared side-by-side to evaluate variations in individual patient activation. Real-time interaction with the brain atlas was created so the physician can know at anytime the location of activation.

RESULTS

By creating this technology, we have been able to create quantitative comparison data with normative control patient's for areas of FMRI activation (figure 1). The higher resolution neuro anatomic atlas provides the clinician with an interactive tool to evaluate activation location. This is vastly improves the confidence and rapidity in interpreting FMRI data sets.

CONCLUSION

A high-resolution interactive anatomic atlas of the brain has been created based on the MNI 152 data set allowing for more rapid and accurate FMRI data evaluation along with creating quantitative comparative control data.

CLINICAL RELEVANCE/APPLICATION

Improvement for the clinical utilization of fMRI requires standarized comparison to neuro anatomic atlases. Current atlases are low resolution, non-interactive, semi-quantitative and therefore are never used.

SSE18

Neuroradiology (Neurodegenerative Disorders)

Monday, Nov. 28 3:00PM - 4:00PM Room: N229

NR MR

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

FDA Discussions may include off-label uses.

Participants
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Sub-Events

SSE18-01 Rapid Analysis of Volumetric MRI Data Using Deformable Model-based Segmentation can differentiate Alzheimer Disease Patients from Healthy Controls

Monday, Nov. 28 3:00PM - 3:10PM Room: N229

Awards
Student Travel Stipend Award

Participants
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PURPOSE

The purpose of this study was to test the efficacy of a novel method for shape-constrained deformable segmentation for using the volumes of subcortical structures to differentiate patients with early Alzheimer's disease (AD) from controls.

METHOD AND MATERIALS

Patients who underwent MRI with a protocol including a standardized volumetric magnetization-prepared rapid gradient-echo (MP-RAGE) T1 sequence for evaluation of cognitive impairment from January 1, 2013 to June 30, 2015 were identified retrospectively. The patients were clinically categorized by review of the electronic medical record for a diagnosis of AD. Of the 56 patients identified, 17 had clinically diagnosed AD. Cognitively normal control subjects (n = 48, age and gender matched) were obtained from the Alzheimer's Disease Neuroinitiative database (ADNI).

RESULTS

The overall MANOVA model fitted to all structures included in the segmentation showed statistically significant results, emphasizing volumetric differences in subcortical grey matter between the control and AD groups (Wilks' lambda=0.4584, df=1, F=6.38, p=0.0001) with the AD group having smaller mean volumes than the controls. Further post-hoc analysis of the MANOVA results indicated that the AD patients had significantly (CI 95%, p<.5) smaller volumes for the amygdala (p=0.0001), caudate (p=0.0022), hippocampus (p=0.0008), putamen (p=0.0266), thalamus (p=0.0380), brainstem (p=0.0295), cerebellum (p=0.0046), and significantly larger lateral ventricles (p=0.0032).

CONCLUSION

Rapid analysis of volumetric MRI data using a deformable model-based segmentation appears to be a viable approach to evaluate changes in regional brain volumes associated with AD. These results are consistent with the existing hypothesis that AD affects subcortical grey matter and is associated with detectable and statistically significant structural atrophy in a number of sub-cortical regions.

CLINICAL RELEVANCE/APPLICATION

Rapid and clinically applicable deformable model-based segmentation of volumetric T1 sequences could allow immediate quantitative segmentation on the scanner, simplifying the current segmentation workflow and allowing quantitative data to be more readily available to the radiologist and clinician. Additionally, this segmentation method has previously been shown to provide more reproducible results than other methods which may be of benefit in diseases like dementia that benefit from longitudinal analysis.

SSE18-02 Heritability of Focal Brain Atrophies in Older Adults on MRI: The Osaka Twin Study

Monday, Nov. 28 3:10PM - 3:20PM Room: N229

Participants
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PURPOSE

Focal brain atrophy is related to neurodegenerative diseases including Alzhiemer's disease, frontotemporal dementia, and Huntington's disease etc. The objective of this study is to determine the heritability of focal brain volume reduction in middle to advanced age using twin model.

METHOD AND MATERIALS

72 individuals, 20 monozygotic (MZ) twin pairs (10MM 10FF, mean age 61y min 42y max 75y) and 16 dizygotic (DZ) twin pairs (8MM 8FF, mean age 64y min 41y max 85y), were selected for advanced age and gender match. 3D T1-weighted images from 3.0T MRI were obtained and brain volume was compared to normal healthy control data (232 subjects: mean age 31y, min 18y max 65y) with using statistical parametric mapping (SPM12) in each subject and measured the Z-score for 136 regions of interest. The correlation of each regional Z-score between twin pairs were evaluated. Five locations associated with neurodegenerative diseases (brainstem, superior parietal lobule, thalamus proper, hippocampus, caudate) were selected, and twin modelling and heritability estimates (H2), controlled for age and gender, were performed using statistical platform R with OpenMx.

RESULTS

The Pearson correlation coefficient for twin pairs showed a significant linear relationship between focal atrophy Z-scores and MZ twins have higher correlation coefficient (r=0.697 MZ, r=0.552 DZ). The parietal lobules and hippocampus were found to have strong heritability and fit an AE (additive genetics/unique environment) model based on Akaike information criterion.The brainstem, thalamus proper and caudate aligned to a CE (common environment/unique environment) model, implying a stronger relationship with environmental factors rather than heritance.Heritability (H2) estimates on AE models:Right superior parietal lobule: 70.9% [46.6%–85.5% (95%CI)]Left superior parietal lobule: 58.0% [22.3%–78.8%]Right hippocampus: 73.6% [50.2%–86.1%]Left hippocampus: 71.9% [48.4%–85.0%]

CONCLUSION

Focal brain atrophy is similar between MZ twin pairs. Atrophy of the hippocampus and superior parietal lobule have strong heritance in older adults. However, the brainstem, thalamus and caudate best fit with an environmental model, indicating a lesser heritance.

CLINICAL RELEVANCE/APPLICATION

Atrophy is a common finding on MRI of elderly brains. It is important to consider the strong heritability of brain atrophy when making associations with disease.

SSE18-03 Hippocampal Atrophy and Imaging Markers of Small Vessel Disease in Dementia

Monday, Nov. 28 3:20PM - 3:30PM Room: N229

Participants
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Torkel B. Brismar, MD, PhD, Stockholm, Sweden (*Presenter*) Nothing to Disclose

PURPOSE

Findings suggest that small vessel disease may impact the dementia disease process but relations with hippocampal atrophy are to date unknown and warrant investigation.

METHOD AND MATERIALS

A total of 151 patients, 98 with Alzheimer disease, and 53 with vascular dementia were enrolled in our study. All patients were scanned on 1.5-3.0T MRI scanners. Small vessel disease imaging assessments were done according to the STRIVE, including rating of white matter hyperintensities, cerebral microbleeds, lacunes, cortical superficial siderosis and enlarged perivascular spaces. Hippocampal atrophy ratings were done according to the medial temporal atrophy scale. Cognitive and clinical data were assessed in conjunction with imaging findings in multivariate generalized linear models, with appropriate controlling variables.

RESULTS

In Alzheimer disease there was no association between markers of small vessel disease and greater hippocampal atrophy, but presence of cerebral microbleeds showed a tendency to be associated with a higher hippocampal atrophy grade (B=0.9, P=0.06). In vascular dementia there was an association between severe white matter hyperintensity score and higher hippocampal atrophy (B=1.6, P=0.007), only. There was a positive interaction between microbleeds and low cerebrospinal fluid amyloid, indicating brain amyloid deposition, and higher hippocampal atrophy (B=4.9, P=0.04), in the whole cohort. Higher score of total imaging small vessel diseases markers were associated with higher hippocampal atrophy (B=0.8, P=0.02).

CONCLUSION

Cerebral microbleeds may be indicated in the Alzheimer disease process, whereas white matter hyperintensities likely are of more importance in vascular dementia. Total score of imaging small vessel disease markers may impact the dementia disease process.

CLINICAL RELEVANCE/APPLICATION

Of all imaging small vessel disease markers cerebral microbleeds and white matter hyperintensities are likely of most importance in Alzheimer disease and vascular dementia respectively. A high total score of imaging small vessel disease markers may also be involved in the dementia disease process.

SSE18-04 Physiological Response Delay May Overestimate the Default Mode Network Changes in Alzheimer's Disease Patients

Monday, Nov. 28 3:30PM - 3:40PM Room: N229

Participants
Yi-Tien Li, MSc, New Taipei, Taiwan (*Presenter*) Nothing to Disclose

PURPOSE

We study the impact of spontaneous physiology on characterizing the DMN of AD patients. The goal is to test how the difference in default mode network (DMN) features may change, while physiological response due to spontaneous cardiac and breathing rhythms are appropriately controlled in Alzheimer's Disease (AD) patients.

METHOD AND MATERIALS

Resting-state functional magnetic resonance imaging (fMRI) scans were acquired by T2*-weighted echo-planar imaging (EPI) for 400 seconds. Cardiac and respiratory cycles were recorded using a pulse oximeter and a respiration belt, respectively. The total of 32 subjects of AD patients as well as age andgender matched controls were include. We rely on RETROICOR (Gary H. Glover, 2000) to remove phase-locked physiological artifact. The lower frequency physiological effects of the same phase but different amplitudes (for respiration variations) or intervals (for heart rate) were corrected by RVHRCOR (Chang and Glover, 2009).

RESULTS

While AD patients have different DMN characteristics from the normal controls before physiological noise correction, however, the difference could not be significantly observed after suppressing physiological noise. We found that the RV and HR factors both did not explain as much variance as the healthy subjects in the AD group. The weighted map of beta values estimated in GLM for both RV and HR showed significant differences between the healthy controls and AD patients, especially at DMN regions. Further, the delayed physiological response in AD patients could be observed by comparing the arrival time of respiration and cardiac response function with normal controls.

CONCLUSION

The impact of the spontaneous physiology in the two groups were not the same, especially dominated by the low frequency physiological factors, RV and HR, especially at the regions near the DMN nodes. The phenomenon was attributed to the different BOLD responses between the AD and control groups supported by the evidence of physiological response functions delay measured in the AD patients.

CLINICAL RELEVANCE/APPLICATION

The evidences that the physiological response changes could alter the DMN features in the AD patients had been revealed in our study. Our results suggest the importance of controlling hemodynamic responses associated with spontaneous physiology in order to achieve sensitivity and specificity of AD patients' features of DMN.

SSE18-05 Relationship between Tau Positron Emission Tomography with [18F]-AV-1451 and Cortical Atrophy in Alzheimer Disease

Monday, Nov. 28 3:40PM - 3:50PM Room: N229

Awards
Student Travel Stipend Award

Participants
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Tammie S. Benzinger, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Research Grant, Eli Lilly and Company Investigator, Eli Lilly and Company Investigator, F. Hoffmann-La Roche Ltd

PURPOSE

[18F]-AV-1451 is a positron emission tomography (PET) tracer used for evaluation of neurofibrillary tau pathology *in vivo*. The objective of this study was to look at the relationship between PET tau deposition and atrophy as measured by cortical thickness in Alzheimer disease (AD).

METHOD AND MATERIALS

The local institutional review board approved this study. Participants were drawn from ongoing studies on aging at the local institution. A total of 53 cognitively normal (CN) participants (with Clinical Dementia Rating 0) and 12 cognitively impaired (CDR > 0, 8 CDR 0.5, 3 CDR 1, and 1 CDR 2) participants underwent PET imaging with AV-1451 and structural magnetic resonance imaging (MRI). Volumetric segmentation and cortical surface reconstruction was performed using FreeSurfer. Standardized uptake value ratios (SUVRs) that were normalized to the whole cerebellum and partial volumes corrected were calculated for 36 regions of interest (ROIs) generated using FreeSurfer. For each participant, the cortical thickness map was registered to an average cortical surface and geodesically smoothed with a Gaussian 10-mm full-width half-max kernel. Global PET tau burden for each participant was estimated by taking the mean SUVR from the entorhinal cortex, amygdala, inferior temporal cortex, and lateral occipital cortex ROIs. A vertex-wise generalized linear model was used to look at the relationship between cortical thickness and mean PET tau SUVR, controlling for age and gender.

RESULTS

Results after false discovery rate multiple comparisons correction to $p<0.05$ are shown. There was a significant relationship between global burden of PET tau and cortical thickness in the lateral inferior temporal, lateral occipital, and precuneus areas, consistent with the known spatial topography of PET tau uptake in AD.

CONCLUSION

Global PET tau burden as measured by AV-1451 correlates with cortical atrophy in Alzheimer disease.

CLINICAL RELEVANCE/APPLICATION

This study provides early evidence that neurodegeneration as measured by [18F]-AV-1451 PET tau correlates with regionally specific cortical thinning in Alzheimer disease.

SSE19

Neuroradiology (Interventional Neuroradiology)

Monday, Nov. 28 3:00PM - 4:00PM Room: N230B

NR IR MR

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

FDA Discussions may include off-label uses.

Participants
Colin P. Derdeyn, MD, Saint Louis, MO (*Moderator*) Consultant, Terumo Corporation; Consultant, Penumbra, Inc; Stock options, Pulse Therapeutics, Inc; ;
Neeraj Chaudhary, MBBS, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SSE19-01 Carotid Endarterectomy (CEA) and Carotid Angioplasty and Stenting (CAS) in Asymptomatic Extracranial Carotid Artery Stenosis: A Meta Analysis

Monday, Nov. 28 3:00PM - 3:10PM Room: N230B

Participants
Pedram Golnari, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Sameer A. Ansari, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ali Shaibani, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Michael C. Hurley, MBBCh, Dublin, Ireland (*Abstract Co-Author*) Nothing to Disclose
Matthew B. Potts, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Babak S. Jahromi, MD,PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Medical, surgical, and endovascular care for carotid disease has continued to evolve. We aimed to review and analyze the most recent studies comparing short and longterm complications of CEA and CAS in asymptomatic patients with extracranial carotid artery (ICA) stenosis.

METHOD AND MATERIALS

Two recent major clinical trials involving asymptomatic ICA stenosis (i.e. ACT I and CREST) were included. From CREST, data for patients with asymptomatic stenosis were extracted and included. Outcome measures included in the analysis were: stroke, myocardial infarction (MI), and death or stroke, both individually and as a composite outcome as defined in the trials. Methodological quality was assessed using the Cochrane Collaboration's tool for assessing risk of bias. A metaanalysis was performed on comparable outcomes at the same timepoints using RevMan v5.3 software. Risk ratios (RRs) with 95 % confidence intervals were calculated using the MantelHaenszel method with fixedeffect models. Heterogeneity was assessed by I2 and Cochran Q tests.

RESULTS

ACT I showed a lower methodological quality, having a higher risk of attrition bias and failing to report blinding of outcome assessment. There was no significant difference in the composite outcome of death, stroke (ipsilateral or contralateral, major or minor), or MI during the periprocedural period (p=0.70). No heterogeneity was observed in the analyses (I2= 0). During the periprocedural period, CAS had a significantly higher rate of stroke alone than CEA (p=0.05), and trend towards higher stroke or death than CEA (p=0.07). In the postprocedural period, the two treatments did not have different rates for the composite of death, stroke or MI at 5 years.

CONCLUSION

Both CREST and ACT I individually failed to show any differences between CEA and CAS in asymptomatic ICA stenosis (CREST was not powered to determine such a difference in asymptomatic patients a priori). However, their combined metaanalysis demonstrates a higher risk of periprocedural stroke after CAS than CEA. It is unclear whether further evolution in endovascular techniques may change this, and whether any intervention is superior to medical therapy.

CLINICAL RELEVANCE/APPLICATION

Current trials are underway to determine whether any intervention is warranted in asymptomatic ICA stenosis. Until then, patients selected for intervention should preferentially undergo CEA rather than CAS due to a lower risk of periprocedural stroke.

SSE19-02 MRI Features of Irreversible Electroporation of the Brain: A Swine Model

Monday, Nov. 28 3:10PM - 3:20PM Room: N230B

Participants
Sin Man Wong, MBBS, Hong Kong, Hong Kong (*Presenter*) Nothing to Disclose
Simon C. Yu, MD, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Anthony W. Chan, MBChB, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Matthew T. Chan, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Dewi K. Rowlands, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Danny T. Chan, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the MRI features of irreversible electroporation (IRE) of the brain using a swine model.

METHOD AND MATERIALS

Institutional ethics approval for animal experiment had been obtained. ECG-synchronized IRE was performed on the brain parenchyma of five swine subjects under general anesthesia and neuromuscular blockade. 10 ablations and 1 control electrode insertion had been performed. Each ablation was carried out by two parallel monopolar electrodes inserted percutaneously into the frontal or parietal lobes under CT guidance. The voltage varied from 900V-2240V and electrode spacing varied from 10-15mm. The exposed length, pulse length and pulse number were 1cm, 50 microsecond and 90 respectively. MRI of the brain was performed immediately after the procedure. The configuration, volume and signal of the lesions were analyzed. The subjects were then euthanized.

RESULTS

No MR lesion was identified for the control electrode insertion and two ablations (900V and 1000V, spacing 10mm). For each of the four ablations with electrode spacing of 15mm (Voltage 1050V, 1200V, 1500V, 1800V), two separate ablation zones were produced, one around each electrode tip (mean volume: T2W 0.386cm3; T2FLAIR 0.27cm3; ADC 0.59cm3; contrast enhanced 0.43cm3). For each of the three ablations with electrode spacing of 14mm (1680V, 1960V, 2240V), a single ellipsoid ablation zone was produced (mean volume: T2W 1.77cm3; T2FLAIR 1.52cm3; ADC 2.02cm3; contrast enhanced 1.3cm3). For one ablation with electrode spacing of 13mm (1170V), a single ellipsoid ablation zone was produced (T2W 0.72cm3; T2FLAIR 0.87cm3; ADC 0.64cm3; contrast enhanced 0.5cm3). Lesion size on T2 and T2FLAIR sequences correlated significantly with the voltage used ($p<0.05$). Lesion size negatively correlated with electrode spacing, although not reaching statistical significance. No parenchymal hematoma or extra-axial collection was evident.

CONCLUSION

A high voltage (>1170V) and narrowed electrode spacing (<14mm) both appear important prerequisite to produce an effective MRI identifiable IRE ablation zone. Lesion size on T2 and T2FLAIR sequences appears to positively correlate with voltage used.

CLINICAL RELEVANCE/APPLICATION

Both high voltage and narrowed electrode spacing appear important to produce an effective MRI identifiable IRE ablation zone.

SSE19-03 Selective Ablative Thalamotomy of Ventral Intermediate Nucleus using High Intensity Focused Ultrasound (HIFU) MRI-Guided in Patients With Essential Tremor

Monday, Nov. 28 3:20PM - 3:30PM Room: N230B

Participants
Esther de Luis, MD,PhD, Mostoles, Spain (*Presenter*) Nothing to Disclose
Jose Angel Pineda, Mostoles, Spain (*Abstract Co-Author*) Nothing to Disclose
Raul Martinez, Mostoles, Spain (*Abstract Co-Author*) Nothing to Disclose
Jose M Millan, Mostoles, Spain (*Abstract Co-Author*) Nothing to Disclose
Marta del Alamo, Mostoles, Spain (*Abstract Co-Author*) Nothing to Disclose
Rafael Rodriguez-Rojas, Mostoles, Spain (*Abstract Co-Author*) Nothing to Disclose
Jose Obeso, Mostoles, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MRI-guided high-intensity focused ultrasound (HIFU) is a novel technology that is revolutionizing the concept of neurosurgery. HIFU has been used to perform ablation of the ventral intermediate nucleus (VIM) of the thalamus for drug refractory Essential Tremor (ET).This abstract summarizes our early experience in the first five VIM ablation procedures.

METHOD AND MATERIALS

Fourteen patients with ET were considered candidates for ablative unilateral thalamotomy after neurological evaluation. MRI evaluation was performed in a 3T MR imaging system. Head CT was also acquired and Skull Density Ratios (SDR) were estimated.VIM ablations were performed using a HIFU equipment fully compatible with the MR scanner. 3D-T2w images were acquired to define our target for ablation. VIM was localized in relation to anterior commissure and posterior commissure coordinates. Then the natural focus of the transducer was manually aligned to our target and energy administration (sonication) was gradually raised in order to increase temperature in the target. Patients were awake during the procedure, and neurological examination was carried out in order evaluate tremor remission, and detect any possible side-effects.The day after procedure, a post treatment cranial MR was performed, using the same protocol as in the pre-treatment session and three months later. Clinical follow-up examination was performed at 24 hours, one week, one and six months after the procedure.

RESULTS

Tremor remitted in all patients after the procedure, with reduction in clinical rating scale for tremor (CRST) in all patients (50-76%). One month after CRST scores were stable with a maximum variation of 6% from post treatment score.Side effects after the procedure included mild ataxia, mild paresis and perioral paraesthesia.MR exams showed no compplications after treatment and residual hemosiderin deposit in VIM three months later.

CONCLUSION

Based in our experience, HIFU is a safe and effective treatment for tremor control in patients with ET. All patients showed marked improvement in their tremor that, while awaiting for a longer follow-up, was maintained for more than one month. Side-effects were transient and related to the ablative procedure.

CLINICAL RELEVANCE/APPLICATION

HIFU treatment is now been evaluated not only for ET but also for Parkinson's disease which opens new horizons in the management of patients with movement disorders.

SSE19-04 Safety and Efficacy of Thermal Ablation for Treatment of Vertebral Body Metastases and Neoplasms

Monday, Nov. 28 3:30PM - 3:40PM Room: N230B

Awards

Student Travel Stipend Award

Participants
Waleed Brinjikji, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Percutaneous thermal ablation has been shown to be an effective minimally invasive technique for treatment of primary osseous tumors and osseous metastases. The purpose of this study was to assess the safety and efficacy of percutaneous thermal ablation in the treatment of vertebral metastases and primary osseous neoplasms.

METHOD AND MATERIALS

We retrospectively reviewed a consecutive series of patients who underwent thermal ablation for treatment of vertebral metastases and primary osseous neoplasms. Data were collected on demographics, lesion location, tumor type, use of intraoperative neural monitoring, complications, recurrence rates and retreatment rates. Major complications were defined as complications resulted in change in management, extended length of stay or additional morbidity.

RESULTS

123 patients underwent percutaneous thermal ablation for treatment of 157 vertebral metastases. Mean patient age was 58.1±16.1 years. Treatment goal was palliation or prevention of progression toward a neural element in 147 cases (93.6%). Nine cervical spine lesions, 77 thoracic spine lesions, 51 lumbar spine lesions, 26 sacral lesions and five iliac lesions were treated. The most common metastatic lesion treated was renal cell carcinoma (41 cases, 26.1%). The most common primary neoplasm was hemangioma (13 patients, 8.4%). Intraoperative neural monitoring was used in 109 cases (69.4%) due to proximity to the cord or nerve roots. In 54 cases (49.5%) there was a reduction in potentials which were reversible in 86% of cases. Minor complications which did not result in any change in management or morbidity occurred in 10 cases (6.7%) and major complications occurred in 11 cases (7.3%) including one death. Overall, there was recurrence in 49 cases (31.6%) and retreatment in 14 cases (8.9%).

CONCLUSION

Percutaneous thermal ablation for treatment of vertebral body neoplasms is generally safe and effective. While recurrence rates were high the goal in most cases was alleviation of pain and progression toward a neural element. Intraoperative neural monitoring was generally critical in avoiding neurological complications related to nerve root or spinal cord injury.

CLINICAL RELEVANCE/APPLICATION

Percuatenous thermal ablation of vertebral body primary neoplasms and metastases is safe and generally effective even when performed in proximity of nerve roots and the spinal cord. Close electrophysiologic monitoring is essential to avoid complications.

SSE19-05 CT-Fluoroscopy Guided Interlaminar Epidural Steroid Injections in the Cervical Spine: Rate of Inadvertent Dural Puncture and Complications

Monday, Nov. 28 3:40PM - 3:50PM Room: N230B

Participants
Timothy J. Amrhein, MD, Cary, NC (*Presenter*) Nothing to Disclose
Sherveen N. Parivash, MS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Peter G. Kranz, MD, Durham, NC (*Abstract Co-Author*) Research Consultant, Cephalogics, LLC Research Consultant, Biogen Idec Inc
Linda L. Gray, MD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Conventional fluoroscopic guided interlaminar epidural steroid injections (ILESIs) are rarely performed above the C6/7 interspace due to concerns about inadvertent dural puncture. Dural puncture is more likely to occur in the cervical spine because the ligamentum flavum is known to be discontinuous and the dorsal epidural space is diminutive (typically 1 – 2 mm in width). This precludes treatment of patients with pain originating from the mid and upper cervical spine. CT fluoroscopic guided (CTFG) cervical ILESI is an alternative technique that provides excellent soft tissue visualization as well as imaging acquisition in the axial plane, allowing for the precise needle placement required to perform ILESI at all levels throughout the cervical spine. The purpose of this study is to determine the rate of inadvertent dural puncture during CTFG cervical ILESI.

METHOD AND MATERIALS

We retrospectively reviewed consecutive CTFG cervical ILESI performed at one institution from 11/2015 to 7/2011. Procedural images were reviewed by a board certified radiologist with a CAQ in neuroradiology and 5 years experience performing CTFG pain injections. The following information was recorded: presence of dural puncture (based on contrast in intrathecal space or commented on in the procedural report), level of injection, AP diameter of the spinal canal, and complications.

RESULTS

A total of 931 CTFG cervical ILESIs were identified. There were inadvertent dural punctures in 15 cases (1.6%). Procedures were performed at all levels of the cervical spine: C1/2 (4), C2/3 (9), C3/4 (41), C4/5 (97), C5/6 (356), C6/7 (298), C7/T1 (126). Inadvertent dural punctures occurred within the inferior cervical spine and were proportional with the number of attempts: C5/6 (9, 2.5%), C6/7 (4, 1.3%), C7/T1 (2, 1.6%). There were no complications.

CONCLUSION

ILESI can be performed throughout the cervical spine using CTFG technique without complications and with an equivalent rate of dural punctures (1.6%) to that of conventional fluoroscopy performed at the C6/7 and C7/T1 levels (previously reported at 1.4%).

CLINICAL RELEVANCE/APPLICATION

CTFG ILESI allows for safe, directed, treatment at all levels throughout the cervical spine - an improvement over conventional fluoroscopy, which is typically limited to C6/7 and below.

SSE19-06 Electron Microscopy Demonstrates Fragmentation of the Hydrophilic Coating on Guidewires After

Flow-Model Manipulation

Monday, Nov. 28 3:50PM - 4:00PM Room: N230B

Awards
Student Travel Stipend Award

Participants
Ari J. Spiro, MD, Bronx, NY (*Presenter*) Nothing to Disclose
David J. Altschul, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Richard Zampolin, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Edward A. Dauer, MD, Fort Lauderdale, FL (*Abstract Co-Author*) Nothing to Disclose
Brad Bradshaw, MS, Coral Gables, FL (*Abstract Co-Author*) Nothing to Disclose
Todd S. Miller, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Allan L. Brook, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the degree of degradation of hydrophilic coating after manipulation in a cerebral flow model.

METHOD AND MATERIALS

A looped silicone model was filled with normal saline and positioned to mimic the tortuous conditions of the intracranial arterial tree. Two 0.014in microwires and two 0.035in hydrophilic-coated guidewires were used and passed through 1.7fr microcatheter and 4fr guide-catheters, respectively, to mimic standard conditions. The 0.014in wires were flushed, and back-loaded through a rotating valve hemostat before being passed. One wire was passed 1 time, another 7 times. A control wire was flushed but not passed through the catheter. The 0.035in wires were flushed in their housing, including the control wire that was not passed through the catheter. One wire was passed 1 time, another 7 times. The wires were put through equally tortuous conditions. Each wire was subsequently cut 5 cm proximal to the tip utilizing a standard wire cutter. The wires were evaluated with electron microscopy. This included mounting on 32 mm aluminum stubs. The wires were subsequently gold plated in a Denton Vacuum Desk V sputter coater and identifying numbers were marked on the specimen holder. Coating was approximately 10 nanometers thick, at 50 mas for 45 seconds. Mounting and coating was performed to avoid charging specimens with the electron beam and to protect the wire from distortion or damage during imaging. Images were produced on a JEOL scanning electron microscope with magnification levels between 50x and 1500x.

RESULTS

Multiple areas of degradation involving the hydrophilic coating of the wires were demonstrated including fraying, focal and linear defects, as well as fragmentation. Coating fragments were demonstrated measuring from 10-100 microns. The number and size of the coated wire fragmentation was more numerous and larger with more wire passes.

CONCLUSION

Electron microscopy demonstrated signs of degradation of the hydrophilic coating of microwires and guidewires after use in a flow model. Further rigorous experimentation is required to determine the minimal amount of force and usage necessary to degrade hydrophilic coating.

CLINICAL RELEVANCE/APPLICATION

There are reports demonstrating small infarcts after cerebral angiography. This experiment was able to demonstrate creation of fragments of hydrophilic coating that are of sufficient size to occlude the cerebral microcirculation. Additional work is needed to further characterize the implications of this finding.

SSE20

Science Session with Keynote: Pediatrics (Neuroradiology)

Monday, Nov. 28 3:00PM - 4:00PM Room: S102AB

NR MR PD

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

Participants
Susan Palasis, MD, Atlanta, GA (*Moderator*) Nothing to Disclose
Jeremy Y. Jones, MD, Bellaire, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSE20-01 Pediatrics Keynote Speaker: Brain and Spine Trauma in Children

Monday, Nov. 28 3:00PM - 3:10PM Room: S102AB

Participants
Jeremy Y. Jones, MD, Bellaire, TX (*Presenter*) Nothing to Disclose

SSE20-02 Relationship between MEG and Diffusion Imaging Measured Changes over a Season of High School Football

Monday, Nov. 28 3:10PM - 3:20PM Room: S102AB

Participants
Elizabeth M. Davenport, PhD, Dallas, TX (*Presenter*) Nothing to Disclose
Jillian Urban, Winston- Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Ben Wagner, BS, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Mark A. Espeland, PHD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Christopher T. Whitlow, MD, PhD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Joel Stitzel, Winston- Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Joseph A. Maldjian, MD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to characterize associations between Diffusion Tensor Imaging (DTI), Diffusion Kurtosis Imaging (DKI), and magnetoencephalographic (MEG) measured delta waves over a season of high school football in the absence of clinical concussion.

METHOD AND MATERIALS

Twenty-four players from a high school football team (mean age=16.9; no history of concussion) were instrumented with the Head Impact Telemetry System (HITs) during all practices and games. The biomechanical metric Risk Weighted cumulative Exposure (RWE) was computed. All players received pre- and post-season MRI. Whole-brain DTI images were acquired using a 2D single-shot EPI sequence. DTI-derived metrics were calculated using DTI-TK. DKI-derived metrics were computed using the Diffusional Kurtosis Estimator. Eight minutes of eyes-open, resting-state MEG data were acquired pre- and post-season for each subject and brain space delta-wave power was computed. Changes (post- minus pre-season) of each metric were computed for each subject and then used to determine the total number of abnormal voxels (2 standard deviations above or below the group mean). We have previously shown changes in select DTI, DKI, and MEG metrics to correlate with RWE. Spearman's rank correlation analyses were performed to examine the relationships between MEG, DTI, and DKI data.

RESULTS

Spearman's rank correlation analyses revealed a statistically significant association between the number of abnormal DKI Tortuosity voxels and abnormally increased MEG delta power voxels. There was also a strong correlation between DTI mean diffusivity (MD) and MEG delta power, as well as DKI axonal water fraction (AWF) and MEG delta power.

CONCLUSION

We demonstrate a significant correlation between the changes in tortuosity and MEG delta power over a season of high school football in the absence of clinical concussion. Fractional anisotropy (FA) was not significant, possibly because it is a less specific measurement. Tortuosity is expected to be sensitive to the myelinated axonal fraction where FA is a measure of general anisotropy. The relationship of Tortuosity with delta waves may indicate a correlation between the number of myelinated axons and delta waves.

CLINICAL RELEVANCE/APPLICATION

Both DKI and MEG may be more sensitive than current conventional imaging and they may provide information regarding physiological changes mediating subconcussive and concussive injuries.

SSE20-03 Diffusion Tensor Imaging of the cervical and Thoracic Spinal Cord in Pediatric Subjects Using an Inner FOV 2D RF Pulse Sequence

Monday, Nov. 28 3:20PM - 3:30PM Room: S102AB

Participants
Sona Saksena, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Devon M. Middleton, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Laura Krisa, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Pallav N. Shah, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

Scott H. Faro, MD, Haddonfield, NJ (*Abstract Co-Author*) Nothing to Disclose
Rebecca Sinko, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
John P. Gaughan, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Jurgen Finsterbusch, PhD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
MJ Mulcahey, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Feroze B. Mohamed, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Mahdi Alizadeh, Philadelphia, PA (*Presenter*) Nothing to Disclose

PURPOSE

(a) To investigate the feasibility of obtaining reliable DTI parameters along the entire cervical and thoracic spinal cord (SC) in typically developing (TD) children and children with spinal cord injury (SCI) using an inner field-of-view (FOV) sequence, (b) examine the reproducibility of DTI parameters, and (c) determine whether microstructural changes quantified by DTI are associated with clinical neurological deficits.

METHOD AND MATERIALS

22 TD children without SC pathology and 15 patients with chronic SCI were recruited. Written informed child assent and parent consent were obtained under the protocol approved by IRB. ISNCSCI was used to define the clinical level and severity of injury in SCI patients. Subjects underwent 2 identical scans using 3T Siemens MR scanner. The protocol consisted of structural scans and axial DTI scans based on inner FOV sequence. DTI images were acquired axially using 2 overlapping slabs to cover the cervical (C1-upper thoracic region) and thoracic (upper thoracic-L1) SC. Imaging parameters included: 3 averages of 20 diffusion directions, 6 b0 acquisitions, b=800s/mm2, voxel size=0.8x0.8x6mm3, axial slices=40, TR=7900ms, TE=110ms, and TA=8:49min. *Data Analysis:* After postprocessing, ROIs were manually drawn on whole cord on FA maps at every axial slice along the cervical and thoracic SC for both scans. DTI parameters were quantified at each intervertebral disk level and mid-vertebral body level of the cervical and thoracic SC. *Statistical Analysis:* Analysis of covariance for repeated measures was performed to compare data from TD and SCI. Test-retest reliability was calculated using the intra-class correlation coefficient.

RESULTS

FA values were significantly lower while RD was significantly higher along the cervical and thoracic SC in SCI patients compared to TD. There was a strong reliability for all DTI parameters along the cervical and thoracic SC (ICC: 0.79-0.94). MD, AD and RD showed the greatest number of correlations with ISNCSCI followed by FA indicating that better neurological function is associated with greater unidirectional diffusion.

CONCLUSION

This study demonstrates that DTI has a potential to be used as an imaging biomarker for evaluating the extent of injury which may be useful to prognosticate and monitor patients with SCI.

CLINICAL RELEVANCE/APPLICATION

DTI has the potential to be used as a diagnostic imaging tool for evaluating the severity of SCI in children using the inner FOV DTI technique.

SSE20-04 Perfusion Abnormalities on 3D Arterial Spin Labeling at 3T MR in Pediatric and Adolescent Patients with Migraine

Monday, Nov. 28 3:30PM - 3:40PM Room: S102AB

Participants
Hiroyuki Uetani, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Mika Kitajima, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Sugahara, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Hironori Kikuchi, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kohei Yamada, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoo Hirahara, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Sadahiro Yamamura, Kumamoto-Shi, Japan (*Abstract Co-Author*) Nothing to Disclose
Koya Nakashima, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yumi Yanaga, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

The prevalence and topography of perfusion abnormalities on 3D arterial spin labeling (ASL) at 3T in pediatric and adolescent patients with migraine have not been systematically investigated. The purpose of this study was to determine the prevalence and topography of perfusion abnormalities on 3D ASL at 3T in pediatric and adolescent patients with migraine.

METHOD AND MATERIALS

The study subjects were 44 consecutive patients (20 women, 24 men; age range, 3–18 years; mean age, 11 years) with migraine. All were diagnosed based on criteria of the International Classification of Headache Disorders, third edition (ICHD-Ⅲ) and all underwent 3T MRI including 3D ASL. We retrospectively reviewed 3D ASL, diffusion weighted images (DWI), T2 weighted images (T2WI), T1 weighted images (T1WI), T2* weighted images, FLAIR, and MR angiography (MRA). Abnormal perfusion on 3D ASL was qualitatively evaluated using a 5-point grading system from score -2 (moderate to severe hypoperfusion compared to the normal appearing region) to score +2 (moderate to severe hyperperfusion), and was correlated with conventional MR images and MRA.

RESULTS

Of the 44 patients, 15 (34%) exhibited perfusion abnormalities. One had mild hyperperfusion (score +1), 10 had mild hypoperfusion (score -1), and 4 had moderate to severe hypoperfusion (score -2). In 8 of these 15 patients (53%) the occipital lobe was the most frequent site with perfusion abnormalities. One patient with sporadic hemiplegic migraine manifested vasoconstriction of the left middle and posterior cerebral artery on MRA, and prominent hypointense cortical and medullary veins in the area corresponding to the vasoconstriction on T2* weighted image. DWI, T1WI, T2WI, and FLAIR showed no abnormality in any of the patients. Of the 15 patients with abnormal perfusion, 5 underwent follow up MRI including ASL; the perfusion abnormalities were improved in all.

CONCLUSION

In patients with pediatric and adolescent migraine, 3T ASL showed a high prevelance of abnormal perfusion especially in the occipital lobe.

CLINICAL RELEVANCE/APPLICATION

ASL may be a noninvasive imaging tool to evaluate and monitor cerebral perfusion in pediatric and adolescent patients with migraine.

SSE20-05 First Order Texture Analysis of Typically Development Pediatric Spinal Cord MR Images

Monday, Nov. 28 3:40PM - 3:50PM Room: S102AB

Participants
Mahdi Alizadeh, Philadelphia, PA (*Presenter*) Nothing to Disclose
Chris Conklin, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Devon M. Middleton, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sona Saksena, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Scott H. Faro, MD, Haddonfield, NJ (*Abstract Co-Author*) Nothing to Disclose
Laura Krisa, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
M. J Mulcahey, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Feroze B. Mohamed, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Identify and evaluate the patterns of texture features as a measure of tissue integrity and its potential clinical relevance in typically development (TD) pediatric spinal cord MR images.

METHOD AND MATERIALS

A total of 11 healthy subjects who had no evidence of spinal cord injury (SCI) or pathology with the age of 12.083±2.598 years (mean±standard deviation) (range 6-15 years) were recruited and scanned using a 3.0T Siemens Verio MR scanner. The axial T2-weighted-GRE scan was prescribed from the sagittal T2-weighted image to cover the entire spinal cord (C1-T12-L1 levels). The imaging parameters included: voxel size=0.42×0.42×6.0mm3, matrix size=384×384, TR=878ms, TE=7.8ms, slice thickness=6mm, flip angle=25°, number of averages=1 and acquisition time=156s. The method consists of three main stages, namely, normalization, manual segmentation and feature extraction. After image normalization, histogram based texture features were calculated using region of interest (ROI) manually drawn at every axial T2-weighted-GRE image along the spinal cord (C1-T12-L1). Histogram based descriptors were included entropy (measures the randomness of the intensity distribution), mean (measure of brightness), variance (variation of voxel intensity from mean), skewness (measure of histogram symmetry) and kurtosis (measures of the tail of the histogram).

RESULTS

The subjects showed the following texture features averaged across all subjects: entropy=4.95±0.314, mean=0.372±0.081, variance=0.034±0.016, kurtosis=4.802±3.826, and skewness=-0.551±1.04. The mean± standard deviation of each texture feature, as a function of cord level was calculated as well. It shows that entropy and mean values are consistence between subjects along spinal cord. The averaged 95% confidence interval (CI) across all subjects was: entropy= (4.762–5.133), mean= (0.324–0.42), variance= (0.024–0.043), kurtosis= (4.802–7.063), and skewness= (-1.166–0.064). Also, 95% CI was calculated as a function of spinal cord level in this study.

CONCLUSION

Texture descriptors could be used a surrogate marker for quantification and visualization of the spinal cord and has the potential to improve our understanding of damage and recovery in diseased states of the spinal cord.

CLINICAL RELEVANCE/APPLICATION

Consistent information from routine conventional pediatric spinal cord MRI can be extracted using texture analysis.

SSE20-06 Reduced FOV Diffusion Tensor MR Imaging and Fiber Tractography of the Pediatric Cervical Spinal Cord

Monday, Nov. 28 3:50PM - 4:00PM Room: S102AB

Participants
Mahdi Alizadeh, Philadelphia, PA (*Presenter*) Nothing to Disclose
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Devon M. Middleton, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

(a) evaluate the feasibility of generating diffusion tensor tractography (DTT) images of the cervical spinal cord in children using a deterministic method, (b) to measure the DTI indices as well as tract specific information using regions of interest (ROIs) generated at every axial slice location along the entire cervical spinal cord based on DTT images, and (c) to investigate if there are differences in these values between the typically development (TD) subjects and patient group with SCI.

METHOD AND MATERIALS

A total of 20 pediatric subjects included 10 healthy subjects (with the age of 15.13±3.51 (mean ±standard deviation) and age range of 11-21) and 10 subjects with SCI in the cervical area (with the age of 13.8±3.26 (mean ±standard deviation) and age range of 8-20) were recruited and scanned using 3.0T Siemens Verio MR scanner with 4-channel neck matrix and 8-channel spine

matrix coils. The DTI parameters used were: number of directions=20, b=1000s/mm2, voxel size=1.2×1.2×3.0mm3, matrix size= 36×208, axial slices=35-45, TR=6100-8000ms, TE=115ms, number of averages=3 and acquisition time=7min.The fiber tracks generated based on pre-defined upper and lower FA thresholds (0.30 and 0.15 for all TD and SCI patients, respectively) were constrained within the limits of these thresholds as well as when the fiber track turns by more than a particular angle threshold in this case 70 degrees. Also, a lower track length threshold of 4.8mm was set to eliminate fiber fragments caused by noise within the tract reconstruction.

RESULTS

The mean FA values in the controls and patients were 0.6±0.13 and 0.45±0.14, respectively. FA values were significantly decreased in the patients with SCI (p=0.0238). ADC values in the controls and patients were 7.38±1.81×10-4mm2/sec and 7.67±2.37×10-4mm2/sec, respectively. However they were not statistically significant. The mean number of fiber tracks in the controls and patients were 1157±156.1 and 750±259.4, respectively and was significantly decreased in the SCI group (p=0.0005). However, the mean length of fiber tracks (24.30±15.85mm and 23.06±15.11mm in the controls and patients, respectively) did not show significant differences.

CONCLUSION

DTI and DTT could be used a surrogate marker for quantification and visualization of the injured spinal cord.

CLINICAL RELEVANCE/APPLICATION

DTT can be used to demonstrate three dimensional structures of white matter tracts in the brain and spinal cord.

SSE21

Physics (CT-Dose II)

Monday, Nov. 28 3:00PM - 4:00PM Room: S403A

CT PH SQ

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

Participants
Cynthia H. McCollough, PhD, Rochester, MN (*Moderator*) Research Grant, Siemens AG
Xiujiang J. Rong, PhD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSE21-01 Prospective Multicenter Study on DRLs Comparison According to Clinical Indication and Anatomical Region: Preliminary Results

Monday, Nov. 28 3:00PM - 3:10PM Room: S403A

Participants
Hugues G. Brat, MD, Sion, Switzerland (*Presenter*) Nothing to Disclose
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Dominique Fournier, MD, Sion, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Federica Zanca, PhD, Leuven, Belgium (*Abstract Co-Author*) Employee, General Electric Company

PURPOSE

To compare diagnostic reference levels (DRLs) for CT examinations when using clinical indication versus anatomical region protocols.

METHOD AND MATERIALS

CT dose data from 7 scanners in 5 medical imaging centers of the same institution were collected using a single dose management software (DoseWatch, GE). Prior to data collection, parameters uniformization and protocol Radlex mapping occurred. The institutional DRLs (median CTDIvol) of chest and abdomen CT examinations were estimated based on anatomical region and clinical indication protocols and compared to each other as well as to national DRLs. The one-sample Wilcoxon signed rank and the Mann-Whitney tests were used to assess statistical significant differences among groups, as appropriate.

RESULTS

The institutional DRLs based on anatomical region (175 chest and 499 abdomen CT examinations) were: chest 5.7mGy, abdomen 8mGy and were significantly lower than the national DRLs (10mGy chest, 15mGy abdomen, $p<0.0001$). Per clinical indication, a large variation in dose levels was observed, but the dose was significantly lower than national DRLs in all cases: Chest DRLs: emphysema 4.8mGy, pulmonary embolism 7mGy, pneumonia 5.6mGy ($p<0.0001$ for all). Abdomen DRLs: colonography 4.6mGy, liver 7.5mGy, pancreas 7.6mGy, renal infection 6.5mGy, renal tumor 6.7mGy, diverticulitis 9mGy ($p<0.0001$ for all).When comparing institutional DRLs per clinical indication to anatomical region protocols: For Chest CT examinations, there was no statistical significant difference (p-value range 0.2-0.8). For abdomen CT examinations, there was a statistical significant difference for CT colonography ($p<0.05$), diverticulitis ($p<0.05$), renal infection ($p<0.005$) and renal tumor ($p<0.002$).

CONCLUSION

Dose levels for chest and abdomen CT examination protocols based on specific clinical indications are significantly lower than national DRLs in all cases and significantly lower than institutional anatomical region DRLs for CT colonography, diverticulitis, renal infection and renal tumor. National DRLs are therefore not reflecting clinical practice, where protocols are adapted to clinical indication rather than to anatomical region.

CLINICAL RELEVANCE/APPLICATION

DRL values should be linked to clinical indication, which may require different image quality and therefore a different dose.

SSE21-02 Out-of-Plane Shielding in Pediatric CT: Effect of Lead Apron Location on Radiation Dose Reduction

Monday, Nov. 28 3:10PM - 3:20PM Room: S403A

Participants
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Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jane S. Matsumoto, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Richard L. Morin, PhD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

Use of lead aprons to shield regions outside the CT scan field has been proposed to reduce radiation dose to patients. In practice, aprons need to be placed some distance from the scan range to avoid inclusion in the scan, which can decrease image quality and increase dose when used with tube current modulation. This study aimed to quantify dose reduction as a function of the distance between the apron and the bottom of the scan field for pediatric chest CT.

METHOD AND MATERIALS

Three semi-anthropomorphic head and abdominopelvic (AP) phantoms (CIRS Inc.) were placed adjacent to a chest phantom to mimic the habitus of a 5-year old. A chest CT scan (scan range 20 cm) was performed on a dual-source scanner using both sources operating in a high pitch (Flash) mode, with a reference mAs 10 times the clinical technique to allow measurements of small scattered doses in the AP areas. A point dosimeter (0.3 cc, Radcal Accu-Gold) was used to measure the dose every 5 cm from the start of the scan range (top of the chest) to the end of the AP phantom, which included a 25 cm range beyond the bottom of the scan that received only scattered radiation. A 0.5mm thick lead-equivalent apron was placed 1, 5, and 10 cm away from the bottom of the scan range. The averaged dose (2/3 peripheral + 1/3 center) was calculated both within and outside the scan field for each 5-cm position.

RESULTS

The mean averaged dose within and outside the scan field was 1.7 and 0.067 mGy, respectively. The average dose reduction achieved by the lead apron outside the scan field was 0.018 mGy (27.0%), 0.013 mGy (19.2%), and 0.010 mGy (14.2%) when the apron was 1, 5, and 10 cm away from the bottom of the scan range. The corresponding overall dose reduction (including both scan region and beyond the scan range) was 1.0%, 0.7%, and 0.5%.

CONCLUSION

When the lead apron was placed further away from the scan field, the amount of radiation dose reduction diminishes quickly. The reduction in dose was negligible compared to the overall dose of the exam.

CLINICAL RELEVANCE/APPLICATION

Dose reduction using out-of-plane shielding is extremely small. Potential risks (e.g. artifacts, infection, and discomfort) outweigh the benefit of the small dose reduction gained from the shielding.

SSE21-03 Using a Dedicated CT Metal/Artifact Reduction Algorithm for Arthroplasty Imaging: Can we Reduce the Dose?

Monday, Nov. 28 3:20PM - 3:30PM Room: S403A

Participants
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Andrew Primak, PhD, Malvern, PA (*Abstract Co-Author*) Employee, Siemens AG
Frank Dong, PhD, Solon, OH (*Abstract Co-Author*) Equipment support, Siemens AG Software support, Siemens AG
Joshua M. Polster, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Brian R. Herts, MD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

To compare readers' ability using iterative metal artifact reduction (iMAR), a new CT reconstruction technique, and standard filtered back projection (FBP) technique to detect lesions near hardware in a CT phantom model at different radiation doses.

METHOD AND MATERIALS

An anthropomorphic CT phantom was manufactured with cobalt chromium spheres attached to titanium rods, simulating an arthroplasty. Spherical lesions of different sizes (10-20mm) and different attenuations from the background (10–60HU) were embedded around the head and stem. Scans were performed using standard clinical technique (140kVp, 0.6mm collimation) at standard-dose (300 rmAs), half-dose (150 rmAs) and double-dose (600 rmAs) on a single CT scanner (Siemens FLASH). iMAR and FBP images were reconstructed with identical parameters and independently and blindly reviewed by 3 radiologists. A confidence score (0 – 100%) was assigned for the presence of a lesion in 8 locations near the head and stem. Accuracy, measured as the area under the ROC curve (AUC), sensitivity and specificity were calculated.

RESULTS

Readers' accuracy (0.946-0.979) and sensitivity (0.818-0.953) using iMAR were significantly higher (p=0.039—0.001) than with FBP (0.856-0.916 and 0.578-0.74, respectively) at all doses. Specificity with iMAR (0.984) and FBP (0.974-0.995) were high at all doses with no significant differences (p=1.0). Accuracy of half-dose iMAR (0.946) was not inferior to standard-dose FBP (0.888,p=0.003) or double-dose FBP(0.916,p=0.038). Accuracy with double-dose iMAR (0.979) and FBP (0.916) were not significantly higher than standard-dose iMAR (0.975, p=0.178-0.880) or standard-dose FBP (0.888, p=0.459). Sensitivity decreased less with iMAR than FBP with decrease in lesion size (p=0.021) and lesions near the head (p<0.001). There were no other significant differences in sensitivity based on lesion characteristics between the techniques.

CONCLUSION

iMAR, at all doses, significantly improved readers' ability to detect lesions near hardware in a CT phantom model, with the accuracy of half-dose iMAR equivalent to standard-dose and double-dose FBP.

CLINICAL RELEVANCE/APPLICATION

Using iMAR reconstructions when evaluating patients with arthroplasties may improve the readers' ability to detect pathology near hardware and allow for significant dose reductions compared to standard FBP reconstructions.

SSE21-04 Dose to the Eye Lens and Skin in CT Perfusion Exams

Monday, Nov. 28 3:30PM - 3:40PM Room: S403A

Participants
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PURPOSE

Techniques and tools for CT dosimetry are not generally available for CT perfusion exams. At the same time, CTDIvol cannot be used as a surrogate for organ dose as this metric is expected to overestimate locally absorbed doses in small scanned volumes. The aim was therefore to quantify the eye lens and skin doses due to CT perfusion exams by means of thermoluminescent dosimeters (TLDs) measurements in a cadaver and compare them with reported CTDIvol and Monte Carlo (MC) dose estimations.

METHOD AND MATERIALS

With the help of a pathologist, 35 TLDs were carefully inserted in different organs or tissues (brain, skin, bone surface and eye lens) in a female cadaver head, scanned in a Siemens Definition Flash scanner, using the clinical protocol for brain perfusion (80 kVp, 200 mAs, 32x1.2 mm collimation, 1.5 s scan time, 0.28 s rotation time, 30 scans). A trained CT radiographer positioned the cadaver head as for a typical exam in some of the non-cooperative patients: the eye lenses were in the primary beam (worst-case scenario). From the CT images, a voxel model was created. Doses were calculated with a MC simulation (EGSnrc) and compared to TLD measurements and to the CTDIvol after the exam.

RESULTS

The measured doses were: 216.3 mGy (right eye), 154.4 mGy (left eye), 185.3 mGy (average for eyes) and 107.6 mGy (average) for the skin. Compared to the reported CTDIvol of 260 mGy, the eye lens dose was overestimated by 17% (right) and 41% (left) with an average overestimation of 29%; the skin dose followed the same trend with an overestimation of 59%.MC calculations were: 177.0 mGy and 111.0 mGy for the average eye lenses and skin, respectively, indicating a high accuracy (-4.5% and 3.6% difference respect to TLDs measurements, respectively).

CONCLUSION

CTDIvol stays a conservative metrics for eye lens and skin dose estimation and allows evaluating a safe utilization of such protocols in clinical practice. However, MC framework allows a more accurate dose estimations.

CLINICAL RELEVANCE/APPLICATION

Monte Carlo simulations are easier to perform than TLD measurements if accurate dosimetry is needed, in order to evaluate the applicability of high dose protocols in clinical practice.

SSE21-05 Not all Water Equivalent Diameters Yield the Same Dose: The influence of Patient Ellipticity on AEC Algorithms in CT

Monday, Nov. 28 3:40PM - 3:50PM Room: S403A

Participants
Timothy P. Szczykutowicz, PhD, Madison, WI (*Presenter*) Equipment support, General Electric Company; License agreement, General Electric Company
Ashley Hermanns, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
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Dominic Crotty, PhD, Waukesha, WI (*Abstract Co-Author*) Employee, General Electric Company

PURPOSE

Dose monitoring in CT is now common place due to the multitude of commercial and in house dose aggregating tools available. For CT protocols using automatic exposure control (AEC) the dose will increase with patient size. To compare patient doses across patient size, metrics such as SSDE can be used. Other options include plotting a dose surrogate or scanner output as a function of patient size. In any of these methods, one seeks to obtain feedback on how appropriate the dose was for a given patient size. This work explains how on some CT scanners, even for the same water equivalent diameter (WED), the scanner output will change as a function of the ellipticity ratio of the patient. This effect can modulate the scans AEC by large amounts and therefore it should be taken into account.

METHOD AND MATERIALS

Patient dose, size, and scanner output data were acquired under IRB protocol for abdominal pelvis scans. The WED, effective mAs, and ellipticity ratio were calculated for each image slice. The effective mAs for each image slice was plotted against WED for a cohort of patients. The WED and ellipticity ratio were also plotted against effective mAs for individual patients.

RESULTS

The scanner employed an AEC function that produces an exponential increase in effective mAs with WED for uniform cylindrical phantoms. For the patient data analyzed in this study, the effective mAs did not follow the expected exponential relationship with WED. It was observed that when the effective mAs data deviated from the expected relationship, the patient ellipticity changed. In other words, while the patient's cross section remained uniform in anterior to posterior ratio, the AEC behaved as expected. Alternatively, when the ratio deviated, so did the AEC. For example, two patient image slices corresponding to a WED of 370 mm were measured to have effective mAs values of 93 and 136. Their ellipticity ratios were measured to be 1.34 and 1.47 respectively.

CONCLUSION

A new effect of AEC systems was investigated. It was shown that if one desires to obtain a confident estimate of the appropriateness of patient dose for a given patient size, the ellipticity or distribution of the patient's cross section must also be considered.

CLINICAL RELEVANCE/APPLICATION

This work demonstrates an additional patient attribute, the ellipticity of the patient's cross section, which should be considered in addition to overall size for identifying CT dose outliers.

SSE21-06 Comparison of Size-Specific Dose Estimate Conversion Factors for Fixed Tube Current and Tube Current Modulated Computed Tomography

Monday, Nov. 28 3:50PM - 4:00PM Room: S403A

Participants
Anthony Hardy, BS, Los Angeles, CA (*Presenter*) Nothing to Disclose
Maryam Bostani, PhD, Los Angeles, CA (*Abstract Co-Author*) Research support, Siemens AG
Christopher H. Cagnon, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Abstract Co-Author*) Institutional research agreement, Siemens AG Research support, Siemens AG

PURPOSE

The purpose of this work is to compare the conversion factors used to calculate size-specific dose estimate (SSDE) as outlined in TG 204 for tube current modulation (TCM) with different modulation strengths to those of fixed tube current (FTC).

METHOD AND MATERIALS

A series of abdominal CT protocols were performed on three cylindrical polymethyl methacrylate (PMMA) phantoms with diameters of 32 cm, 16 cm, and 8 cm on a 64-slice MDCT scanner (Definition AS64, Siemens). The scans were performed using the same kV, collimation, rotation time, and pitch. Several scans were performed using fixed mAs (200) and TCM (CareDose4D, Quality Reference mAs = 200). To examine the effects of different scanner parameters, both Adult and Child options were used as well as three different modulation strengths for TCM: Very Weak, Average, and Very Strong. For each scan, a 0.6-cc ionization chamber was placed in the center hole of each phantom and the air kerma measurement was recorded for each condition. In addition, the scanner reported CTDIvol was recorded and used to normalize the air kerma values in order to produce conversion factors similar to those described in TG 204. Phantom size was described in terms of water equivalent diameter (WED). The conversion factors for all different strengths were plotted against WED. Percent differences were reported between conversion factors from all three strengths and those from FTC scans.

RESULTS

For the child abdomen protocol, differences between FTC and TCM conversion factors were 7%, 7%, and 5% at 32 cm; 6%, 1%, and 4% at 16 cm; and 55%, 13%, and 72% at 8 cm for Average, Very Weak, and Very Strong modulation, respectively. For the adult abdomen protocol, differences between FTC and TCM conversion factors were 21%, 17%, and 23% at 32 cm; 26%, 4%, and 23% at 16 cm; and 46%, 13%, and 63% at 8 cm for Average, Very Weak, and Very Strong modulation, respectively.

CONCLUSION

FTC conversion factors were systematically larger than those of TCM at the three modulation strengths. TCM conversion factors possessed a similar exponential relationship relative size to the FTC factors with the 32 and 16 cm phantoms. At 8 cm, surprisingly, TCM factors deviated from this relationship in a reproducible manner. This deviation is currently being investigated.

CLINICAL RELEVANCE/APPLICATION

FTC conversion factors may not be applicable for TCM protocols depending patient size as they yield an inaccurate estimate of SSDE.

SSE22

Physics (PET/CT and PET/MRI)

Monday, Nov. 28 3:00PM - 4:00PM Room: S403B

CT MR NM PH

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

Participants
Tinsu Pan, PhD, Waukesha, WI (*Moderator*) Nothing to Disclose
Stephen J. Glick, PhD, Silver Spring, MD (*Moderator*) Nothing to Disclose

Sub-Events

SSE22-01 Feasibility of 18F-FDG Dose Reduction in Dynamic PET using A Next Generation Digital PET/CT

Monday, Nov. 28 3:00PM - 3:10PM Room: S403B

Participants
Xiaoli Liu, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Ajay Siva, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Presenter*) Nothing to Disclose

PURPOSE

To explore the feasibility of low dose dynamic PET imaging using a next generation digital PET/CT while achieving accurate quantification designed for response assessment studies at multiple time points.

METHOD AND MATERIALS

30min dynamic FDG PET scans were acquired on a digital PET/CT system (Vereos) in continuous list mode. Dynamic PET data were reconstructed (3i15s) using 3 techniques (Time-of-Flight, TOF + Point Spread Function (PSF), and TOF + PSF + Gaussian Filter (GF)), and following a 30-frame (fr) protocol (60s×30fr), a 30s×60fr and 15s×120fr to simulate based on full tracer dose of 450MBq FDG, 1/2 and 1/4 tracer doses. Maximum activity concentrations (Bq/mL) of lesions and arteries were obtained by 3D VOI placement. The average lesion uptake value (L_Ave) and the standard deviation (SD) of lesion uptake (L_SD) were calculated. Kinetic parameters were estimated using in-house developed software with 2-tissue compartment model (2TCM) (k1, k2, k3 and Ki; k4 was set to be 0) and Patlak model (Ki). The 60s×30fr with TOF data were taken as reference. L_Ave values and kinetic parameters generated with different doses and reconstruction techniques were compared to gold standard using Student's t-test with statistical significance being set at $p<0.05$.

RESULTS

High-quality dynamic 18F-FDG PET images could be generated and all lesions were readily identifiable even when FDG dose was decreased by 75%. The addition of PSF alone seemed to slightly increase PET image noise, especially with lower doses. PET with both 50% and 25% doses could still accurately quantify SUVmax values. Kinetic parameters k1, k2 and k3 calculated by 2TCM did not show significant difference with 50% dose regardless of reconstruction technique. PET with 25% dose could generate accurate k3, however, it caused significant differences in k1 and k2 ($p<0.05$). Ki values calculated either by Patlak analysis or 2TCM remained consistent with full as well as lower doses.

CONCLUSION

Even with a 75% FDG dose reduction to the current 13mCi standard, dynamic PET images of high-quality and quantitative accuracy can be obtained using a next generation digital PET system.

CLINICAL RELEVANCE/APPLICATION

This study demonstrates the feasibility of dynamic PET even with very low tracer doses using a next generation digital PET without impacting image quality or quantification.

SSE22-02 Relation of Rb-82 Rest/Regadenoson-Stress PET/CT Measurements to Multi-Vessel Disease as Assessed by X-Ray Coronary Arteriography

Monday, Nov. 28 3:10PM - 3:20PM Room: S403B

Participants
Kenneth Nichols, PhD, New Hyde Park, NY (*Presenter*) Royalties, Syntermed, Inc;
Andrew Van Tosh, MD, Roslyn, NY (*Abstract Co-Author*) Consultant, Pfizer Inc ; Consultant, Bracco Group; Consultant, Cardinal Health, Inc ; Consultant, Ion Beam Applications SA
Nathaniel Reichek, MD, Roslyn, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Palestro, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

X-ray contrast arteriography is the reference standard for confirming coronary artery disease (CAD), but is not always possible due to its invasive nature. Our study was conducted to assess which PET parameter agreed most strongly with a finding of multi-vessel disease (MVD) by arteriography.

METHOD AND MATERIALS

Data were reviewed retrospectively for 70 pts referred for Rb-82 rest/regadenoson-stress PET/CT who also had quantitative x-ray contrast arteriography, with MVD defined as 2 or more left ventricular main arteries with ≥ 70% stenoses. Absolute myocardial

blood flow was calculated from first pass count curves using a 2-compartment model, with coronary vascular resistance (CVR) computed as mean arterial pressure ÷ flow. Gender-specific Rb-82 normal limits for relative perfusion were applied to compute summed stress score (SSS). Emory Cardiac Toolbox algorithms computed ejection fraction (EF) & quantified regional asynchrony as contraction phase histogram bandwidth. ROC analysis determined parameter thresholds of discrimination of MVD by maximizing accuracy, i.e., area under ROC curves.

RESULTS

Of the 70 pts, 14 (20%) had MVD & 56 (80%) did not. For each category of parameter studied, stress values exhibited higher correlation with angiography than either rest values or change values. Highest ROC areas were observed for SSS, EF, bandwidth, & CVR (accuracy = 84%, 79%, 76% & 75%, respectively). For each parameter, stress values were significantly different for pts with & without MVD (SSS = 21±7 versus 10±9, p = 0.0002; EF = 39±19% versus 61±15%, p < 0.0001; bandwidth = 150±69º versus 79±54º, p = 0.0001; CVR = 104±42 versus 68±39 mm Hg/ml/g/min, p = 0.004). Optimal discrimination between pts with & without MVD was the combination of SSS > 12 & stress EF < 50% (accuracy = 87%, sensitivity = 71% & specificity = 91%).

CONCLUSION

Rb-82 rest/regadenoson-stress PET/CT computations agree well with arteriographic findings of multi-vessel disease.

CLINICAL RELEVANCE/APPLICATION

Rb-82 PET is a reasonable alternative in detecting multi-vessel disease when arteriography is not possible.

SSE22-03 Longitudinal Variability of PET SUVs in the NCI Quantitative Imaging Network (QIN)

Monday, Nov. 28 3:20PM - 3:30PM Room: S403B

Participants
Paul E. Kinahan, PhD, Seattle, WA (*Presenter*) Research Grant, General Electric Company; Co-founder, PET/X LLC
Darrin W. Byrd, MS, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Clinical oncology trials that utilize PET measurements to asses change in response to therapy may suffer from reduced study power if biases in the standardized uptake value (SUV) are not consistent between sites or across time. Bias instability due to instrument calibration has not been previously characterized except in studies having limited repeat measurements over short time periods. We evaluated the variability in SUVs over roughly 8 months in a multicenter network.

METHOD AND MATERIALS

We used cross-calibration 'kits' with two long-lived sealed PET sources of 68-Ge in epoxy. The first source is a NIST-traceable dose calibrator reference standard while the second is implicitly NIST-traceable (i.e. made by the same process) 4.5 cm diam. uniform cylinder source for PET scanners. These were distributed to 9 cancer centers that were part of the NCI Quantitative Imaging Network (QIN), with a total of 19 PET/CT scanners and 16 dose calibrators. The number of scans per scanner ranged from 3 to 43 (average of 13) and the duration over which scans were performed ranged from 39 to 412 days (average of 232). A total of 161 dose calibrator measurements were made with an average separation of 24 days between measurements. SUV bias was estimated from the scanner and dose calibrator biases.

RESULTS

Scanner bias was higher than expected, probably due to attenuation and scatter corrections for the epoxy used in the source. However, neither scanner or dose calibrator signal recoveries were stable in time. Scanner bias varied by approximately 10% on average over the course of measurements. Dose calibrator recovery variability was approximately 5%. Fluctuations in recovery of scanners and dose calibrators were uncorrelated, thus SUV variability was not smaller than scanner or dose calibrator variability.

CONCLUSION

Scanner and dose calibrator bias variations are potentially significant contributors to SUV variability both in networks of hospitals and at single sites. Biases from dose calibrators and PET scanners do not cancel out in SUV calculations. Sites conducting clinical trials should employ long-lived sources as part of quality control for PET scanner calibration monitoring.

CLINICAL RELEVANCE/APPLICATION

Sites conducting clinical trials should employ long-lived sources as part of quality control for PET scanner calibration monitoring. Submitted on behalf of the QIN Data Acquisition Working Group.

SSE22-04 A Multi-Method, Multi-Center Study of PET/MRI Brain Attenuation Correction on A Large Cohort of [18F]-FDG Patients: Ready for Clinical Implementation

Monday, Nov. 28 3:30PM - 3:40PM Room: S403B

Participants
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PURPOSE

In order to improve the current vendor-implemented MR attenuation correction (AC) methods for achieving more accurate quantifiable radioactivity concentration measured by PET, a number of AC methods have been proposed in the literature. The aim of this study was to evaluate a selection of novel methods, and identify the ones suitable for clinical use by applying a unified quantitative evaluation with identical metrics, subject cohort, and common CT-based reference.

METHOD AND MATERIALS

In total, eleven MRAC methods were evaluated on 204 [18F]-FDG subjects, and compared to attenuation correction based on CT. Methods were: two vendor-implemented (Dixon (Martinez-Moller et al., 2009) and UTE (Keereman et al., 2010)), five based on template/atlas information (SEGBONE (Koesters et al., 2016), ONTARIO (Anazodo et al., 2014), BOSTON (Izquierdo-Garcia et al., 2014), UCL (Burgos et al., 2014), and LYON (Merida et al., 2015)), one based on simultaneous reconstruction of attenuation and emission (MLAA (Benoit et al., 2015)), and three based on image-segmentation (MUNICH (Cabello et al., 2015), CAR-RiDR (Juttukonda et al., 2015), and RESOLUTE (Ladefoged et al., 2015)). Evaluation was performed both globally and regionally, with a special focus on robustness and outlier analysis (Ladefoged et al., 2015).

RESULTS

The average global performance in PET tracer uptake was for each method (mean ± SD)%: Dixon (-11.3±3.5)%, UTE (-5.7±2.0)%, SEGBONE (-1.7±3.6)%, ONTARIO (-4.3±3.6)%, BOSTON (-0.3±1.8)%, UCL (0.7±1.2)%, LYON (-0.4±1.6)%, MLAA (-1.9±2.6)%, MUNICH (3.7±2.1)%, CAR-RiDR (-0.4±1.9)%, and RESOLUTE (0.3±1.7)%. The best performing methods showed regional average errors within ±3% of PET with CT (BOSTON, UCL, LYON, RESOLUTE). Five methods (BOSTON, UCL, LYON, RESOLUTE, CAR-RiDR) showed that for 95% of the patients, 95% of brain voxels had an uptake that deviated by less than 15% from the reference.

CONCLUSION

All novel methods showed great performance on average. The main difference among the methods has to be found in the robustness, clinical feasibility, and number of outliers. It may be concluded that the problem of MRAC in the brain has been solved to an acceptable degree.

CLINICAL RELEVANCE/APPLICATION

This study compares a selection of novel MR attenuation correction methods, and attempts to identify the ones suitable for clinical use.

SSE22-05 PET/MR Imaging of the ACR Phantom Using Adapted MRAC Techniques

Monday, Nov. 28 3:40PM - 3:50PM Room: S403B

Participants
Joseph Meier, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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Yiqiang Jian, Waukesha, WI (*Abstract Co-Author*) Nothing to Disclose
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Osama R. Mawlawi, PhD, Houston, TX (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG

CONCLUSION

The proposed modifications of the MRAC allows accurate PET SUV qunatification in all regions of the ACR phantom with the exception of the Teflon insert. These modifications allow the use/evaluation of the same MRAC pulse sequnece on both patients and phantom studies without resorting to CTAC templates.

Background

The GE SIGNA PET/MR utilizes a LAVA FLEX pulse sequence to separate fat and water to create PseudoCTs(PCT) for attenuation correction(AC) of PET data. This results in large biases in phantom imaging primarily due to lack of fat in PET phantoms and lack of signal from the phantom shell and its solid internal structures when using standard MR pulse sequences. Our objective was to develop novel techniques to generate PCT of the ACR phantom while still using the LAVA FLEX sequence that will result in no bias in the corresponding PET image quantification.

Evaluation

A PET ACR phantom filled with an activity concentration equivalent to 370 MBq of injected activity was scanned on a GE 710 PET/CT and a GE MR 750. Two acquisitions were acquired on each scanner, one with a 300 ml bottle of vegetable oil affixed to the side of the phantom and one without. PET images were reconstructed using CTAC, LAVA FLEX MRAC (PCT_Clin) without oil bottle, and a modified MRAC (PCT_mod) which included: oil bottle to enable fat/water separation, slice to volume normalization, removal of vertebral mask to allow for air pockets, rescaled MRAC Houndsfield Units(HU) from soft tissue(42) to water(0) and fat(-104) to oil(-115), and acrylic shell from HU of -1000 to 120 which was digitally inserted into the phantom. Image analysis was performed according to ACR specifications and compared to CTAC which was considered as the gold standard.

Discussion

There was no appreciable visual difference in uniformity and resolution in the reconstructions. The percent error of the PCT_clin and PCT_mod with respect to CTAC was: Background SUVmean(-31%, -2%), 25mm Hot Cylinder(-30%, -3%), Air SUVmean(174%, -1%), Teflon SUVmean(-67%, -84%), Cold Water SUVmean(-31%, -5%).

SSE22-06 PET/MR Headphone Attenuation Estimation using MLAA

Monday, Nov. 28 3:50PM - 4:00PM Room: S403B

Participants
Thorsten Heusser, Dipl Phys, Heidelberg, Germany (*Presenter*) Nothing to Disclose
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Marc Kachelriess, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To estimate headphone attenuation in hybrid PET/MR imaging using maximum likelihood reconstruction of attenuation and activity (MLAA).

METHOD AND MATERIALS

Attenuation correction of flexible hardware components such as MR body coils or headphones is still a major challenge in hybrid PET/MR imaging. While stationary components (e.g., patient table and head coils) can be added to the MR-derived patient attenuation map in a straightforward way using CT-derived templates, attenuation of flexible components is neglected in clinical routine. Ignoring headphone attenuation has been shown to result in local brain SUV underestimation values of up to 15%. We propose to employ the MLAA algorithm to simultaneously estimate attenuation and activity distributions outside the patient body outline to obtain an estimate of the headphone attenuation. Due to cross-talk effects, MLAA cannot recover the true attenuation coefficients of the headphones. However, the outline of the headphones can be segmented and pre-defined attenuation coefficients can be applied. The average headphone attenuation coefficients were empirically derived performing phantom measurements and chosen such that the SUV underestimation when ignoring headphone attenuation could be compensated for. For clinical evaluation, we investigated the proposed headphone attenuation estimation for six PET/MR patient data sets acquired with a Siemens Biograph mMR.

RESULTS

For the headphones used in our mMR system it turned out that an average attenuation coefficient of $\mu = 0.007$ 1/mm was required to compensate for the SUV underestimation in the phantom measurements, reducing the average and maximum underestimation from 5.3% to 1.6%, and 12.7% to 2.1%, respectively. Ignoring headphone attenuation resulted in an average SUV underestimation across the six patient data sets of 3.9% evaluated in the full brain and 8.6% evaluated in the cerebellum, compared to compensating for headphone attenuation using the proposed method.

CONCLUSION

We propose a method to estimate PET/MR headphone attenuation making use of the MLAA algorithm. The proposed method was shown to significantly reduce SUV underestimation in both phantom and patient data.

CLINICAL RELEVANCE/APPLICATION

MLAA-based estimation of headphone attenuation has the potential to improve PET quantification in brain PET/MR. The proposed method can, potentially, be readily included into clinical workflow.

SSE23

Physics (Dose in Radiography, Fluoro and Mammography)

Monday, Nov. 28 3:00PM - 4:00PM Room: S404AB

BR PH SQ

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

Participants
Mitchell M. Goodsitt, PhD, Ann Arbor, MI (*Moderator*) Research collaboration, General Electric Company
Charles E. Willis, PhD, Houston, TX (*Moderator*) Medical Advisory Board, General Electric Company

Sub-Events

SSE23-01 A Five Year Retrospective Review of Radiation Dose from Fluoroscopically Guided Interventional Procedures Performed using Different Imaging Technology - Where We Were, Where We Are and Where Are We Heading?

Monday, Nov. 28 3:00PM - 3:10PM Room: S404AB

Awards
Student Travel Stipend Award

Participants
Zachary Merritt, Philadelphi, PA (*Presenter*) Nothing to Disclose
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Jaydev K. Dave, PhD, MS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Transitioning from II to FPD systems was not associated with radiation dose savings, but FPD with newer dedicated image processing software has allowed for substantial dose reduction.

Background

Imaging technology for fluoroscopically guided interventional (FGI) procedures has advanced from image intensifiers (II) to flat panel detectors (FPD) and recently, to FPD systems with dedicated image processing software for radiation dose reduction. The purpose of this work was to evaluate the effect of imaging technology on radiation dose from FGI procedures.

Evaluation

After IRB approval, data from FGI procedures performed in interventional radiology suites was obtained from RIS (years: 2011-2015). Fluoroscopy time, cumulative air kerma (CAK; only for FPD systems) and kerma-area product (KAP) were obtained for all procedures performed either using II, FPD or FPD systems with dose reduction software (ClarityIQ, Philips Healthcare; FPD-CIQ). Data from RIS was cross-verified, and analyzed in aggregate and split by procedure codes (procedures with n > 30 cases with each type of system).

Discussion

Data from 27251 cases was obtained. Error checking and deleting duplicate instances resulted in 22414 cases from 92 unique procedures. Overall, ANOVA revealed a significant effect of imaging technology on fluoroscopy time, CAK and KAP ($p<0.01$). The median fluoroscopy time and KAP were 1.3 minutes and 11.0 Gy*cm² (n=6300), 1.9 minutes and 15.0 Gy*cm² (n=10418), and 2.4 minutes and 6.9 Gy*cm² (n=5696) for II, FPD and FPD-CIQ systems, respectively. The median CAK values for FPD and FPD-CIQ systems were 43.4 mGy and 23.5 mGy, respectively. Trend data showed complex cases increasingly being performed on FPD and FPD-CIQ systems (e.g., 194, 1075 and 699 embolization cases on II, FPD and FPD-CIQ systems, respectively). There were 27 unique procedures with more than 30 cases performed on each type of system; a significant effect of imaging technology on dose values for each of these procedures was noted ($p<0.01$). In this subset, the ratios of median KAP ranged from 0.4 to 1.7 (FPD/II) and from 0.2 to 0.6 (FPD-CIQ/II). For 26 of these procedures, the median CAK with FPD-CIQ systems was less than FPD systems.

SSE23-02 Variability in Target Exposure Index (TEI) and Deviation Index (DI) among Digital Radiography Practices across the United States

Monday, Nov. 28 3:10PM - 3:20PM Room: S404AB

Participants
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Charles E. Willis, PhD, Houston, TX (*Abstract Co-Author*) Medical Advisory Board, General Electric Company

CONCLUSION

Considerable variation was noted in both the TEI and DI from digital radiography practices across the United States. Most of the radiographic images had DI outside the recommended target range. Based on these observations, TEI and DI are potential targets for quality improvement in digital radiography practices.

Background

In digital radiography, target exposure index (TEI) expresses the target image receptor air kerma and the deviation index (DI) quantifies the difference between the air kerma delivered to the image receptor and the target air kerma for a specific body part and view. The current recommended target range for the DI is from -0.5 to 0.5, with DI outside this range identified as under- or over-exposure. The purpose of this work was to quantify the variability in TEI and DI from digital radiography practices across the United States.

Evaluation

Each practice complied with local Institutional Review Board requirements for this retrospective study. TEI and DI values for radiographs of the chest, abdomen, pelvis and extremities corresponding to anteroposterior, posteroanterior, lateral, and decubitus views were collected from 10 practices across the United States between 2012 and 2015. Data were analyzed both in aggregate and stratified by exposure control method, image receptor technology, patient age, and practice site for each body part and view. Descriptive statistics and percentage of cases falling outside the DI target range were computed.

Discussion

Data from 505,930 radiographs were analyzed. The ratio of maximum TEI to minimum TEI for the same body part and view ranged from 2.4 to 4.4 and 3.2 to 16.6 for adult radiographs and from 1.7 to 4.1 and 1.1 to 5.0 for pediatric radiographs acquired with scanned pixel ("CR") and fixed pixel ("DR") image receptor technology, respectively. The standard deviation of the DI stratified by practice site ranged from 1.3 to 3.6 and from 1.3 to 3.0 for adult and pediatric radiographs, respectively. The percentage of cases falling outside the DI target range was 85%, 85%, 80%, and 86% for adult radiographs and 87%, 80%, 78%, and 87% for pediatric radiographs of the abdomen, chest, pelvis, and extremities, respectively.

SSE23-03 Radiation Dose Reduction in X-ray Differential Phase Contrast Breast Imaging using an Energy-resolved Grating Interferometer

Monday, Nov. 28 3:20PM - 3:30PM Room: S404AB

Participants
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Xu Ji, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Ran Zhang, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
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Guang-Hong Chen, PhD, Madison, WI (*Abstract Co-Author*) Research funded, General Electric Company Research funded, Siemens AG

PURPOSE

X-ray differential phase contrast (DPC) breast imaging exploits the wave nature of x-rays, generating images with enhanced soft tissue contrast in addition to standard absorption contrast mammographic images. Although DPC imaging has become feasible at clinically acceptable radiation dose levels, additional improvement in its dose efficiency would further expand its potential clinical implementations such as earlier and more frequent screening of women with higher risk of breast cancer. The purpose of this work is to develop a novel image processing method to reduce radiation dose in energy-resolved DPC imaging systems.

METHOD AND MATERIALS

An energy-resolved single photon counting detector (PCD) was incorporated into a DPC breast imaging benchtop system with a hospital-grade x-ray tube. Photons with energies similar to the designed operation energy of the interferometer system were selectively utilized to maximize the detected fringe visibility and the dose efficiency of DPC imaging. On top of this, photons in other energy bins were also utilized by exploiting the rank-one nature of the spatial-spectral DPC image matrix, as DPC information encoded in different energy bins are scalable by an energy square factor. Such intrinsic physical property allows noise to be rejected by only maintaining information in the first rank, meanwhile preserving both DPC signal accuracy and spatial resolution. The proposed rank-one approximation method was experimentally validated using an ACR Mammography Accreditation Phantom.

RESULTS

Compared with images of the ACR phantom acquired at 100% reference dose level and standard DPC image processing method, images acquired with 50% radiation dose and the proposed ran-one approximation method demonstrated equivalent image quality. The measured noise standard deviation for the 50% dose images with the proposed method [(1.98±0.13) ×1E-2] was no greater than that of the 100% dose images [(2.12±0.04) ×1E-2, $p < 0.01$]. Neither spatial resolution loss nor noise texture distortion was observed.

CONCLUSION

A novel energy-resolved grating interferometer system was developed to successfully reduce radiation dose by 50% for DCP imaging.

CLINICAL RELEVANCE/APPLICATION

Radiation dose reduction in DPC imaging would further extend the scope of its potential clinical utilities such as earlier and more frequent screening of women with higher risk of breast cancer.

SSE23-04 Optimization of Patient Dose in Digital Mammography Utilizing a Simplified Method of an FROC Observer Study with a CDMAM Phantom

Monday, Nov. 28 3:30PM - 3:40PM Room: S404AB

Participants
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Yusuke Bamba, Ishikawa, Japan (*Abstract Co-Author*) Employee, EIZO Corporation
Junji Shiraishi, Kumamoto, Japan (*Abstract Co-Author*) Research Grant, FUJIFILM Holdings Corporation; Research Grant, Nihon Medi-Physics Co, Ltd

PURPOSE

Diagnostic accuracy of the radiologic images should be evaluated by taking into account various factors due to human observers as well as the characteristics of the display used in the interpretation. The aim of this study was to propose a simplified method for performing an FROC observer study to optimize patient dose in digital mammography based on the diagnostic accuracies for low-contrast signal detection in a CDMAM phantom.

METHOD AND MATERIALS

The digital images of a CDMAM phantom were obtained by a full-field digital mammography system (Amulet, Fuji Film, Japan) with three levels of patient dose (60, 80, and 100% of the average glandular dose, 30 kV, W/Rh) to compare the diagnostic accuracies for low-contrast signal detection. Case sample images without and with various number of signals (0-3 signals/case) were cropped along the threshold lines predicted by using a CDMAM Analyser (14 regions/image × 3 images× 3 conditions). Case sample images were observed on a high resolution medical LCD by six board-certified breast radiographers using a publically available computer interface (ROC Viewer 2015 ver. 1.0). The figure of merit (FOM) values was calculated and significant differences were statistically tested among the three different imaging conditions with the JAFROC software. Our results obtained with the proposed FROC method were validated by comparison with those obtained from CDMAM Analyser.

RESULTS

Average FOM values and sensitivities of the 6 breast radiographers' performance improved with increasing dose level, whereas no statistically significant difference was found among the three conditions. In addition, there was a high correlation between the average FOM and inverse image quality figure (inv. IQF) in each dose level ($r = 0.98$). Furthermore, the average reading time for 120 case samples was 22 min, which could be considered very short.

CONCLUSION

The effect of dose reduction on the low-contrast signal detection was assessed by a simplified FROC observer study using ROIs of CDMAM phantom images as case sample images. FROC observer studies were conducted in shorter time, with smaller errors and reduced complexity, and the results were well-supported by those obtained by a CDMAM Analyser.

CLINICAL RELEVANCE/APPLICATION

This FROC method can demonstrate changes in diagnostic accuracies of various dose levels and can be utilized for the optimization of patient dose, which is a primary concern in digital mammography.

SSE23-05 Phantom Estimated Dose Comparison between Contrast Enhanced Spectral Mammography (CESM) and Established X-ray Breast Screening Modalities

Monday, Nov. 28 3:40PM - 3:50PM Room: S404AB

Participants
Georgeta Mihai, PhD, Boston , MA (*Presenter*) Nothing to Disclose
Jordana Phillips, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Matthew R. Palmer, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Da Zhang, PhD, Boston, MA (*Abstract Co-Author*) Investigator, Toshiba Medical Systems Corporation

PURPOSE

As contrast-enhanced spectral mammography (CESM) is considered for breast cancer screening, it is important to understand how its dose compares to other commonly used x-ray modalities. Image reported average glandular dose (AGD) cannot be used to compare between vendors due to the different AGD algorithms employed. Dance et al. have standardized a reproducible method of estimating AGD. Our study used their aproach to compare dosimetry for two x-ray systems (General Electric -GE and Hologic-H) and 5 imaging modes (GE 2D, GE-CESM, H 2D, H Tomo, H Combo).

METHOD AND MATERIALS

Seven breast thicknesses (20-90 mm) were simulated with PMMA slabs and imaged in AEC mode. The reported entrance skin exposure (ESE), AGD, and exposure settings (kVp, mAs, target and filter combination) were recorded. In a separate experiment the exposure settings were then entered in manual mode to measure entrance air kerma (K) and the half value layer (HVL) using a dosimeter. The AGD was estimated using K'*g*c*s*T (where K' is the air kerma corrected to the upper surface of the dosimetry phantom and g, c, s and T are factors determined by Monte Carlo simulations in Dance et al. published work).

RESULTS

The estimated AGD for all 5 imaging modes is shown in Figure 1. GE-2D mode shows the lowest estimated AGD. The GE-CESM (low plus high energy exposures) AGD estimate is slightly above but comparable to the Hologic 2D and Hologic 3D exposures. Hologic Combo mode (2D plus 3D) has the highest AGD estimate at all breast thicknesses.
The range of percent difference in reported and measured ESE, and reported and estimated AGD respectively were: 31.3-56.9% and 22.3-35.4% (GE 2D), 22.0-33.2% and 1.6-22.7% (low energy GE-CESM), 1.4-2% and 2.9-21.4% (high energy GE-CESM), 3-7% and 1.29-18.95% (Hologic 2D), 2.05-4.51% and 3.3-14.65% (Hologic Tomo), 3.35-4.51% and 2.3-17.44% (Hologic Combo Tomo), 6.97-3.18% and 1.1-22.66% (Hologic Combo-2D).

CONCLUSION

Our phantom study demonstrates that GE CESM has an estimated AGD that is comparable to other commonly used x-ray breast cancer screening tools. The differences between the systems' reported and the phantom measured ESE and estimated AGD confirm

that the reported measures should not be used to compare x-ray systems of different vendor .

CLINICAL RELEVANCE/APPLICATION

This study provides phantom validation for AGD appropriateness of GE-CESM for breast cancer screening.

SSE23-06 Automatic Exposure Control using Constant CNR in Digital Radiography

Monday, Nov. 28 3:50PM - 4:00PM Room: S404AB

Participants
Alexander W. Scott II, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Yifang Zhou, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Jessica L. Nute, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Christina M. Lee, BS,ARRT, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To modify the calibration of automatic exposure control in digital radiography from constant exposure index (EI) to constant contrast-to-noise ratio (CNR) and to determine the resulting dose reduction for small or pediatric patients.

METHOD AND MATERIALS

A Philips Optima x-ray unit and Carestream DRX-1C digital detector were used along with phantoms composed of 2-8" of Lucite over an ACR accreditation plate. The plate has targets of decreasing contrast to assess image quality; the third-lowest contrast target (#7) was required to be visualized for ACR radiographic accreditation. The kVp for each Lucite stack was selected based on the detector calibration instructions. Images were acquired for each kVp/Lucite combination using a range of mAs values. The CNR of target #7 was measured using ImageJ by placing an ROI over the target and then drawing an annulus of similar area around the target as background. CNR vs. mAs was fitted using Curve Expert Professional for each kVp/stack combination. For the purpose of making constant CNR exposures, a baseline CNR was determined using the lowest-dose image allowing visualization of target #7 for the 85kVp/5" Lucite combination. The results were then used to back-calculate a mAs and resultant EI for other kVp/sizes to provide an optimal technique.

RESULTS

Baseline CNR was determined to be 0.86 but conservatively set to 1.0 to account for variability in visibility vs. CNR. The back-calculated mAs values corresponding to the baseline CNR at different kVps had uncertainties of 20% - 40%. Compared to the initial phototimer setup for an EI of 1400, the entrance skin exposure (ESE) for the small phantom (2" – 3") would decrease by 60%, the ESE for the medium phantom would be consistent, and the ESE for the large phantom (8") would increase by a factor of 5 – 10.

CONCLUSION

Maintaining constant CNR instead of constant EI when varying patient size would improve image quality for large patients while minimizing dose for small patients (especially important for pediatrics). However, given that the ESE for the 8" and 125 kVp combination would increase from 44 mR to 462 mR, we are currently recommending constant EI for large patients and constant CNR for small patients to save dose.

CLINICAL RELEVANCE/APPLICATION

Recalibration of AEC settings to achieve constant CNR across some patient sizes could be used to reduce unnecessarily high dose in small patients while increasing image quality for large patients.

SSE24

Radiation Oncology (Gastrointestinal)

Monday, Nov. 28 3:00PM - 4:00PM Room: S104A

GI RO OI

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

Participants
Tarita O. Thomas, MD, PhD, Chicago, IL (*Moderator*) Nothing to Disclose
Richard Tuli, MD, PhD, Los Angeles, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSE24-01 Feasibility of Vascular Matching for Pancreatic Stereotactic Body Radiotherapy

Monday, Nov. 28 3:00PM - 3:10PM Room: S104A

Awards
Student Travel Stipend Award

Participants
Subha Perni, New York, NY (*Presenter*) Nothing to Disclose
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Ping Yan, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Theodore Yanagihara, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
David Horowitz, MD, New York, NY (*Abstract Co-Author*) Consultant, Champions Oncology

PURPOSE

Implanted fiducial markers (IFM) and biliary stents are established as targets for image-guidance during stereotactic body RT (SBRT) in treatment of pancreatic adenocarcinoma (PDAC). IFM are well tolerated, but may delay treatment. IFM/stent migration may also cause insufficient target coverage and normal tissue toxicity. This study evaluated vascular matching (VM), IFM and stent matching for image-guidance in delivery of SBRT for PDAC.

METHOD AND MATERIALS

Between April 2011- November 2015, 39 patients received SBRT for PDAC at our institution. Cone beam CT (CBCT) was performed for setup verification. 221 CBCT images were analyzed for setup shifts based on either IFM, stent or celiac and SMA vasculature contoured using Mosaiq, version 2.60 (IMPAC Medical Systems, Inc. Sunnyvale, CA). Kaplan-Meier calculations, analysis of variance, likelihood ratio, and Wilcoxon tests were used to evaluate local control and survival and compare groups.

RESULTS

15 patients were treated with IFM, 9 with stents, and 15 with VM. Waiting times from consult to treatment in the IFM, stent, and VM groups were 24 days (range 2-91 days), 14 days (range 9-56 days), and 19 days (range 5-39 days), respectively. The average magnitude for superior/inferior shifts was 0.45 ± 0.42 mm (IFM), 0.48 ± 0.46 mm (stent), and 0.37 ± 0.33 mm (VM) ($p = 0.24$), lateral shifts 0.42 ± 0.99 mm, 0.29 ± 0.35 mm, and 0.26 ± 0.22 ($p = 0.26$), and anterior/posterior shifts were 0.33 ± 0.40 mm, 0.34 ± 0.28 mm, and 0.37 ± 0.28 mm ($p = 0.70$). Vector magnitudes were 0.85 ± 1.04 mm, 0.74 ± 0.53 mm, and 0.67 ± 0.36 mm, respectively ($p = 0.24$). There were no complications from IFM or stent placement or significant differences in GI toxicities ($p = 0.25$), but there was one Grade 3 toxicity in the stent group. There were no significant differences in tumor resectability ($p = 0.70$), margin status ($p = 0.43$), local control ($p = 0.31$), or overall survival ($p = 0.88$).

CONCLUSION

There was no difference in positional shifts, toxicity, or outcomes for patients planned with implanted fiducial markers, stents, or vascular matching. VM may be preferable over more invasive methods of target localization.

CLINICAL RELEVANCE/APPLICATION

Vascular matching is a feasible, less invasive image-guidance technique that allows for reproducible and convenient SBRT delivery to PDAC and shorter treatment delays.

SSE24-03 Repeat Stereotactic Body Radiation Therapy for Liver Tumors

Monday, Nov. 28 3:20PM - 3:30PM Room: S104A

Awards
Student Travel Stipend Award

Participants
James O. Galle, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose
David Long, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Mark Tann, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Susannah Ellsworth, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
John A. Cox, MD, Carmel, IN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Stereotactic body radiation therapy (SBRT) for liver tumors has high rates of local control (LC) and acceptable toxicity. Some patients develop recurrent hepatic disease and additional SBRT can be considered; however, outcomes after repeat SBRT are not well described.

METHOD AND MATERIALS

383 patients treated with liver SBRT at a single institution from 2006-2016 were reviewed; 16 patients underwent multiple SBRT courses. 7 patients were re-treated for hepatocellular carcinoma (HCC), 1 for cholangiocarcinoma, and 8 for metastases (LM). 2 patients with HCC were excluded; 1 for incomplete radiation plans and 1 who had routine liver transplant after 1 fraction of repeat SBRT without toxicity. 2 patients received a 3rd course of SBRT.

RESULTS

Median dose for patients with primary liver tumors (PLT) was 48 Gray (Gy) / 3 fractions for the 1st SBRT and 40 Gy / 5 fractions for 2nd SBRT, compared to 54 Gy / 3 fractions and 50 Gy / 5 fractions for LM for the 1st and 2nd SBRT, respectively. Median follow up was 18.2 months in living patients. Crude LC for the 1st and 2nd treatment was 78.6% and 85.7%, respectively. For the whole cohort, mean progression free survival (PFS) and overall survival (OS) from the 2nd SBRT were 11.9 and 28.1 months, respectively. PFS was significantly shorter in patients with LM compared to PLTs with median values of 4.3 vs 18.4 months, respectively (p=0.01), but there was no difference in OS between the two groups (median 20.7 vs. 26.6 months, p=0.18). Change in liver volume between the 1st and 2nd SBRT courses was predictive of PFS and OS (p=0.05 and p=0.02, respectively). Median OS in patients with liver volume loss between SBRT courses was 13.1 vs 42.5 months in patients without volume loss (p=0.01, HR 5.17 [0.83-32.37]). 2nd SBRT was well tolerated, but severe liver decompensation was seen in both patients receiving a 3rd SBRT course.

CONCLUSION

A 2nd course of liver SBRT is safe and associated with high LC; however, PFS differs between patients with PLT and LM. Patients with liver volume loss appear to have worse outcomes. Significant toxicity occurred in both patients undergoing a 3rd SBRT. Weaknesses of this study include its retrospective nature and low patient numbers.

CLINICAL RELEVANCE/APPLICATION

Although a 2nd course of liver SBRT appears safe, caution should be used when considering re-treating patients with liver volume loss; more than 2 SBRT courses were not well tolerated.

SSE24-04 The Dosimetric Impact of Inter-fractional Organ-at-Risk Movement during Liver Stereotactic Body Radiation Therapy

Monday, Nov. 28 3:30PM - 3:40PM Room: S104A

Participants
Ryan Schmid, BS, Milwaukee, WI (*Presenter*) Nothing to Disclose
An Tai, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Khalid Ramahi, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Taylor Giordano, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Slade Klawikowski, PhD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
X. A. Li, PhD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Jared R. Robbins, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The use of stereotactic body radiation therapy (SBRT) for treating liver malignancies is increasing. The impact of inter-fractional variation of organs-at-risk (OAR) during SBRT is not well studied. We examine the dose variations due to inter-fractional organ movement in patients treated with liver SBRT.

METHOD AND MATERIALS

Ten subjects treated with liver SBRT were analyzed. Most patients were treated with five fraction regiments with gated treatment delivery. Daily image-guidance with diagnostic quality CT-on-rails imaging was performed prior to each fraction. OARs were delineated on daily CTs including the liver, heart, right kidney, esophagus, stomach, duodenum and large bowel. Contouring and planning was performed using Monaco planning software (Stockholm, Sweden). Dose distribution on each daily CT was generated by templating the original plan to the daily CT using the daily shifts to replicate the daily treatment isocenter. Daily doses to all 7 OARs were recorded including the maximum dose to the 5cc, 3cc, 1cc, 0.3cc and 0.1cc and other clinically relevant metrics.

RESULTS

Although the doses to the OARs varied daily, only one organ in one patient on one day exceeded a clinically relevant threshold for a rate of error <1/300. For all OARs the dose to the liver was most consistent between fractions. For the liver dose parameters, the composite average percent change ranged from -5.92% to 1.2% with standard deviations of 0.11 to 0.74. Doses to the other OARs varied more between fractions depending on the proximity of the OAR to the target volume and organ motion. There were some large variations between the planned and delivered doses with up to two-fold differences for some OARs, but these did not exceed clinically meaningful levels.

CONCLUSION

With our current standard using CT-on-rails and respiratory gating, inter-fractional variations in liver doses were fairly consistent, while more variation was observed for other OARs. While inter-fractional variations of daily dose could be large, it was rarely clinically relevant. Dose accumulation measurement may help further evaluate the clinical significance of these changes, but currently no extra planning parameters seem necessary in most patients and scenarios.

CLINICAL RELEVANCE/APPLICATION

There can be significant inter-fractional variation in radiation doses to OARs during liver SBRT, but in this study the variation did not lead to clinically significant risks to patients.

SSE24-06 Radiotherapy Technique Can Be Important on Survival in Patients with Gastric Cancer Treated with Postoperative ChemoRadiotherapy

Monday, Nov. 28 3:50PM - 4:00PM Room: S104A

Participants
Beyza Sirin Ozdemir, antalya, Turkey (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To investigate the clinical and pathological features and evaluate the survival rate of patients with gastric carcinoma receiving postoperative chemoradiotherapy.Materials/Methods: Two hundred and four patients who have had postoperative chemoradiotherapy for the diagnosis of gastric cancer in our clinic between 1999 and 2014 have been evaluated retrospectively. Clinical prognostic factors affecting survival were studied.Results: One hundred and twenty nine (63%) of the patients were male, 75 (37%) were female and median age was 57 years (range 28-81). According to the stage distribution; 4 (%2) patients were on stage I, 61 (30%) patients were on stage II and 139 (68%) patients were on stage III. Applied surgery type: subtotal gastrectomy on 128 (62,7%) patients and total gastrectomy on 76 (37,3%) patients. Histopathologically, 73% of the patients were adenocarcinoma, 24% were signet-ring cell and 3% were other histopathological diagnosed. Tumor differentiation was evaluated in 197 patients and 11,2% of them were well-differentiated, 33% were moderately differentiated and 55,8% were poorly differentiated. Surgical margin status was positive or close in 33 (16,7%) out of 204 patients. Lymphatic dissection type was D1 on 159 (78%) patients, D2 on 28 (14%) patients; however, it was unknown in 17 (8%) patients. The median number of the dissected lymph node was 16 (range 0-90), which was 10 or less in 63 (31%) patients, more than 10 in 141 (69%) patients. 166 (81,4%) of the patients had lymph node metastasis. 92% of the patients received 5-fluorouracil (5-FU) -based chemotherapy during radiotherapy (RT). Doses of RT ranged from 40 to 54 Gy with a median dose of 46 Gy in 1.8-2 Gy fractions. RT technique was two-dimensional conventional on 98 (48%) patients and three-dimensional conformal RT on 106 (52%) patients. During chemoradiotherapy, it was monitored that 14,3% of the patients had hematologic, 5% of the patients had gastrointestinal grade 3 and more toxicity. The median follow-up was 29 months (range 3-147). The overall survival rates for 2, 5 and 10 years were 52%, 37% and 32% respectively. Stage, lymphatic dissection type (D1 or D2), presence of lymph node metastasis, dissected lymph node number (10 or less) and RT technique (two-dimensional conventional or three-dimensional conformal) have been found as significant prognostic factors in terms of overall survival. The 2, 5 and 10- year progression-free survival rates were 59%, 51% and 46%, respectively. Stage and presence of nodal metastasis are significant prognostic factors of progression-free survival. Conclusion: Postoperative chemoradiotherapy should be considered for all patients with high risk of recurrence after gastrectomy. Beside well-known prognostic factors such as stage, lymph node metastasis, lymphatic dissection type; RT technique was an important prognostic factor in our study. These results suggest that there is a long-term survival benefit for patients treated with three-dimensional conformal radiotherapy.

SSE25

Vascular Interventional (Non-vascular Interventions)

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

CT IR US

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

FDA Discussions may include off-label uses.

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

Sub-Events

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

Monday, Nov. 28 3:00PM - 3:10PM Room: N226

Participants
Michael Olson, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Thomas D. Atwell, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lance A. Mynderse, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Bernard F. King Jr, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Timothy Welch, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Ajit H. Goenka, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

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

Monday, Nov. 28 3:10PM - 3:20PM Room: N226

Awards
Student Travel Stipend Award

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

PURPOSE

Myofascial pelvic pain and spasm are a significant source of morbidity among affected patients, and may be treated with botulinum toxin A (Botox) injection into pelvic floor muscles. Conventional injections are performed by a gynecologist using physical exam landmarks without imaging guidance. CT-guidance of injections may offer benefits due to ability for definitive localization of injections to target. The present study aims to evaluate the safety and efficacy of CT-guided intramuscular injection of Botox for treatment of myofascial pelvic pain.

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

SSE25-03 Portable Ultrasound-Guided High Intensity Focused Ultrasound with 3D Electronic Steering and Targeting Forecast Function: Prospective Clinical Trial for Uterine Fibroids

Monday, Nov. 28 3:20PM - 3:30PM Room: N226

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

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

The volume of treated uterine fibroids ranged from 7.5 cm3 to 274.4 cm3 (mean, 69.8 cm3; SD, 64.3 cm3). Mean NPVR on immediate post-HIFU MR imaging was 74.8 ± 25.2%. Mean FVSR was 17.3 % at 1-month; 33.3 % at 3 months; 44.8% at 5 months; and 43.7% at 1 year after HIFU treatment. Mean time taken to treat was 44.6 ± 28.2 minutes per fibroid and 72.9 ± 31.4 minutes per patient. Uterine fibroid-related symptoms and life quality showed statistically significant improvement after HIFU treatment. For safety issue, no significant symptom or complication occurred.

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

1. A portable ultrasound-guided HIFU device provides 3D electronic steering and targeting forecast function, which is helpful to reduce treatment time and to increase safety.
2. A portable ultrasound-guided HIFU device can effectively and safely treat uterine fibroid in a noninvasive manner
3. Significant number of patients who were treated showed significant volume reduction of treated uterine fibroids and significant symptom improvement.

SSE25-04 Fibroid Treated by MRgFUS: MR-Texture Parameters are Associated with Ablathermy Efficacy

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

Participants
Arnaud Hocquelet, Pessac, France (*Presenter*) Nothing to Disclose
Bauoduin d. Senneville, Talence, France (*Abstract Co-Author*) Nothing to Disclose
Nora Frulio, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Cecile Salut, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Mounir Bouzgarrou, MD, Merignac, France (*Abstract Co-Author*) Nothing to Disclose
Herve Trillaud, MD, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

Heterogeneity of fibroid texture is negatively correlated with MRgFUS efficacy

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

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

Participants
Giovanni Mauri, MD, Milan, Italy (*Presenter*) Consultant, Esaote SpA
Claudio M. Pacella, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Cesareo, Latina, Italy (*Abstract Co-Author*) Nothing to Disclose
Valerio Pasqualini, Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
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Pasquale De Feo, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
G Gambelunghe, Latina, Italy (*Abstract Co-Author*) Nothing to Disclose
Bruno Raggiunti, Perugia, Italy (*Abstract Co-Author*) Nothing to Disclose
Tina Doris, Perugia, Italy (*Abstract Co-Author*) Nothing to Disclose
Maurilio Deandrea, Atri, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Limone, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose
Alberto Mormile, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimo Giusti, Genova, Italy (*Abstract Co-Author*) Nothing to Disclose
Silvia Oddo, Turin, Italy (*Abstract Co-Author*) Nothing to Disclose
G Achille, Genova, Italy (*Abstract Co-Author*) Nothing to Disclose
Enrico Di Stasio, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Irene Misischi, Albano Laziale, Italy (*Abstract Co-Author*) Nothing to Disclose
Enrico Papini, MD, Albano Laziale, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

The mean basal volume of nodules treated with LA and RFA was 21.5±16.5 ml and 24.6±17.9 mL (P= .065) respectively. At 12 months mean nodule volume decreased to 8.0±7.2mL (P< .001) in LA patients and to 9.9±9.5mL (P< .001) in RFA patients. The nodules with basal volume >30 mL have had a percentage volume reduction (PVR) at 12th month significantly higher in LA patients than in RFA patients (-64±16% vs -56±21%, respectively; P= .033). The total energy delivered was significantly higher in RFA patients than in LA ones (64.6±58 vs 5.8±2.7 KJ; P= .001).A total of 138 patients from each group were matched. After this adjustment, mean nodule reduction at 6th and 12th month was -67%±19% vs -57%±21% (P< .001) and -70%±19% vs 62%±22%

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

SSE25-06 Vertebroplasty and Kyphoplasty Outcomes in Spinal Metastatic Osseous Lesions: A Systematic Review and Meta-Analysis

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

Awards
Student Travel Stipend Award

Participants
Karan N. Patel, MD, Detroit, MI (*Presenter*) Nothing to Disclose
Haiying Yu, MD,PhD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Mark Le, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Aravind N. Mohandas, MD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Hiren Rangunwala, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Monte L. Harvill, MD, Franklin, MI (*Abstract Co-Author*) Nothing to Disclose
Jeffrey J. Critchfield, MD, Royal Oak, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

10 published studies on KP and 3 published studies on VP for metastatic spine lesions met the inclusion criteria, representing 342 patients undergoing VP and KP at various levels of the spine with most common treated level being the thoracic spine. No significant difference in the cement leaks (p=0.35) and incidence of perioperative complication (p=0.77) was noted between the KP and VP groups. KP group showed significant reduction in the VAS by postoperative day 1-3 (p=0.0002) and by posoperative month 0.5-3 (p<0.0001). Within the KP group, significant decrease in Oswestry Disability Index from baseline was observed by postoperative day 1-3 and by postoperative month 0.5-3.

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

KP is more effective in providing pain relief as early as postoperative day 1-3, improving patient's functional status for up to a year postoperatively without an increase in cement leaks/perioperative complications in comparison to VP.

MSAS24

Reconfiguring Imaging Services for an Electronic World (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Monday, Nov. 28 3:30PM - 5:00PM Room: S105AB

LM

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

Participants
Morris A. Stein, BArch, Phoenix, AZ (*Moderator*) Nothing to Disclose
William A. Undie, PhD, RT, Houston, TX (*Moderator*) Nothing to Disclose
Steven L. Venable, Houston, TX, (svenable@mdanderson.org) (*Presenter*) Nothing to Disclose
Richard Rucksdashel, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Evaluate the patients' and staff's expectations of new technologies, facility design, process flow and improved convenience in the efficient delivery of patient care. 2) Tie the operational strategy to the strategic planning of the organization and a patient centric care delivery model. Evaluate the impact and importance of staff satisfaction on patient satisfaction. 3) Appraise different technologies, such as smartphones, www access, and modeling software to configure imaging services and facility design to new delivery methods of imaging services.

ABSTRACT

Patients and staff are able to purchase books, groceries, dinner and conduct their financial business from virtually any location at any time of day. This course focuses on the technologies and implementations to drive a patient centric imaging services model in a world where the patients and caregivers participate in an Electronic World. Appraisal of simulation modeling for workflow analysis and facility design validation, application of tablet and smartphone technologies for data management for the patient and caregiver will be reviewed. The course will comprise an examination of how leveraging the technologies and practice associated with the Electronic World can be used to enhance patient safety, patient and staff satisfaction and delivery of imaging services.

MSCT22

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

Monday, Nov. 28 3:30PM - 5:00PM Room: S100AB

CH

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

Participants
Diana Litmanovich, MD, Haifa, Israel, (dlitmano@bidmc.harvard.edu) (*Director*) Nothing to Disclose

Sub-Events

MSCT22A Airway Disorders

Participants
Diana Litmanovich, MD, Haifa, Israel, (dlitmano@bidmc.harvard.edu) (*Presenter*) Nothing to Disclose

MSCT22B Post-surgical Thoracic Disorders

Participants
Jo-Anne O. Shepard, MD, Boston, MA, (jshepard@partners.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The radiologist will be familiar with the expected and unexpected appearance in patients following thoracic surgical procedures.
2) The radiologist will be able to identify specific complications on chest radiography and CT in the post-operative patient.

ABSTRACT

1.Understand the expected post-operative appearance of commonly performed thoracic surgical procedures.2. Be familiar with unexpected complications following thoracic surgical procedures and recognize their imaging features.3. Apply knowledge of complications learned to clinical practice.

MSCT22C Non-Traumatic Emergencies of the Thorax

Participants
Jeffrey P. Kanne, MD, Madison, WI, (kanne@wisc.edu) (*Presenter*) Research Consultant, PAREXEL International Corporation; Advisory Board, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES

1) Identify chest radiographic findings associated with acute non-traumatic thoracic emergencies. 2) Define the role of CT in the evaluation of non-traumatic thoracic emergencies. 3) Describe the CT findings of acute aortic syndrome.

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/

Jeffrey P. Kanne, MD - 2012 Honored Educator
Jeffrey P. Kanne, MD - 2013 Honored Educator

MSMC24

Cardiac CT Mentored Case Review: Part IV (In Conjunction with the North American Society for Cardiovascular Imaging) (An Interactive Session)

Monday, Nov. 28 3:30PM - 5:30PM Room: S406A

CA CT

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.00

Participants
Jill E. Jacobs, MD, New York, NY (*Director*) Nothing to Disclose
David A. Bluemke, MD, PhD, Bethesda, MD (*Moderator*) Research support, Siemens AG
Vincent B. Ho, MD,MBA, Bethesda, MD (*Moderator*) In-kind support, General Electric Company

LEARNING OBJECTIVES

1) To understand the clinical indications for retrospective ECG gated cardiac CT. 2) To illustrate methods to assess myocardial function from cine cardiac CT images. 3) To illustrate methods to assess normal and abnormal valvular function from cine cardiac CT images.

ABSTRACT

The mentored case review provides the opportunity for the attendees to learn the image acquistion, post-processing, and diagnosis for a wide variety of cardiac diseases commonly encountered in CT.

Sub-Events

MSMC24A Coronary Artery Disease and Incidental Noncardiac Findings

Participants
Karin E. Dill, MD, Evanston, IL, (karin.dill@umassmemorial.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

ABSTRACT

CT Angiography (CTA) is a guideline endorsed strategy to assess symptomatic patients with low to intermediate risk of coronary artery disease in both the non-emergent and emergent settings. Coronary CTA uses ECG gating to freeze cardiac motion and enables assessment of the lumen for stenosis. Coronary CTA has a high negative predictive value, but suffers when a lesion is detected with a moderate stenosis. Emerging CT methods are also exploring the role of CT to assess individual lesions, including ones that have been problematic, for hemodynamic significance. The clinical relevance relates to the fact that only lesions that are hemodynamically significant should undergo intervention, for example with balloon angioplasty and stenting. In addition, each coronary CTA should include images reconstructed "skin to skin" over the entire craniocaudal field of view that encompasses the heart. Thus, incidental lesions can and should be reported for all coronary CTA studies.

MSMC24B Congenital Heart Disease

Participants
Dianna M. Bardo, MD, Phoenix, AZ, (dbardo@phoenixchildrens.com) (*Presenter*) Speaker, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Author, Thieme Medical Publishers, Inc

LEARNING OBJECTIVES

1) Recognize the most common congenital heart disease (CHD) findings found in adults with unsuspected CHD. 2) Recognize and understand findings of CHD in patients with known CHD and the findings which may trigger surgical intervention. 3) Recognize the CT findings of commonly performed surgical procedures for palliation of CHD. 4) Develop an organized pattern for search and reporting of CHD findings. 5) Understand why CT is chosen as the advanced imaging modality over MR.

ABSTRACT

Adults with congenital heart disease (CHD) now outnumber children with CHD two to one. This phenomenon is due to the success of surgical palliation and medical management of patients with even the most severe forms of CHD. Surgical intervention is often performed at the time of diagnosis and in patients with residual hemodynamic lesions is often required throughout life. Though echocardiography is typically the initial imaging modality of choice, diagnosis and imaging surveillance of complex hemodynamic and anatomic CHD lesions is now most often accomplished with CT and MR. CT and CTA imaging techniques may be used to show detailed anatomic and functional images of the heart, postoperative changes and long term consequences of CHD.An organized, reproducible approach to identify cardiac anatomy of CHD lesions and surgical palliation should be adopted in order to accurately and thoroughly describe findings.

Active Handout:Dianna M. Ehrhart Bardo

http://abstract.rsna.org/uploads/2016/9001152/ACTIVE MSMC24B.pdf

MSMC24C Coronary Atherosclerosis and Bypass Grafts

Participants
Gautham P. Reddy, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify focal areas of stenosis in the coronary arteries on CT. 2) Describe the appearance of bypass graft stenosis on coronary CT. 3) Review the diagnosis of aneurysms in the native coronary arteries and in bypass grafts.

ABSTRACT

Honored Educators

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Gautham P. Reddy, MD - 2014 Honored Educator

MSMI24

Molecular Imaging Symposium: Teaching Residents and Their Teachers about Molecular Imaging with Cases: Has the Time Come?

Monday, Nov. 28 3:30PM - 5:00PM Room: S405AB

MI ED

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

FDA Discussions may include off-label uses.

Participants
Vikas Kundra, MD, PhD, Houston, TX, (vkundra@mdanderson.org) (*Moderator*) License agreement, Introgen Therapeutics, Inc
Jeffrey T. Yap, PhD, Salt Lake City, UT (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify molecular imaging. 2) Comprehend the basis of aspects of molecular imaging. 3) Describe molecular imaging performed in a radiology setting.

ABSTRACT

This course will describe molecular imaging, identify the mechanisms of some aspects of molecular imaging, and give examples of molecular imaging in oncology. Cases will include those from current practice. Mechanisms and scientific basis of examples will be discussed. Sample applications will be discussed and illustrated. Translational examples, including those that have good potential for clinical application, will be used to illustrate interesting aspects of molecular imaging in oncology.

Sub-Events

MSMI24A Oncology

Participants
Vikas Kundra, MD, PhD, Houston, TX, (vkundra@mdanderson.org) (*Presenter*) License agreement, Introgen Therapeutics, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

MSMI24B Neurology

Participants
Rathan M. Subramaniam, MD, PhD, Dallas, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

MSMI24C Cardiology

Participants
Robert J. Gropler, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify molecular imaging for CV disease. 2) Describe CV molecular imaging performed in a radiology setting

ABSTRACT

MSMI24D Vascular Inflammation

Participants
Chun Yuan, PhD, Seattle, WA (*Presenter*) Research Grant, Koninklijke Philips NV; ;

LEARNING OBJECTIVES

1) Explain the basic pathophysiology of vascular inflammation and needs for imaging. 2) Learn the basic imaging approaches for vascular inflammation, quantitative measurements, and their clinical and research applications. 3) Discuss challenges and future directions.

ABSTRACT

MSMI24E Instrumentation

Participants

Jeffrey T. Yap, PhD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

RCA25

Learning and Using the Open Source MIRC Teaching File System (Hands-on)

Monday, Nov. 28 4:30PM - 6:00PM Room: S401AB

IN

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

Participants
Michael R. Cline, MD, Ann Arbor, MI, (micline@med.umich.edu) (*Presenter*) Nothing to Disclose
Andre M. Pereira, MD, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the features of the RSNA's MIRC software for teaching files. 2) Learn how to download and install the software.
3) Learn to use the RSNA MIRC Wiki to obtain documentation on the software.

ABSTRACT

MIRC (Medical Imaging Resource Center) or TFS (Teaching File System) is a component of RSNA's CTP (Clinical Trials Processor), a suite of tools developed by RSNA to optimize research in radiology mainly with emphasis on workflow and security of patient information. It is offered free of charge by RSNA.
Simply put, MIRC can be used to build a radiology teaching file, be it for an individual of for an institution with many simultaneous users.
Development started in 2000 and the project has been kept alive along the years, funded by RSNA, with great support both from RSNA and from the community of users.
Installation is very streamlined and available for virtually all plataforms and operational systems. All files necessary for installation are available at the download session of RSNA's own MIRC server (http://mirc.rsna.org).
This course is aimed to cover basic and some advanced authoring tools.
After finishing this course the attendee will be proficient in authoring and uploading cases, and also be familiar with the resources for installation and administration of MIRC.

Active Handout:Andre Martins Pereira

http://abstract.rsna.org/uploads/2016/16005101/ACTIVE RCA25 MIRC_handout_2016_b.pdf

RCB25

Intro to Texture Analysis (Hands-on)

Monday, Nov. 28 4:30PM - 6:00PM Room: S401CD

IN

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

Participants
Luciano M. Prevedello, MD, MPH, Dublin, OH (*Presenter*) Nothing to Disclose
Barbaros S. Erdal, PhD, Columbus, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn what image texture analysis is and recognize some of its applications in Radiology through practical examples.2) Understand how to extract imaging texture features from various imaging modalities. 3) Learn how to visualize and analyze results.

ABSTRACT

During this course, an introduction to image texture analysis will be provided through hands on examples. Participants will interact with open source as well as freely available commercial platforms in order to achieve tasks such as segmentation, registration and image feature extraction. Imaging samples will include both 2D and 3D datasets from a variety of anatomical regions and modalities (CT, MR). First, a brief generic introduction will be given and concepts related to algorithm development will be discussed. Participants will then be exposed to DICOM and various visible light based formats. After hands on exercises on texture extraction, visualization of results will be covered. Finally, various quantization methods for storage and analysis will be presented.

RCC25

Mission Critical: How to Increase Your Value By Mastering the Intersection of Quality Improvement and Informatics

Monday, Nov. 28 4:30PM - 6:00PM Room: S501ABC

IN SQ

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

Participants
Richard E. Sharpe JR, MD, MBA, Denver, CO, (RichSharpeJr@gmail.com) (*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.

ABSTRACT

Sub-Events

RCC25A Using Information Systems to Facilitate Improvement While Keeping Your People Engaged

Participants
David B. Larson, MD, MBA, Los Altos, CA (*Presenter*) License agreement, Bayer AG; Potential royalties, Bayer AG

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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David B. Larson, MD, MBA - 2014 Honored Educator

RCC25B 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, (spatel@rad-inc.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Informatics tools can enhance the ability of radiologists to increase the value they provide to patients, referring providers, and administrators. Participants will 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/2016/16005040/RCC25B RSNA 2016-SPATEL MD (1).pdf

RCC25C Examples of Informatics Quality Project Successes and Future Opportunities

Participants
Alex Towbin, MD, Cincinnati, OH, (alexander.towbin@cchmc.org) (*Presenter*) Author, Reed Elsevier; Grant, Guerbet SA; Grant, Siemens AG;

LEARNING OBJECTIVES

At the complation of this talk, attendees should be able to:1. describe how informatics tools can be used to drive quality improvement projects2. give 3 examples of quality improvement projects enhanced by informatics

ABSTRACT

Honored Educators

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Alex Towbin, MD - 2014 Honored Educator

RCC25D How to Create a Culture of Continuous Quality Improvement Using Existing and Free Resources

Participants
Richard E. Sharpe JR, MD, MBA, Denver, CO, (RichSharpeJr@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

Radiologists are the key quality improvement resource in many radiology groups. 1) Learn how to empower radiologists to lead performance, interpretation and system improvements, and 2) Create a culture of continuous quality improvement using existing or available free resources.

ABSTRACT

SPDL21

RSNA Diagnosis Live™: Chest and Abdomen

Monday, Nov. 28 4:30PM - 6:00PM Room: E451B

CH GI

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

Participants

Paul J. Chang, MD, Chicago, IL (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Advisory Board, Bayer AG
Neety Panu, MD, FRCPC, Thunder Bay, ON (*Presenter*) Nothing to Disclose
Gregory L. Katzman, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

ABSTRACT

URL

SPSI21

Special Interest Session: Global Medical Radiation Campaigns: Image Gently, Image Wisely and EuroSafe: Is All This Still Necessary?

Monday, Nov. 28 4:30PM - 6:00PM Room: N226

SQ

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

Participants
William W. Mayo-Smith, MD, Boston, MA (*Presenter*) Author with royalties, Reed Elsevier; Author with royalties, Cambridge University Press
Donald P. Frush, MD, Durham, NC, (donald.frush@duke.edu) (*Presenter*) Nothing to Disclose
Guy Frija, MD, Paris, France, (guy.frija@aphp.fr) (*Presenter*) Nothing to Disclose
Kalpana M. Kanal, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review continuing need for educational campaigns; Suggest tips for organizational success. 2) Report on the Dose index registry. 3) Describe challenges and controversies. 4) Impact to date.

ABSTRACT

SPSI22

Special Interest Session: A New Model of Patient Care: Value over Volume-a RAD Talk

Monday, Nov. 28 4:30PM - 6:00PM Room: E353B

LM OT

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

Participants
Mary C. Mahoney, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose
Christine Zars, MS, Saint Charles, IL (*Presenter*) Nothing to Disclose
Jennifer L. Kemp, MD, Denver, CO, (jkemp@divrad.com) (*Presenter*) Nothing to Disclose
James V. Rawson, MD, Augusta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the mission and goals of RSNA's Radiology Cares: The Art of Patient-centered Practice and ACR's Imaging 3.0 campaigns. 2) To assess your radiology practice model and realign it to focus on value over volume. 3) To learn tactics to put the concepts of patient-centeredness and value vs. volume into practice. 4) To understand your patients' perspectives as they navigate through the healthcare continuum, especially as it relates to radiology.

ABSTRACT

In many healthcare facilities and institutions, the culture and actual practice of radiology have marginalized the patient. Today the call to practice patient-centered care is one of the primary drivers of change within the radiology community. The benefits include improved patient care, improved communication between radiologists and their patients and referring physicians, and greater awareness of the essential role that radiologists play in patients' overall healthcare. The RSNA's Radiology Cares and ACR's Imaging 3.0 campaigns were launched to provide tools to move the radiology profession to focus on patient-centeredness and to help transform the way radiology is practiced. This session, presented in the style of a TED Talk, will offer insights into the radiology patient mindset and describe tools to bring the concept of patient-centeredness into practice.

URL

SPSI23

Special Interest Session: Imaging Cognition 2016: Psychosis

Monday, Nov. 28 4:30PM - 6:00PM Room: E350

NR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: .75

Participants
David B. Hackney, MD, Boston, MA (*Moderator*) Nothing to Disclose
Leo P. Sugrue, MD, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the clinical features of psychosis and schizophrenia. 2) Describe the biological abnormalities that underlie psychosis and schizophrenia. 3) Identify the primary imaging methods and results that distinguish psychosis and schizophrenia from normal controls. 4) Assess the role of imaging in evaluation of patients with psychosis with particular emphasis on those with first episode schizophrenia.

Sub-Events

SPSI23A Classical Psychiatry of Schizophrenia

Participants
Matcheri S. Keshavan, MD, Boston, MA, (mkeshava@bidmc.harvard.edu) (*Presenter*) I was a one time consultant to Forum Pharmaceuticals to give a presentation on cognitive remediation in schizophrenia

LEARNING OBJECTIVES

At the end of the presentation, participants will1. be able to list the key clinical features of schizophrenia, and its outcome and natural course.2, able to outline the current understandng of the pathophysiology of this illness.3.

ABSTRACT

Schizophrenia is a commin, highly disabling disorder that affects about 1% of the general population. Onset of symptoms is typically in adolescence or early adulthood. Classic symptoms include positive symptoms (delusions, hallucinations and thought disorder) and negative symptoms (such as amotivation, asociality and affective blunting). The disease is characterized by a premorbid phase extending back to childhood, followed prodromal attenuated positive and negative symptoms beginning in adulthood, a florid psychotic phase and then a chronic phase. We do not have a clear idea about the pathophysiology, though brain structural and functional alterations,, and dopaminergic aberrations are clearly involved. Outcome is heterogeneous. Treatment currently is still driven by dopamine blochers and psychotherapy aimed at support, cognitive restructuring and rehabilitation.

URL

SPSI23B Biological Psychiatry of Schizophrenia

Participants
Godfrey Pearlson, MD, Hartford, CT (*Presenter*) Consultant, Astellas Group

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI23C Advanced Imaging of Schizophrenia

Participants
Martha Shenton, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Clinical questions often cannot be answered until new imaging techniques become available. This has certainly been the case in schizophrenia and mild traumatic brain injury (mTBI), where both disorders evince subtle brain alterations not detected using conventional imaging techniques. Inroads to understanding the neuropathology thus had to await more advanced imaging tools. Here we review findings derived from advanced neuroimaging and post-processing techniques. A different approach that approximates precision medicine is also reviewed where subject-specific brain alterations are demonstrated in mTBI, although this approach can be applied to any disorder where group analyses may fail when there is heterogeneity across individuals, as in mTBI where injuries are in different locations in the brain. Examples of the application of these tools, including compression algorithms to cut down time in the magnet, while still obtaining the same quality of data, and extracellular free water, a diffusion MRI measure that is likely a putative marker of neuroinflammation, are reviewed as are new applications of PET to understand possible early indicators of chronic traumatic encephalopathy (CTE) in living former National Football Players with clinical symptoms but no radiological evidence of CTE at this time. Of note, imaging modalities such as diffusion MRI were not used in research studies of mTBI until 2002. There is also a need to standardize these measures so that they can be used more effectively in the clinic. We conclude with what we believe advanced neuroimaging techniques may offer the clinician if we can test these approaches in the clinic.

Active Handout:Martha Shenton

http://abstract.rsna.org/uploads/2016/16019873/ACTIVE SPSI23C Shenton-RSNA-NOV-28-2016.pdf

SPSI23D Current and Emerging Clinical Radiology of Schizophrenia

Participants
Qiyong Gong, MD, PhD, Chengdu, China, (qiyonggong@hmrrc.org.cn) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the role of the emerging psychoradiology for investigating the mental disorders. 2) Specify the psychoradiological approaches for obtaining 'radiological signs' (imaging biomarkers) for schizophrenia. 3) Assess the technical and methodological developments of psychiatric MR which have promise of imminent clinical utility for schizophrenia patients.

ABSTRACT

ABSTRACT

Schizophrenia is one of the most disabling mental disorder. The question of whether there are significant changes in brain anatomy and function at illness onset and over the early course of schizophrenia is a crucial issue with broad implications for prognosis, patient care, and models of illness pathophysiology. However, the major obstacle to its effective diagnosis and treatment has been our poor understanding of the underlying neuropsychopathology and, particularly the lack of biomarkers for diagnosis, prognosis and risk prediction. Advanced psychoradiological techniques allows noninvasive investigation of brain structure and function in vivo and is increasingly playing an important role in the study of schizophrenia. Technically, the psychoradiological development such as multi-modal MR imaging has allowed quantification of brain tissue at the structural, functional and molecular levels. Using high-field MR imaging (i.e., 3.0 Tesla MR), the structural and functional correlates of a number of mental disorders have been identified. Taking advantage of novel approaches and techniques for the acquisition and analysis of MR imaging data, several clinical studies have revealed imaging biomarkers in populations that are at high risk for developing schizophrenia and diagnostic biomarkers as well as underlying pathological mechanisms. The results not only support the current focuses on biological investigation of mental disorders advocated by the U.S. National Institute of Mental Health's Research Domain Criteria (RDoC) but also provide the first step toward the translational use of psycho radiological discoveries for diagnosis, prediction of treatment response, and monitoring of therapeutic effects.For example, multi-modal MR imaging studies of treatment-naive first-episode schizophrenia patients gave us the opportunity to examine the fundamental psychopathologies caused by the disease, irrespective of the medications. Both short-term and long-term effects of antipsychotic treatment on a patient's brain can be observed based on the connectivity analysis of the resting state fMRI data. However, the elevated prefrontal brain connectivity in schizophrenia patients appears to be a robust biomarker associated with the clinical severity of the disorder, in contrast to the results from other studies. Available evidence further indicates that 1) regionally dissociated functional and structural brain changes are already present at the onset of schizophrenia and can predict clinical outcome; 2) starting antipsychotic treatment leads to acute changes in brain anatomy and function; and 3) alterations seen in first-episode patients are different from those observed in chronic patients, and there is preliminary evidence for progressive brain changes in longitudinal studies. While current longitudinal studies of first-episode schizophrenia patients are far from characterizing changes over the full course of the disorder, these studies are providing a new understanding of dynamic changes in neural networks related to acute episodes of illness and illness progression effects in a dynamic manner. In time, a systematic understanding of these issues may provide objective methods for improved differential diagnosis based on biologically defined subgroups of patients with psychotic disorders.In summary, "psycho-radiological" (i.e., psychiatric imaging) research allows us to obtain various objective "radiological signs" (i.e., imaging biomarkers) of schizophrenia, which could be used in a clinical context similar to the current methods that neuroradiologists use to manage neurological diseases. These results may represent an initial step toward the use of "psycho-radiological" findings to inform early clinical diagnosis as well as effective treatment for patients with schizophrenia. In particular, the development of novel quantitative MRI (qMRI) methods such as macromolecular tissue volume estimation and Magnetic Resonance Fingerprinting, if validated clinically, will expedite the translation of "psycho-radiological" discoveries into clinical care of patients with schizophrenia.**Acknowledgments**: Studies at the West China Hospital of Sichuan University in Chengdu were supported mainly by the National Natural Science Foundation of China (Grant Nos. 81030027 and 81220108013). Dr. Gong also acknowledges his Visiting Adjunct Professor appointment in the Department of Radiology at the University of Illinois Hospital & Health Sciences System and the Department of Psychiatry at the Yale School of Medicine, Yale University, USA.**References**: Gong QY, He Y (2015). Depression, Neuroimaging and Connectomics: A Selective Overview. Biological Psychiatry, 77 (3), 223-35. Gong Q, Lui S, & Sweeney JA (2016). A selective review of cerebral abnormalities in patients with frst-episode schizophrenia before and after treatment. American Journal of Psychiatry,173(3):232-43【Invited Review】highlighted by ajp Podcast. ajp.psychiatryonline.org Lui S, Zhou XJ, Sweeney J, Gong QY. Psychoradiology: The Frontier of Neuroimaging in Psychiatry. Radiology, In press. [Presented in part by Dr Gong as the NIBIB New Horizons Lecture at the 2015 ISMRM Annual Meeting & Exhibition]

URL

1. URL: http://www.hmrrc.org.cn2. Biography: http://www.hmrrc.org.cn/gongqy3. Online Links of the Most Recent Peer-Reviewed Publications of Dr Qiyong Gong: *Google Scholar:* http://scholar.google.com/citations?user=u8RcQKAAAAAJ *Research Gate:* https://www.researchgate.net/profile/Qiyong_Gong/publications/ *Frontiers*: http://www.frontiersin.org/people/QiyongGong/90082/publications

Active Handout:Qiyong Gong

http://abstract.rsna.org/uploads/2016/16019874/ACTIVE SPSI23D.pdf

SPSI23E Panel Discussion: Role of Imaging in Research, Clinical Trials, and Clinical Care with and Emphasis on the First Episode

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI24

Special Interest Session: Translating Quantitative Imaging from Academia to the Practice of Precision Medicine

Monday, Nov. 28 4:30PM - 6:00PM Room: E351

BQ

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

Participants
Edward F. Jackson, PhD, Madison, WI (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of QIBA in the translation of quantitative imaging applications from academia to the practice of precision medicine. 2) Understand the QIBA process and the underlying metrological approaches. 3) Appreciate the key deliverables of the QIBA process with regard to standardization of quantitative image biomarkers. 4) Appreciate how QIBA is contributing to the documentation of the value of quantitative imaging and its necessity in the practice of precision medicine.

LEARNING OBJECTIVES

1) Understand the role of QIBA in the translation of quantitative imaging applications from academia to the practice of precision medicine. 2) Understand the QIBA Process and the underlying metrological approaches. 3) Appreciate the key deliverables of the QIBA process with regard to standardization of quantitative imaging biomarkers. 4) Appreciate how QIBA is contributing to the documentation of the value of the quantitative imaging and its necessity in the practice of precision medicine.

Sub-Events

SPSI24A An Overview of QIBA

Participants
Edward F. Jackson, PhD, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

SPSI24B An Introduction to the QIBA Process and Metrology

Participants
Kevin O'Donnell, Pacifica, CA (*Presenter*) Employee, Toshiba Corporation;

LEARNING OBJECTIVES

View learning objectives under the main course title.

SPSI24C QIBA Deliverables: Science and Process

Participants
Paul E. Kinahan, PhD, Seattle, WA (*Presenter*) Research Grant, General Electric Company; Co-founder, PET/X LLC

LEARNING OBJECTIVES

View learning objectives under the main course title.

SPSI24D The Road Ahead: The Role of QIBA in Demonstrating the Value of Quantitative Imaging

Participants
Daniel C. Sullivan, MD, Durham, NC, (daniel.sullivan@duke.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the future activities that RSNA and other imaging-related organizations plan to help move the profession of radiology from a primarily qualitative interpretation paradigm to a more quantitative-based interpretation model. 2) Understand why extracting objective measurements from clinical scans is increasingly necessary for quality assurance activities in radiology and for the development of decision-support tools. 3) Describe why measurements from imaging scans are necessary for the development of therapies for many chronic diseases. 4) List several measurements from imaging scans that are needed in clinical practice.

URL

http://www.rsna.org/QIBA/

SPSI25

Special Interest Session: Quality, Clinical Care and Effectiveness in Image-Guided Therapy: Do It Right, First Time, Every Time

Monday, Nov. 28 4:30PM - 6:00PM Room: S404AB

IR SQ

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

Participants

LEARNING OBJECTIVES

1) To understand the importance of interventional oncologists assuming primary clinical responsibility for their patients, and of their appropriate participation in multidisciplinary care. 2) To learn the concept of scope of quality assurance in procedural disciplines (such as interventional oncology and radiation oncology. 3) To appreciate the importance of patient-reported outcomes in oncology. To understand how safety checklists reduce morbidity and mortality in procedural discipline.

LEARNING OBJECTIVES

1) To understand the importance of interventional oncologists assuming primary clinical responsibility for their patients, and of their appropriate participation in multidisciplinary care. 2) To learn the concept and scope of quality assurance in procedural disciplines (such as interventional oncology and radiation oncology) and outline the first global framework of quality assurance in interventional oncology. 3) To appreciate the importance of patient-reported outcomes in oncology. To understand how safety checklists reduce morbidity and mortality in procedural disciplines.

Sub-Events

SPSI25A Clinical Practice and Patient Pathways in Interventional Oncology: Care for the Patient, Not Just the Tumor

Participants
Andreas Adam, MD, London, United Kingdom, (andy.adam@kcl.ac.uk) (*Presenter*) Institutional research support, Boston Scientific Corporation; Institutional research support, Siemens AG; Institutional research support, Medtronic, Inc

LEARNING OBJECTIVES

1) To understand the importance of interventional oncologists assuming primary clinical responsibility for their patients, and of their appropriate participation in multidisciplinary care. 2) To learn the concept and scope of quality assurance in procedural disciplines (such as interventional oncology and radiation oncology) and to outline the first global framework of quality assurance in interventional oncology. 3) To appreciate the importance of patient-reported outcomes in oncology. To understand how safety checklists reduce morbidity and mortality in procedural disciplines.

ABSTRACT

Multidisciplinary teams are the standard of care in oncology, and interventional radiologists need to be an integral part of these teams. Decisions about patient management, and patient pathways, are often considered at multidisciplinary meetings. Oncologists, surgeons, gastroenterologists and other specialists are present at multidisciplinary meetings. Radiologists are usually involved in the presentation of images but interventional radiologist are often not included, and do not take an active part in the decision-making process. This needs to change.Cancers are getting smaller. Modern imaging can demonstrate tumours 5 mm in size and soon even smaller lesions will be detectable. Small-volume, paucilesional, solid organ disease will fall increasingly within the remit of image-guided therapy. Randomised studies in interventional radiology face significant challenges, including changing chemotherapy regiments, cross over between treatment arms, and difficulties with randomisation.Professor Michael Rawlings, who was the chairman of the National Institute for Clinical Excellence in 2008 said in his Harveian Oration. Randomised controlled trials are not always appropriate. Randomised comparisons between surgery and thermal ablation in patients with colorectal liver metastasis have been tried and been abandoned because of lack of recruitment. Perhaps it is time to accept that such studies will never be carried out and that, if they ever are performed, they may not be valid comparisons.Large-scale, good-quality registries will help us in our decision-making. We should make sure that interventional radiologists are represented in multidisciplinary teams in their capacity is interventionists and not as imagers. And when they are there, they should take an active part in decision-making, taking into consideration pathways suggested by consensus panels of experts.Specialists from various disciplines should discuss each case in detail and decisions should be based on the available expertise. This may be intellectually less satisfying and a cause of frustration to those unfamiliar with the complexities and difficulties of the practical disciplines such as interventional oncology but are more likely to serve the best interests of patients. The Quality Assurance system for interventional oncology developed by CIRSE will make a significant contribution this area by ensuring that all aspects of care and delivered to a high standard.Evolving technologies are a fact of life interventional oncology. There are no smart pathways that can be used in every case. There are only smart doctors, and smart patients who are appropriately advised by them.

URL

SPSI25B Quality Assurance in Interventional Oncology: It's Not Just About the Kit

Participants
Lizbeth Kenny, MD, FRANZCR, Herston, Australia (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

In acknowledgement of the overwhelming importance of standards of practice and their ultimate incorporation into a quality assurance program, CIRSE has developed a set of practice standards for Interventional Oncology. The Standards follow the entire care pathway for patients undergoing interventional cancer procedures. They will support safe quality care for patients and will also act as a basis on which interventional oncologists can work with facilities to improve the infrastructure and processes required for their teams to practice effectively. There are 14 Standards, broadly divided into three areas. and each follows a standard format:
1. Facility management (7 standards)
2. Treatment planning and delivery (3 standards)
3. Safety and quality management (4 standards)
There is a consistent format for each Standard includes:
i Description of the Standards that refer to a corresponding goal or outcome.
ii Criteria that describe the key processes required to attain that goal.
iii A commentary provides information to give background to how a criterion applies in everyday practice.
iv The required evidence that documents the records the facility needs to be able to provide to demonstrate compliance with the Standards. These draft Standards will be available on the CIRSE website and will be piloted in a number of interventional oncology practices within Europe during the second half of 2016.

SPSI25C Patient Reported Outcomes: Living Longer Is Not the Only Yardstick

Participants
Anthony L. Zietman, MD, Boston, MA, (azietman@partners.org) (*Presenter*) Editor, Reed Elsevier

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

SPSI26

Special Interest Session: How Radiologists Can Improve Mammography Screening in the U.S.-Get Organized

Monday, Nov. 28 4:30PM - 6:00PM Room: S402AB

BR DM SQ

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

Participants

LEARNING OBJECTIVES

1) Describe opportunities for improved adherence with regular breast cancer screening through systems and partnerships with referring physicians. 2) Describe the importance of assessment of mammography interpretative skills and regular feedback on performance to improve the overall accuracy of mammography. 3) State the shortcomings in current assessment of breast cancer risk and how breast cancer screening facilities can insure accurate risk assessment for all patients.

Sub-Events

SPSI26A Introduction

Participants
Robert A. Smith, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI26B Improving Adherence to Breast Cancer Screening Using a Systems-based Approach in a Primary Care Network

Participants
Steven J. Atlas, MD, MPH, Boston, MA, (satlas@mgh.harvard.edu) (*Presenter*) Editor with royalties, UpToDate, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout:Steven J. Atlas

http://abstract.rsna.org/uploads/2016/16044138/ACTIVE SPSI26B RSNA 2016 Presentation - Atlas.pdf

SPSI26C State of the Art (and Feasible!) Risk Assessment in a Breast Imaging Center

Participants
Mary Freivogel, Greenwood Village, CO, (mary.freivogel@riaco.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI26D Assessing and Improving the Interpretation of Mammography Images

Participants
Matthew G. Wallis, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Evaluation of screening has to encompass both population level outcomes as well as individual practitioner performance. To alter (improve) performance feedback needs to be tailored, educationally focused and bench marked against peers. Radiologists want to do the best for their patients and have a competitive nature so the key to delivering change is to allow individuals to understand their performance. This requires dedicated data collection with the emphasis on data completeness and interpretive skills to translate numbers in to intelligent information.The ability to determine sensitivity is key to looking at population performance but this requires accurate and timely data linkage to Cancer Registries with comprehensive coverage which is far from straight forward. In lieu of this a great deal of information can be obtained from 3 figures: number screened, number recalled and number of cancers found but for any form of statistical stability this requires a minimum number of women to be screened every year (probably at least 3,000).When comparing individuals or services within a national programmes or individual countries simple cancer detection can be very misleading without taking in to account the characteristics of the programme and the background population and I will argue for the development of age standardised, expected invasive cancer detection rates. I will illustrate my talk with examples from the UK programme and show how regular audit and feedback has been used to improve performance.

SPSI26E Panel Discussion

Participants

Robert A. Smith, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose
Mary Freivogel, Greenwood Village, CO (*Presenter*) Nothing to Disclose
Matthew G. Wallis, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose
Steven J. Atlas, MD, MPH, Boston, MA (*Presenter*) Editor with royalties, UpToDate, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI27

Special Interest Session: Preparing Radiologists to Jump into the "Shark Tank"

Monday, Nov. 28 4:30PM - 6:00PM Room: N228

OT

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants

LEARNING OBJECTIVES

1) Identify strategies for bringing a research idea to the marketplace. 2) Present a proposal in a way that elicits interest from potential investors. 3) Take steps to secure investor funding while developing and protecting the intellectual property. 4) Identify ways to generate business value through licensing and collaborations.

Sub-Events

SPSI27A Creating a Forum for Venture Funding Pitches

Participants
Ronald L. Arenson, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Renee L. Cruea, MPA, Washington, DC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI27B How to Present Your Research to Venture Capitalists & Industry Representatives

Participants
Navid Alipour, Coronado, CA (*Presenter*) Nothing to Disclose
Thomas R. Mackie, PhD, Madison, WI (*Presenter*) Stockholder, Asto CT LLC; Stockholder, HealthMyne, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI27C Developing and Protecting Your IP to Create Business Value

Participants
Scott A. Penner, JD, San Diego, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI28

Special Interest Session: High Impact Clinical Trials

Monday, Nov. 28 4:30PM - 6:00PM Room: S404CD

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

Participants
Udo Hoffmann, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SPSI28A Impact of Repeat Injections on Outcomes Following Epidural Injection of Either Corticosteroid and Lidocaine Versus Lidocaine Alone

Participants
John T. Wald, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Janna L. Friedly, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Felix E. Diehn, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Sean D. Rundell, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Larry G. Kessler, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey G. Jarvik, MD, MPH, Seattle, WA (*Abstract Co-Author*) Co-founder, PhysioSonics, Inc ; Stockholder, PhysioSonics, Inc; Consultant, HealthHelp, LLC; Consultant, UpToDate, Inc

ABSTRACT

Purpose: Our primary goals of this analysis are to: 1) determine the extent to which Lumbar Epidural Steroid Injections for Spinal Stenosis (LESS) trial participants underwent repeat injections, including crossover to the alternate treatment at 6 weeks 2) determine if crossover rates differ by treatment arm 3) identify factors associated with decisions to undergo repeat injections and 4) determine impact of repeat injections on outcomes through 12 months.
Methods: Multicenter, double-blind, randomized trial comparing epidural injections of corticosteroid plus lidocaine versus lidocaine alone for imaging-confirmed lumbar central spinal stenosis. 400 participants with moderate-to-severe leg pain and disability were randomized to receive up to 2 injections before the 6-week primary endpoint. After 6 weeks, blinded participants could receive up to 2 additional injections during the subsequent 6 weeks, either continuing with the randomized injection or crossing over to the alternate medication. Primary outcomes included the Roland-Morris Disability Questionnaire (RDQ) and leg pain intensity (range 0-10) and were obtained at 3 weeks, 6 weeks (primary endpoint), 3 months, 6 months and 12 months post baseline injection. Secondary outcomes included opioid use, physical therapy, spine surgery and crossover rates. We used univariate logistic regression models to identify pre-treatment demographic factors, clinical characteristics, pre- and post-treatment outcome measures and treatment guesses at 14 days that were associated with patient crossover to the alternate treatment.
Findings: At 6 weeks, among participants randomized to lidocaine alone, 45% (n=90) crossed over and received an injection of corticosteroids plus lidocaine, 10.5% (n=21) repeated the lidocaine alone injection, and 44.5% (n=89) had no additional injection. Among participants randomized to corticosteroid plus lidocaine, 30% (n=60) crossed over to an injection of lidocaine alone, 14.0% (n=28) repeated the injection of corticosteroid plus lidocaine, and 56.0% (n=112) had no additional injection. The difference in crossover between those randomized to corticosteroid plus lidocaine and to lidocaine alone was statistically significant (p=0.003). In both randomization groups, participants who crossed over at 6 weeks continued to have worse long-term outcome trajectories (through 12 months) compared with participants who repeated the randomized injection or had no additional injections at 6 weeks. Significant predictors of crossover included the 6-week RDQ, 6-week leg pain, 0-6-week change from baseline in RDQ and leg pain rating, and treatment guess responses at 2 and 5-weeks. A treatment guess of lidocaine at 5 weeks predicted the decision to cross over (p<0.001) regardless of initial treatment assignment. No other demographic or clinical characteristics were associated with crossover and only recruitment site (a single site) predicted crossover differentially by randomization group. At 12 months, there were no significant differences between those randomized to corticosteroid plus lidocaine versus lidocaine alone on the RDQ (adjusted mean difference: -0.4; 95% confidence interval [CI]: -1.6, 0.9; p=0.55), leg pain (adjusted mean difference: 0.1; 95% CI: -0.5, 0.7; p=0.75); opioid use (41.4% versus 36.3%, p=0.41); or spine surgery (16.8% versus 11.8%, p=0.22).
Conclusions: For lumbar spinal stenosis, treatment with repeated epidural injections offer no additional long-term benefit if injections in the first 6 weeks do not improve pain.

SPSI28B Myometric Data Derived from Routine CT Examinations Predict Adverse Post-Extubation Outcomes in Critically Ill Patients

Participants
Maurice F. Joyce, MD, MEd, Canton, MA (*Presenter*) Nothing to Disclose
George Fuchs, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Tharusan Thevathasan, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yves R. Chretien, MD, Boston, MA, (ychretien@partners.org) (*Presenter*) Nothing to Disclose
Julia Mario, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ulrich Schmidt, MD, PhD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Matthias Eikermann, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Florian J. Fintelmann, MD, FRCPC, Boston, MA (*Abstract Co-Author*) Consultant, McKesson Corporation

LEARNING OBJECTIVES

At the conclusion of this live activity, participants will be able to:- Define CT-derived measures of skeletal muscle mass, including L3SMI, and explain how they are obtained.- List potential advantages of CT-derived skeletal muscle mass indices, relative to standard clinical assessments of muscle function.- Describe the evidence for association between L3SMI and clinical outcomes in critically ill patients.

SPSI28C A Randomized Trial Comparing Coronary Computed Tomography Angiography and Stress Echocardiography in Low-to-Intermediate Risk Emergency Department Patients with Chest Pain

Participants
Fabian Bamberg, MD, MPH, Tuebingen, Germany (*Presenter*) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Research Grant, Siemens AG;
Jeffrey M. Levsky, MD, PhD, Bronx, NY, (jlevsky@montefiore.org) (*Presenter*) Nothing to Disclose
Linda B. Haramati, MD, MS, Bronx, NY (*Abstract Co-Author*) Spouse, Board Member, Bio Protect Ltd; Spouse, Board Member, OrthoSpace Ltd; Spouse, Board Member, Kryon Systems Ltd
Cynthia C. Taub, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Daniel M. Spevack, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Mark A. Menegus, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Durline Brown-Manhertz, RN, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Terence Chen, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Sarah Mizrachi, BA, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Jonathan N. Tobin, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Mario J. Garcia, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Deborah J. White, MD, MBA, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Samantha Selesny, BA, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose: Acute chest pain is one of the most common reasons for presentation to the Emergency Department (ED), resulting in about 8 million visits per year in the US. Accelerated diagnostic protocols streamline care of chest pain patients and reduce healthcare expenses, primarily by discharging patients directly from the ED when noninvasive testing is negative. Coronary computed tomography angiography (CCTA) has been promoted as an ED modality of choice due to wide availability and superior negative predictive value. CCTA, however, entails a relatively high associated dose of ionizing radiation, which is increasingly recognized by medical practitioners and laypeople alike as a cancer risk. Stress echocardiography (SE) is a powerful diagnostic and prognostic modality used in many clinical settings, including the ED, which involves no radiation. The objective of this randomized, controlled trial is to compare the effectiveness of CCTA and SE for ED triage. **Methods:** 400 patients with acute chest pain (mean age 55 years; 43% women; 46% Hispanic, 32% African-American, 13% Caucasian; mean BMI 30.4) were randomized to initial CCTA (n=201) or SE (n=199) at a single inner-city ED. Low-to-intermediate risk was defined by Diamond-Forrester probability of significant coronary disease of 10-90%. The primary outcome was hospital admission. The secondary outcome was length of stay. Safety outcomes include major adverse cardiovascular events at 30 days and one year and rates of cardiac catheterization and revascularization. ClinicalTrials.gov #NCT01384448 **Results:** 39 (19%) patients who had CCTA and 22 (11%) who had SE were hospitalized at initial presentation (difference 8%, 95% confidence interval 1%-15%, p =0.026). Median ED length of stay from randomization for discharged patients was 5.4hours (inter-quartile range 4.2-8.0 hours) for the CCTA group and 4.7 hours (interquartile range 3.5-6.1 hours) for the SE group (p = .002). 30-day follow-up was complete for 198/201 CCTA patients and 198/199 SE patients. There were 8 and 6 total major adverse cardiovascular events in the CCTA and SE arms, respectively (p =0.79). 5 CCTA and 3 SE patients had non-fatal myocardial infarctions (all at the time of randomization visit). 1 CCTA and 3 SE patients had non-fatal strokes during follow-up. 1 CCTA patient had a cardiac arrest and another CCTA patient died (>3 years after randomization from metastatic cancer). 21 CCTA and 14 SE patients underwent cardiac catheterization (p = 0.29), of which 6 CCTA and 6 SE patients had subsequent percutaneous interventions and 4 CCTA and 0 SE patients had bypass surgery (p =0.12). **Conclusions:** SE was more effective in ED chest pain triage than CCTA, discharging a significantly higher number of patients with a significantly shorter length of stay. There was no significant difference in safety between modalities in terms of major adverse cardiovascular event rates. There was a trend towards increased cardiac catheterization and coronary bypass surgery in the CCTA arm which is of uncertain benefit and requires further study. Stress echocardiography, a modality entailing no ionizing radiation exposure, should be considered a first-line option for ED chest pain.

MSRO29

BOOST: Gastrointestinal-eContouring

Monday, Nov. 28 4:45PM - 6:00PM Room: S104B

GI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants

Theodore S. Hong, MD, Boston, MA (*Presenter*) Nothing to Disclose