

Wednesday

SPDL40

RSNA Diagnosis Live™: Keeping Radiology Weird-Spot Diagnoses from the Pacific Northwest

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

CA **CH** **MK** **NR**

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

FDA Discussions may include off-label uses.

Participants

Cristina Fuss, MD, Portland, OR (*Presenter*) Nothing to Disclose

Bryan R. Foster, MD, Portland, OR (*Presenter*) Nothing to Disclose

Brooke R. Beckett, MD, Portland, OR, (becketbr@ohsu.edu) (*Presenter*) Nothing to Disclose

David R. Pettersson, MD, Portland, OR (*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

Controversy Session: Elementary, My Dear Watson: Will Machines Replace Radiologists?

Wednesday, Nov. 30 7:15AM - 8:15AM Room: E450B

AMA PRA Category 1 Credit™: 1.00
ARRT Category A+ Credit: 1.00**Participants**John Eng, MD, Cockeysville, MD, (jeng@jhmi.edu) (*Moderator*) Nothing to Disclose

Eliot L. Siegel, MD, Baltimore, MD (*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;

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

LEARNING OBJECTIVES

1) Identify the advances in machine learning that may enable computing machines to perform tasks currently performed by a radiologist. 2) Classify the key challenges facing computing machines to perform these tasks. 3) Estimate the probability that computing machines will perform these tasks within the next 20 years.

ABSTRACT

This session will address the role of computer-aided diagnosis and machine learning in the practice of radiology. The debate format will address the question of whether computers will replace radiologists in 20 years. The session will include information on state-of-the-art machine learning methods, computer-aided diagnosis results, and prognostications on these tools. Impediments to computers replacing radiologists will also be described.

URL

Hot Topic Session: New Informatics Tools in the Era of Managed Care

Wednesday, Nov. 30 7:15AM - 8:15AM Room: E451A

INAMA PRA Category 1 Credit™: 1.00
ARRT Category A+ Credit: 1.00**Participants****Sub-Events****SPSH40A Image Exchange: Pearls and Pitfalls**

Participants

Andy Strickland, Seattle, WA (*Presenter*) Nothing to Disclose**LEARNING OBJECTIVES**

The speaker will provide our institutions history with image exchange. Describe the types of solutions we have used. Discuss the benefits and problems experienced with exchange options. Provide thoughts and ruminations of what image exchange might look like in the near future.

ABSTRACT

Image Exchange has become an important aspect of PACS programs in most hospitals in the US. For the last few years, we have used CDs that we mail or deliver to one another. The CDs are manually copied to the receiving PACS system and normalized. CDs are still an important component of image exchange in most places. In recent years, cloud-based vended solutions have become widely available. Many larger systems have built virtual private networks (VPNs) between themselves and their most common exchange partners. UW Medicine has built over 100 of these to support our high volume of (mostly) inbound exams. There are a variety of drawbacks and complications with the current state of image exchange, no matter which techniques are used. In the near future, we hope to see new options which avoid most or all of these problems. One approach, which might work for an HIE, is for a dominant member to broker all image exchanges through the use of an XDS registry that contains the metadata of all the exams generated by all the member institutions, but does not contain the images. Members of the HIE would be able to request and/or view the exams from their partner institutions. Authentication, access and audit would be centrally administered. Normalization would still be an issue, but a PIX system should at least be able to match patient identifiers in many cases and make it possible to identify potentially relevant imaging from all participating locations. The use of smart hanging protocols on PACS viewers could potentially identify relevant priors without morphing metadata first. Optionally, DICOM brokers could assist in automatically normalizing data if and when it is ingested into the destination PACS. We plan to participate IHE-based in the near future and reduce the use of our current image exchange methods, however, slow adaption to IHE profiles and available software make this difficult.

URL**SPSH40B Using Data to Improve Operational Efficiency and Quality in Emergency Radiology**

Participants

Jeffrey W. Dunkle, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose**LEARNING OBJECTIVES**

1) Identify key performance metrics in Emergency Radiology. 2) Differentiate between the different components of turnaround time (TAT) and the parts of workflow they correlate to. 3) Assess trends in TAT and volume data to identify service gaps and support staffing decisions. 4) Identify types of quality improvement projects that can add extra value in Emergency Radiology.

SPSH40C Clinical Decision Support Interventions in the ED Setting

Participants

Aaron D. Sodickson, MD, PhD, Boston, MA, (asodickson@bwh.harvard.edu) (*Presenter*) Research Grant, Siemens AG; Consultant, Bayer AG**LEARNING OBJECTIVES**

1) Identify potential targets for decision support interventions during ordering of Emergency Imaging. 2) Understand common implementation challenges in an ED setting. 3) Highlight potential benefits of decision support interventions to improve appropriateness of imaging and capture of relevant clinical information.

ABSTRACT**URL****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

MSRT41

ASRT@RSNA 2016: A Team Approach to Patient-centered Imaging

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



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

Participants

Susan D. John, MD, Houston, TX, (susan.d.john@uth.tmc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the challenges of promoting a culture of patient-centered care in radiology practices. 2) Understand the value of a establishing a multidisciplinary team to enhance patient satisfaction in imaging. 3) Create opportunities to make a positive impact on patients before, during, and after imaging

ABSTRACT

Prostate MRI (Hands-on)

Wednesday, Nov. 30 8:00AM - 10:00AM Room: S401AB

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**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 (*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 be able to review up to 40 multi-parametric MRI cases with various prostatic pathology using a dedicated workstation. Focus will be on the overall assessment of PI-RADS v2 category, which enables them to score the probability of the presence of a significant cancer in patients with elevated PSA and/or clinical suspicion. All cases are from daily non-academic practice, and have various levels of difficulty. The cases include: easy and difficult significant peripheral-transition- and central zone cancers, inflammation, BPH, and the most common pitfalls. Internationally renowned teachers will guide the participants during their PI-RADS v2 scoring. There will be 50 workstations available. 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/2016/16002005/RCA Coursebook Prostate hands on course.pdf](http://abstract.rsna.org/uploads/2016/16002005/RCA_Coursebook_Prostate_hands_on_course.pdf)

MSCP41

Case-Based Review of Pediatric Radiology (An Interactive Session)

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



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

FDA Discussions may include off-label uses.

Participants

Ricardo Restrepo, MD, Miami, FL (*Director*) Nothing to Disclose

Sub-Events

MSCP41A Pediatric Brain and Spine Disorders

Participants

Thierry Huisman, MD, Baltimore, MD, (thuisma1@jhmi.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Correlate imaging findings with clinical symptoms and age/gender demographics to narrow down differential diagnosis of pediatric neurological diseases. 2) Use a pattern recognition approach for identifying various metabolic disorders and its differentials. 3) Apply conventional and advanced neuroimaging for differentiation between tumors and tumor mimickers.

ABSTRACT

Based on a series of common and rare pediatric neurological cases various tools will be discussed how to narrow down differential diagnosis in children with neurological diseases. By combining the clinical symptoms as well as the age and gender of a patient many diseases can be excluded. Furthermore a detailed analysis of the distribution and quality of imaging findings as noted on conventional and advanced neuroimaging may further facilitate final diagnosis. In the current session various illustrative cases will be shown.

MSCP41B Pediatric Head and Neck Disorders

Participants

Amy F. Juliano, MD, Boston, MA, (amy_juliano@meei.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the major types of congenital lesions, inflammatory and infectious processes, and tumors in the head and neck region in the pediatric population. 2) Recognize the clinical presentations and imaging features of these lesions. 3) Provide differential diagnoses based on imaging appearance and location.

ABSTRACT

MSCP41C Pediatric Genitourinary Disorders

Participants

Harriet J. Paltiel, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the most appropriate radiological examinations to evaluate children with a variety of genitourinary symptoms. 2) Describe the diagnostic imaging features of important pediatric genitourinary abnormalities. 3) Discuss the application of new techniques of potential benefit in pediatric genitourinary imaging, including ultrasound contrast and dual source CT.

ABSTRACT

MSES41

Essentials of Breast Imaging

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

BR

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

Participants

Sub-Events

MSES41A Personalized Breast Cancer Screening

Participants

Margarita L. Zuley, MD, Pittsburgh, PA, (zuleyml@upmc.edu) (*Presenter*) Research Grant, Hologic, Inc;

LEARNING OBJECTIVES

1) Understand the role of personal risk, density and age in selecting screening paradigms. 2) Understand the different modalities available for screening of the breast and the rationale of which is best in certain situations.

MSES41B Case-based Review of Clinical Implementation of Tomosynthesis

Participants

Emily F. Conant, MD, Philadelphia, PA, (emily.conant@uphs.upenn.edu) (*Presenter*) Consultant, Hologic, Inc; Consultant, Siemens AG

LEARNING OBJECTIVES

1) Assess the role of tomosynthesis in improving the outcomes of screening and diagnostic breast imaging. 2) Develop strategies to interpret breast tomosynthesis images to improve imaging accuracy.

ABSTRACT

Using a case based approach, the author will discuss the clinical implementation of digital breast tomosynthesis for both screening and diagnostic imaging.

MSES41C Management of High Risk Lesions

Participants

Karen A. Lee, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define high risk lesions encountered in percutaneous breast biopsies and list their associated frequencies and upgrade rates. 2) Describe the imaging characteristics associated with high risk lesions. 3) Discuss the suggested management and clinical significance of high risk lesions.

ABSTRACT

Active Handout:Karen Ann Lee

[http://abstract.rsna.org/uploads/2016/16000853/MSES41C_High_risk.handout_\(1\).pdf](http://abstract.rsna.org/uploads/2016/16000853/MSES41C_High_risk.handout_(1).pdf)

MSES41D Abbreviated Breast MRI: How to Get Started

Participants

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

MSRO41

BOOST: Head and Neck - Oncology Anatomy: Lymph Nodes & Brachial Plexus (An Interactive Session)

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

HN **NR** **RO**

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

Participants

Sub-Events

MSRO41A Imaging of the Lymph Nodes of the Head & Neck: Applied Anatomy

Participants

Suresh K. Mukherji, MD, Northville, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the normal anatomy of the lymph nodes of the head and neck. 2) Define the size criteria used to identify metastatic lymph nodes. 3) Review the classification of the cervical lymph nodes.

ABSTRACT

This lecture will review the normal anatomy of the lymph nodes of the head and neck. The talk will also define the size criteria used to identify metastatic lymph nodes and review the classification of the cervical lymph nodes.

MSRO41B Current Concepts and Controversies in Radiation Planning of the Head & Neck Lymph Nodes

Participants

Sung Kim, MD, New Brunswick, NJ, (sk1375@cinj.rutgers.edu) (*Presenter*) Nothing to Disclose

MSRO41C Question & Answer

Participants

MSRO41D Imaging of the Brachial Plexus: Applied Anatomy

Participants

Suresh K. Mukherji, MD, Northville, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the normal anatomy of the brachial plexus. 2) Describe common tumors that involve the brachial plexus. 3) Review the post-radiation therapy appearance of the brachial plexus.

ABSTRACT

This lecture will review the normal anatomy of the brachial plexus. The lectures will also describe common tumors that involve the brachial plexus and review the post-radiation therapy appearance of the brachial plexus.

MSRO41E Current Concepts and Controversies in Contouring and Treatment of the Brachial Plexus and Surrounding Structures

Participants

Sung Kim, MD, New Brunswick, NJ (*Presenter*) Nothing to Disclose

MSRO41F Question & Answer

Participants

MSSR41

RSNA/ESR Hybrid Imaging Symposium: The ABCs of Hybrid Imaging (An Interactive Session)

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

MR **NM** **PH**

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

FDA Discussions may include off-label uses.

Participants

Alexander Drzezga, MD, Cologne, Germany (*Moderator*) 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
Katrine Riklund, MD, PhD, Umea, Sweden, (katrine.ahlstrom.riklund@umu.se) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

Sub-Events

MSSR41A What You Need to Know about PET-Physics

Participants

Jan Axelsson, Umea, Sweden, (Jan.E.Axelsson@vll.se) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

- 1) To understand the basics of physics in PET imaging.
- 2) To learn about the different approaches of PET attenuation correction.
- 3) To learn about potential artefacts in hybrid imaging.

MSSR41B How MR Physics Influence Image Quality in Hybrid Imaging

Participants

Ciprian Catana, MD, PhD, Charlestown, MA, (ccatana@nmr.mgh.harvard.edu) (*Presenter*) Research Consultant, Cubresa Inc

LEARNING OBJECTIVES

- 1) Learn about MR for attenuation and motion correction.
- 2) Learn about MR artefacts influencing PET-quality.
- 3) Understand the complexity of physics in MR/PET.

ABSTRACT

MSSR41C Interactive Case Discussion

Participants

Jan Axelsson, Umea, Sweden, (Jan.E.Axelsson@vll.se) (*Presenter*) Nothing to Disclose
Ciprian Catana, MD, PhD, Charlestown, MA (*Presenter*) Research Consultant, Cubresa Inc

LEARNING OBJECTIVES

- 1) Learn how to identify common MR artefacts.
- 2) Learn how to identify common PET artefacts.
- 3) Learn how to identify common CT artefacts.

RC501

Practical Issues in Thoracic Imaging (An Interactive Session)

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

CH

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

Participants

Matthew D. Gilman, MD, Boston, MA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the anatomic considerations of the more common ICU tubes and lines. 2) Recognize the proper positioning and malpositions of the more common ICU tubes and lines. 3) Understand the techniques of VA and VV ECMO and the implications for imaging.

ABSTRACT

Critical care patients often require invasive support and monitoring devices to support life and direct clinical management decisions. These tubes and lines are among the most common urgent findings in the imaging of the ICU patient. This presentation will illustrate the anatomy, proper positioning, and malpositions of the more common tubes and lines with illustrations and examples. Newer support devices (ECMO) and the potential pitfalls in imaging these patients will also be illustrated.

Sub-Events

RC501A Managing the Indeterminate Lung Nodule

Participants

Claudio Silva Fuente-Alba, MD, Santiago, Chile, (csilvafa@alemana.cl) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Present a systematic approach to the incidental indeterminate lung nodule. 2) Provide insight on the incremental value of the classic features that suggest malignancy/benignity. 3) Provide evidence-based information on the strengths and weakness of the available diagnostic procedures following detection. 4) Review current follow-up recommendations for solid and subsolid incidental nodules.

ABSTRACT

With increasing number of chest CT performed for various clinical scenarios, the number of incidental nodules detected have grown exponentially. It is the radiologist's role to be able to limit further follow-up studies only to those nodules that may be in an indeterminate status. In this lecture, we will review the imaging findings that are classically associated with benignity and malignancy, and to discuss the current recommendations for follow-up and/or additional studies in incidental solid and subsolid lung nodules.

RC501B Imaging of the ICU Patient: Tubes and Lines

Participants

Matthew D. Gilman, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the anatomic considerations of the more common ICU tubes and lines. 2) Recognize the proper positioning and malpositions of the more common ICU tubes and lines. 3) Understand the techniques of VA and VV ECMO and the implications for imaging.

RC501C Incidental Findings at Thoracic Imaging

Participants

Carol C. Wu, MD, Houston, TX, (ccwu1@mdanderson.org) (*Presenter*) Author, Reed Elsevier

LEARNING OBJECTIVES

1) Understand the prevalence and significance of incidental thoracic imaging findings. 2) Recognize appropriate, evidence-based management or follow-up recommendations for incidental thoracic imaging findings.

ABSTRACT

With increasing utilization of chest CT and PET-CT for lung cancer screening and oncologic evaluation, radiologists often encounter incidental thoracic imaging findings. Some of these incidental findings such as pulmonary emboli may require prompt communication with referring clinicians. Other findings such as thyroid nodules, pulmonary nodules or anterior mediastinal masses may require further imaging work-up. The purpose of this presentation is to discuss the prevalence, clinical significance and management recommendations for these incidental findings.

RC501D 'No Touch' Thoracic Interventional Lesions

Participants

Joseph G. Mammarrappallil, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

RC502

Strategies for ABR Exam Preparation

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

ED

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

Participants

Lori A. Deitte, MD, Nashville, TN, (lori.deitte@vanderbilt.edu) (*Moderator*) Nothing to Disclose

ABSTRACT

Sub-Events

RC502A The ABR Core, Certifying and MOC Exams: Are You Ready?

Participants

Dennis M. Balfe, MD, Saint Louis, MO, (balfed@wustl.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the components of the ABR Core, Certifying and MOC examination. 2) List a variety of item types that will appear on the examination. 3) Discuss the preliminary results of the most recent administrations of the Core Certifying and MOC Examinations.

RC502B Beyond the Differential Diagnosis: Making Noninterpretive Skills Relevant

Participants

Jeffrey L. Creasy, MD, Nashville, TN, (jeff.creasy@vanderbilt.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define noninterpretive skills within the context of a Diagnostic Radiology Residency, Radiology-related fellowship and practice following training. 2) Appraise challenges and opportunities related to noninterpretive skills. 3) Develop a personal strategic plan for assessment and improvement related to noninterpretive skills.

ABSTRACT

Interest in noninterpretive skills may be related to changes in ACGME requirements, ABR examinations, and other institutional/regulatory mandates. Ultimately, the most convincing reason to prioritize these skills is the the importance that they play in our everyday life as Radiologists and Radiologists-in-training. In this session, we will review noninterpretive skills and share practical tips on how to teach and assess these essential skills.

RC502C Strategies for Physics Preparation for the ABR Core and Certifying Exam

Participants

J. Anthony Seibert, PhD, Sacramento, CA, (jaseibert@ucdavis.edu) (*Presenter*) Advisory Board, Bayer AG

LEARNING OBJECTIVES

1) Describe the physics CORE examination study guide and how to use it. 2) Understand how the physics items are structured and vetted through the process of creating an examination, and the mix of basic and clinically-relevant questions. 3) Discuss strategies to learn important physics knowledge with access to traditional textbooks, resources on the web, during clinical activities, and through didactic lecture / flipped classroom opportunities.

Handout: J. Anthony Seibert

http://abstract.rsna.org/uploads/2016/16000536/RSNA_PhysicsStrategies_ABR-2016_final.pdf

RC503

Read with the Experts (Cardiac Radiology) (An Interactive Session)

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

CA

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

FDA

Discussions may include off-label uses.

Participants

Jill E. Jacobs, MD, New York, NY, (jill.jacobs@nyumc.org) (*Moderator*) Nothing to Disclose

Sanjeev Bhalla, MD, Saint Louis, MO, (sanjeevbhalla@wustl.edu) (*Presenter*) Nothing to Disclose

Prabhakar Rajiah, MD, FRCR, Dallas, TX, (radprabhakar@gmail.com) (*Presenter*) Institutional Research Grant, Koninklijke Philips NV; Speaker, Koninklijke Philips NV

Eric E. Williamson, MD, Rochester, MN (*Presenter*) Research Grant, General Electric Company

Amar B. Shah, MD, Long Island City, NY, (ashah01@gmail.com) (*Presenter*) Future royalties, Wolters Kluwer nv

LEARNING OBJECTIVES

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/>

Sanjeev Bhalla, MD - 2014 Honored Educator

Sanjeev Bhalla, MD - 2016 Honored Educator

Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator

RC504

Musculoskeletal Series: MRI of Upper Extremity Sports Injuries

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

MK **MR**

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

FDA Discussions may include off-label uses.

Participants

Martin Torriani, MD, Boston, MA (*Moderator*) Nothing to Disclose
Linda Probyn, MD, Toronto, ON, (linda.probyn@sunnybrook.ca) (*Moderator*) Nothing to Disclose
Robert S. Campbell, MBBCh, Liverpool, United Kingdom (*Moderator*) Royalties, Reed Elsevier
Karen C. Chen, MD, Providence, RI (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

Topical lectures on pre- and post-operative imaging of shoulder, elbow, wrist and hand to familiarize the audience with concepts relevant to clinical practice. This session will also include oral presentation of scientific abstracts in shoulder, elbow and wrist.

ABSTRACT

Active Handout: Robert SD Campbell

http://abstract.rsna.org/uploads/2016/16000532/RC504_Campbell_Post_Operative_Wrist.pdf

Sub-Events

RC504-01 Preoperative Evaluation of Shoulder

Wednesday, Nov. 30 8:30AM - 8:50AM Room: S406B

Participants

Michael J. Tuite, MD, Madison, WI, (mjtuite@wisc.edu mjtuite@wisc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1. Participants will be able to cite the important imaging features that a surgeon needs to know prior to operating on the rotator cuff, biceps tendon or the labrum. 2. Participants will comprehend the specific features of a rotator cuff tear that should be mentioned in the report. 3. Participants will be able to analyze the extent and features of labral tears so as to be able to communicate these to the surgeon.

LEARNING OBJECTIVES

1) Describe the features of rotator cuff tears that are important for presurgical planning. 2) Classify the type of glenoid labral tear to help the surgeon determine the type of operation. 3) Identify tears and dislocations of the biceps tendon that may need to be addressed at surgery.

RC504-02 Comparison of a Fast 5-Minute Shoulder MR Imaging Protocol with a Standard Shoulder MR Imaging Protocol: A Multi-Institutional, Multireader Study

Wednesday, Nov. 30 8:50AM - 9:00AM Room: S406B

Participants

Naveen Subhas, MD, Cleveland, OH (*Presenter*) Research Grant, Siemens AG
Alex Benedick, Cleveland Heights, OH (*Abstract Co-Author*) Nothing to Disclose
Nancy A. Obuchowski, PhD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Siemens AG; Research Consultant, QT Ultrasound Labs; Research Consultant, Elucid Bioimaging Inc
Joshua M. Polster, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Luis S. Beltran, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jean P. Schils, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Gina A. Ciavarra, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Soterios Gyftopoulos, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of a 5-minute shoulder magnetic resonance imaging (MRI) protocol consisting of multiplanar 2-dimensional fast spin echo (2D FSE) sequences with parallel imaging to that of a standard shoulder MRI protocol.

METHOD AND MATERIALS

A HIPAA-compliant, IRB-approved retrospective review of 151 3T shoulder MRIs in 147 patients (mean age, 46.95 years; range, 18-80 years) and 50 1.5T shoulder MRIs in 50 patients (mean age, 53.74 years; range, 27-91 years) with 4 fast and 5 standard sequences from 2 academic centers between January 2014 and April 2015 was performed by 3 musculoskeletal radiologists. Interchangeability of fast and standard MRI was tested by comparing interprotocol (fast v standard) interreader agreement with that of standard MRI interreader agreement. Interreader agreement was also compared using kappa statistics. Frequency of major findings was compared using an adjusted McNemar test. Sensitivity and specificity were compared in patients who underwent surgery.

RESULTS

The interprotocol agreement was not significantly lower than agreement on standard MRI (mean $\leq 1\%$; 95%CI [-3.8%, +3.9%]),

ranging from 61-96% across structures. Interprotocol kappas (0.37–0.65) were similar to standard MRI kappas (0.32-0.73). Frequency of major findings on fast and standard MRI were similar ($p > 0.08$), ranging from 0.7-19.6% across structures. Sensitivities of fast MRI for tendon and labral tears (33-92%) were equivalent or higher than that of standard MRI with similar specificities (77-98%).

CONCLUSION

A fast 5-minute shoulder MRI with multiplanar 2D FSE sequences using parallel imaging is interchangeable, with similar interreader agreement and accuracy, with a standard shoulder MRI for evaluating shoulder injuries.

CLINICAL RELEVANCE/APPLICATION

Use of a fast shoulder MR protocol would improve the efficiency and could lower the costs of shoulder MR imaging without sacrificing interpretative quality when compared to standard shoulder MR imaging. This fast protocol may also result in a more comfortable and tolerable examination.

RC504-03 The Glenoid Labral Articular Teardrop (GLAT) Lesion: A Novel Glenoid Articular Cartilage Injury Pattern on MRI

Wednesday, Nov. 30 9:00AM - 9:10AM Room: S406B

Participants

Pamela J. Lund, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose
Stephen Flores, MD, Phoenix, AZ (*Abstract Co-Author*) Nothing to Disclose
Damien Richardson, MD, Phoenix, AZ (*Abstract Co-Author*) Nothing to Disclose
Christopher Stevens, MD, Phoenix, AZ (*Abstract Co-Author*) Nothing to Disclose
Evan Lederman, MD, Phoenix, AZ (*Abstract Co-Author*) Consultant, Arthrex, Inc; Royalties, Arthrex, Inc; Fellowship funded, Arthrex, Inc; Fellowship funded, Wright Medical Technology, Inc; Fellowship funded, Smith & Nephew plc; Fellowship funded, Ossur HF; Research support, Arthrex, Inc

PURPOSE

The purpose of this study is to describe the arthroscopically correlated MRI features of a recently recognized glenoid rim articular cartilage pattern of injury associated with glenohumeral instability.

METHOD AND MATERIALS

Between December 2010 and September 2015, 31 shoulder MRI studies were identified by a single musculoskeletal radiologist at a group of outpatient imaging centers demonstrating typical features of the glenoid labral articular teardrop (GLAT) injury. All MRI studies were performed on 3T MRI equipment (GE or Siemens) using dedicated shoulder coils. GLAT lesion was identified if characteristic elliptical (teardrop) shaped fragment was present in inferior glenohumeral recess with thin stalk attached to glenoid margin on both standard and MR arthrogram studies. Three dimensional fragment size, location and clinical history were recorded for all images and correlated with arthroscopic findings.

RESULTS

31 patients (26 Male, 4 Female; Average age 30 years) with MRI findings of a GLAT lesion were included in the study. 17 (55%) were noted to have sustained an instability event or had physical exam findings of instability while 14 (45%) had no reported instability or physical exam findings. The lesion is described on MRI and arthroscopy as a chondral, elliptically-shaped articular cartilage fragment, displaced into the glenohumeral recess and rotated on an intact pedicle attached to the peripheral chondral articular surface. The displaced fragment varied in size from 5-20mm. Corresponding chondral defect donor sites were inconsistently identified. Associated injuries included: Hill Sachs (HS) lesions (71%), anterior labroligamentous periosteal sleeve avulsion (ALPSA) injuries (16%), labral tears (16%), osseous Bankart lesions (13%), and loose bodies (10%).

CONCLUSION

The GLAT lesion has a characteristic appearance and location on MRI and is often associated with glenohumeral instability. The distinct appearance should be recognized and included in the spectrum of glenoid labrochondral injuries.

CLINICAL RELEVANCE/APPLICATION

Glenoid labral articular teardrop (GLAT) lesion is a characteristic, previously undescribed, glenoid rim chondral injury pattern on MRI often associated with glenohumeral instability.

RC504-04 Postoperative Evaluation of Shoulder

Wednesday, Nov. 30 9:10AM - 9:30AM Room: S406B

Participants

Laura W. Bancroft, MD, Orlando, FL, (laura.bancroft.md@flhosp.org) (*Presenter*) Author with royalties, Wolters Kluwer nv

LEARNING OBJECTIVES

1. Describe the expected postoperative MRI appearance of the shoulder after rotator cuff and labral repair, and their complications. 2. Review imaging findings of capsular shift, remplissage and Latarjet/Bristow procedures.

ABSTRACT

LEARNING OBJECTIVES

1) Describe the MR imaging features of the postoperative rotator cuff. 2) Identify expected postsurgical change of the long head of the biceps tendon. 3) Classify normal and abnormal appearance of labral repair.

ABSTRACT

RC504-05 Cuff Tear Arthropathy Shoulder Hemiarthroplasty: A Radiographic Outcome Study

Awards

Student Travel Stipend Award

Participants

Alan S. Leung, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company

Alice S. Ha, MD, Seattle, WA (*Abstract Co-Author*) Grant, General Electric Company

PURPOSE

Cuff tear arthropathy (CTA) head prosthesis has recently become an alternative to standard shoulder hemiarthroplasty in patients with severe cuff disease by offering increased surface area and decreased impingement. The purpose of this study is to evaluate the radiographic outcome of CTA prosthesis and to correlate with clinical outcome.

METHOD AND MATERIALS

In this retrospective study of CTA hemiarthroplasties over an 11 year period, two radiologists reviewed pre/post-operative radiographs and clinical data, including surgical reports, and reported pain levels. Rates of surgical revision and radiographic complications were determined using Kaplan-Meier curves. Occurrence of radiographic complications was correlated with subsequent surgery and preoperative radiographs using Cox regression and Weibull proportional hazard models, respectively.

RESULTS

98 CTA hemiarthroplasties were identified in 93 patients (5 bilateral) with mean patient age of 68.5 years. Mean radiographic follow-up was 12 months with a mean of 3.3 radiographs per prosthesis. 39 arthroplasties (39.8%) experienced at least one radiographic complication, including anterior-posterior subluxations (24.5%), acromion remodeling (19.4%), periprosthetic fractures (4.1%), glenoid remodeling (3.1%), superior-inferior humeral head subluxations (2.0%), perihardware lucencies (2.0%), and subsidence (1.0%). Most (42%) radiographic complications occurred by 3 months of initial surgery based on Kaplan-Meier curve analysis. Eight cases underwent revision surgery (8.2%). Risk of surgical revision increased 6.0 times (hazard ratio 95% CI: 1.2-28.9) when a radiographic complication was seen versus without ($p = 0.026$). Risk of radiographic complications increased 3.9 times with moderate to severe preoperative superior-inferior humeral head subluxation compared to without (hazard ratio 95% CI: 1.2-12.3).

CONCLUSION

Radiographic complications after CTA head hemiarthroplasty are common with most occurring by 3 months after surgery and are highly associated with subsequent surgical revision. Understanding normal from abnormal radiographic findings after CTA hemiarthroplasty will enable more efficacious and accurate interpretation of post-operative studies.

CLINICAL RELEVANCE/APPLICATION

Understanding normal and abnormal post-operative radiographic appearance of CTA hemiarthroplasty will enable more efficacious radiology interpretations.

RC504-06 Comparison of ElectroDiagnostical Testing, Neurosonography, MR-Neurography including DTI in Ulnar Neuropathy at the Elbow

Wednesday, Nov. 30 9:40AM - 9:50AM Room: S406B

Participants

Micheal Ho, Zurich, Switzerland (*Presenter*) Nothing to Disclose

Jens Petersen, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Anton S. Becker, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Hans Jung, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Andreas Schiller, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Gustav Andreisek, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Gustav Andreisek, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare diagnostic signs in electrophysiological testing, neurosonography, MR neurography and diffusion tensor imaging (DTI) in patients with clinical symptoms of ulnar neuropathy at the elbow (UNE).

METHOD AND MATERIALS

This prospective study was IRB approved and written informed consent was obtained from all participants. Electrodiagnostic studies, high-resolution ultrasonography at 15 MHz and high-field MR neurography at 3T were performed on both sides of 14 symptomatic patients and on both sides of 10 control subjects at standardized sites at the medial epicondyle as well as proximally of it - corresponding to the segments of ulnar short-segment nerve conduction studies. Nerve calibre in neurosonography and MR neurography, T2-weighted contrast-to-noise ratios of MR neurography and fractional anisotropy (FA) and mean diffusivity (MD) of DTI were assessed as diagnostic signs.

RESULTS

Diagnostic performance, as measured with area under the receiver operating characteristic curve (AUC), was excellent for nerve conduction latency in electrodiagnostical testing (AUC = 0.91; 95% confidence interval [CI]: 0.82, 1.00), nerve caliber in neurosonography (AUC = 0.84; 95% confidence interval [CI]: 0.82, 1.00), nerve caliber in MR neurography (AUC = 0.87; 95% confidence interval [CI]: 0.83, 1.00), nerve T2 weighted signal (AUC = 0.74; 95% confidence interval [CI]: 0.81, 1.00) and moderate for FA (AUC = 0.63; 95% confidence interval [CI]: 0.81, 1.00) and MD (AUC = 0.60; 95% confidence interval [CI]: 0.84, 1.00) in DTI to discriminate symptomatic from asymptomatic findings in patients with UNE.

CONCLUSION

Electrodiagnostical testing is still the most sensitive and specific diagnostic test for detection of UNE. Nerve calibre measurements

in neurosonography and MR neurography as well as the T2-weighted signal in MR neurography might add information in unclear cases, when electrodiagnostic testing is inconsistent or not tolerated by the patient. DTI supports diagnostic findings of other tests, but is less sensitive and less specific.

CLINICAL RELEVANCE/APPLICATION

The results of this prospective study contribute to the understanding of different state-to-the-art diagnostic test in patients with UNE. Electrodiagnostic testing is still the most sensitive and specific test, but nerve calibre measurements in neurosonography and MR neurography and T2-weighted signal in MR neurography support the diagnosis of the former tests.

RC504-07 Preoperative Evaluation of Elbow

Wednesday, Nov. 30 9:50AM - 10:10AM Room: S406B

Participants

Bruce B. Forster, MD, Vancouver, BC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate an understanding of the technical and procedure-related considerations in MR imaging of the elbow. 2) Identify the normal variants that can simulate pathology. 3) Diagnose common sports injuries of the elbow, using a four-compartmental approach.

ABSTRACT

This presentation will discuss technical considerations such as positioning, and protocol issues such as when to use arthrography, and optimal sequences for MR imaging of the elbow. Common sports injuries will be discussed, as well as normal variants that can simulate disease. Collateral ligament injuries, including partial tears of the UCL will be addressed, as will tears of the distal biceps, triceps and common flexor and extensor pathologies.

RC504-08 Postoperative Evaluation of Elbow

Wednesday, Nov. 30 10:20AM - 10:40AM Room: S406B

Participants

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

LEARNING OBJECTIVES

1) Describe the MR imaging features of the postoperative elbow. 2) Identify expected postsurgical change of the ligaments, tendons and nerves. 3) Identify abnormal postsurgical findings of the elbow.

ABSTRACT

RC504-09 Cost-Effectiveness of Utilizing 1.5T MRI, 3T MRI, and MR Arthrography in the Diagnosis of Scapholunate Interosseous Ligament Injury

Wednesday, Nov. 30 10:40AM - 10:50AM Room: S406B

Participants

Sahar J. Farahani, MBBS, Baltimore, MD (*Presenter*) Nothing to Disclose

John Eng, MD, Cockeysville, MD (*Abstract Co-Author*) Nothing to Disclose

C. Craig Blackmore, MD, MPH, Seattle, WA (*Abstract Co-Author*) Author with royalties, Springer Science+Business Media Deutschland GmbH

John A. Carrino, MD, MPH, New York, NY (*Abstract Co-Author*) Research Consultant, BioClinica, Inc; Research Consultant, Pfizer Inc; Research Consultant, Carestream Health, Inc; Advisory Board, General Electric Company; Advisory Board, Halyard Health, Inc;

Nima Hafezi Nejad, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Shadpour Demehri, MD, Baltimore, MD (*Abstract Co-Author*) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation;

PURPOSE

To determine cost-effectiveness of applying 1.5TMRI, 3TMRI, and MR arthrography (MRA) prior to diagnostic arthroscopy (DA) in the patients with suspected scapholunate interosseous ligament injury (SLILI)

METHOD AND MATERIALS

A Markov-cohort decision model was developed to project cost-effectiveness of the following diagnostic strategies: 1) Performing DA in all the patients, 2) 1.5TMRI and 3) and 3TMRI, and 4) MRA. In strategies 2-4, DA was performed in subjects with positive findings. The base-case analysis was conducted for a hypothetical cohort of 30-year old male patients. Outcome measures were lifetime costs, quality-adjusted-life (QALY) and incremental cost-effectiveness ratio (ICER). The model inputs and costs associated with each strategy were derived from literature and Medicare reimbursement data for 2016. The analysis was done from societal perspective. ICER threshold of \$50,000 was considered as cost-effective.

RESULTS

Based on systematic literature review and met-analysis, using prevalence of SLILI at 25%, sensitivity and specificity of 1.5TMRI, 3TMRI, and MRA in detecting SLILI were considered as (46% and 80%), (76% and 97%), and (82% and 93%), respectively. The utility of wrist pain was considered as 0.8. The probability of major complication in DA and MRA was assumed 1% and 0.003%, respectively. The analysis calculated the QALY and costs (\$) of DA, 1.5TMRI, 3TMRI, and MRA as (45.01, 16,850\$), (44.88, 17,414\$), (44.96, 15,135\$), and (44.98, 15,145\$), respectively. 3TMRI was the least expensive and DA was the most effective strategies. 1.5TMRI was the most expensive and the least effective strategy. ICER of DA and MRA in comparison to 3TMRI was \$32,200 and \$542 per one QALY gain, respectively. Sensitivity analysis demonstrated that ICER of DA in comparison to 3TMRI exceeded threshold of \$50,000 where utility of wrist pain was > 0.96, or probability of major DA complication >2%, or prevalence of SLILI < 12%. In SLILI prevalence > 28%, MRA was the least expensive strategy with higher effectiveness than 3T MRI, and DA

continued to be the most expensive and effective strategy.

CONCLUSION

3TMRI and MRA might be cost effective in comparison to DA in detection of SLILI where the patients experiencing less disability due to wrist pain.

CLINICAL RELEVANCE/APPLICATION

In practice where the majority of the patients with wrist pain do not have substantial ligament injury or functional impairment, MRI and MRA could be cost-effective in avoiding unnecessary DA.

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/>

John A. Carrino, MD, MPH - 2013 Honored Educator

John A. Carrino, MD, MPH - 2015 Honored Educator

RC504-10 Added Value of Dynamic Evaluation of Scapholunate Instability using Four Dimensional Computed Tomography in Association with Radiocarpal Osteoarthritis

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S406B

Participants

Nima Hafezi Nejad, MD, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose

John N. Morelli, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Uma Thakur, MD, Watchung, NJ (*Abstract Co-Author*) Nothing to Disclose

John Eng, MD, Cockeysville, MD (*Abstract Co-Author*) Nothing to Disclose

Shadpour Demehri, MD, Baltimore, MD (*Abstract Co-Author*) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation;

PURPOSE

To evaluate the added value of measurements obtained from dynamic computed tomography (CT) imaging in addition to static CT measurements in assessing the Scapholunate (SL) interval, and its association with radiocarpal osteoarthritis (OA).

METHOD AND MATERIALS

SL interval was measured in 55 wrists (31 subjects) with inconclusive plain radiographs (SL interval < 3mm) using: 1) Static CT in neutral position 2) Static CT in other positions: at rest, flexion, and radial deviation. 3) Dynamic CT: Changes from rest to clenched, from flexion to extension, and from radial to ulnar deviation. All subjects were examined by a hand surgeon and were suspected of having SL instability. 3 levels of statistical modeling were designed using CT measurements from 1) Static neutral position, 2) Static neutral position plus another static position, and 3) Static neutral position plus another static position plus dynamic change. Models were assessed for their ability to predict the presence radiocarpal OA. Radiocarpal OA was graded using Kellgren and Lawrence (KL) classification (with KL grade 2 as the threshold for OA diagnosis). Area Under the Curve (AUC) and discrimination slope of each modeling level was calculated and compared in association with radiocarpal OA.

RESULTS

All three modeling levels were in fair to moderate correlation with radiocarpal OA (correlation coefficients range: 0.356 – 0.457; P values < 0.01). CT assessment of another static position in addition to neutral position, was associated with a positive trend of increased AUCs. Additional assessment of dynamic CT changes was associated with a significant increase in the AUC (AUC increase from 0.681 to: 0.731 (rest-clenched; P:0.07), 0.737 (flexion-extension; P:0.05), 0.774 (radial to ulnar deviation; P<0.01)).

CONCLUSION

Dynamic CT evaluations can significantly enhance the detection of SL instability in the prediction of radiocarpal OA, beyond the static CT measurements. Other static position CT images (in addition to neutral position) were associated with a positive trend of enhanced performance.

CLINICAL RELEVANCE/APPLICATION

Dynamic CT evaluations are of significant added value while performed in addition to static CT; when SL instability is suspected, radiographic findings are inconclusive and radiocarpal OA is of concern.

RC504-11 Preoperative Evaluation of Wrist and Hand

Wednesday, Nov. 30 11:00AM - 11:20AM Room: S406B

Participants

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

LEARNING OBJECTIVES

1) Discuss current imaging techniques that can be used to evaluate painful wrist and hand. 2) Review pertinent anatomy and normal MRI appearance to avoid imaging pitfalls. 3) Identify common injuries and their clinical and surgical implications.

ABSTRACT

RC504-12 Variations of Wrist First Extensor Compartment MRI Anatomy and Association with DeQuervain's Tenosynovitis

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S406B

Participants

Connie Y. Chang, MD, Boston, MA (*Presenter*) Nothing to Disclose
Arvin Kheternal, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Timothy Meehan, MD, MS, Newark, NJ (*Abstract Co-Author*) Nothing to Disclose
Martin Torriani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ambrose J. Huang, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the correlation between variations of wrist first extensor compartment anatomy and DeQuervain tenosynovitis.

METHOD AND MATERIALS

A retrospective search of the imaging archive for "DeQuervain" was performed, which yielded 56 subjects (52±15 years, 23 F, 19 M). The control group contained 42 consecutive patients (43±16 years, 36 F, 10 M) with wrist MRI and a normal first extensor compartment. The studies were reviewed for: number of abductor pollicis longus (APL) tendon slips and their insertions, and tendon compartmentalization at the level of the radial styloid. A tendon slip was defined as a hypointense structure with normal caliber and signal intensity, with its own insertion. Groups were compared with Fisher exact test.

RESULTS

In the control vs subject groups, 12/42 (29%) vs 5/46 (11%) had 1, 23/42 (55%) vs 23/46 (50%) had 2, 6/42 (14%) vs 10/46 (22%) had 3, 1/42 (2%) vs 4/46 (9%) had 4, and 0/42 (0%) vs 4/46 (9%) had 5 tendon slips of the APL. There was a statistically significant difference between the controls and subjects when comparing the number of single versus multiple (>1) tendon slips of the APL ($P = 0.03$). In the control vs subject groups, 3/42 (7%) vs 0/46 (0%) had an absent EPB, 30/42 (71%) vs 18/46 (39%) had a normal configuration with a single compartment containing both EPB and APL, 7/42 (17%) vs 25/46 (54%) had a septation in the tendon sheath, and 2/42 (5%) vs 3/46 (7%) the EPB and APL were in separate compartments. There was a statistically significant difference between the compartmentalization of the EPB and APL between subjects and controls (0.0003). There was no statistically significant difference between the control and subject groups in terms of number of insertions on the thumb metacarpal ($P = 0.6$) or trapezium ($P = 0.2$), or having an insertion on both the metacarpal and the trapezium ($P = 0.3$).

CONCLUSION

Subjects with DeQuervain tenosynovitis are more likely to have multiple APL tendon slips, and are more likely to have a septation in the tendon sheath at the level of the radial styloid.

CLINICAL RELEVANCE/APPLICATION

Understanding the anatomy of the APL tendon, the multiplicity of the tendon sheaths, the differences in tendon compartmentalization, and their variant insertions is important to avoid falsely diagnosing tears of the tendon.

RC504-13 Diagnosing Carpal Tunnel Syndrome is As Easy As Diffusion Tensor Imaging, A Systematic Review

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S406B

Awards

Student Travel Stipend Award

Participants

Hiren Rangunwala, MD, Detroit, MI (*Presenter*) Nothing to Disclose
Karan N. Patel, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Amr M. Daous, MD, Detroit, MI (*Abstract Co-Author*) 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
Nicholas A. Lewis, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Kamran A. Shah, MD, Catonsville, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Diffusion tensor imaging (DTI) is a highly sensitive MRI technique to detect pathological states in tissue microstructure. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) are used to measure the compactness of tissue. Both together can detect the structural architecture and integrity of normal versus pathological conditions. This is a systematic review to explore diagnosing carpal tunnel syndrome with DTI.

METHOD AND MATERIALS

A literature search on PubMed was carried out with major sub headings including carpal tunnel syndrome, diffusion tensor imaging and papers from 2007 to 2016 were included. Inclusion criteria included a trial of CTS patients compared to controls using FA and ADC from DTI. Data was extracted including: the number of patients and demographics, FA and ADC at a proximal and distal level. Proximal included the distal radioulnar joint whereas distal included the hook of the hamate and the pisiform. Inverse variance of weighted means was carried out by MedCalc under the random-effects model. An overall effect size with a standard difference of means was obtained. Heterogeneity was defined by I^2 . Additionally sensitivity and specificity were reported in six of the major studies, which were analyzed.

RESULTS

We calculated the standardized mean difference (SMD) of all the acceptable studies in the proximal and distal aspect of the carpal tunnel with FA and ADC using a random effects model. The proximal FA had a SMD of -1.271 with a confidence interval (CI) of -1.451 to -1.092 at 95%. The distal FA had a SMD of -0.887 with a CI of -1.061 to -0.712 at 95%. Study heterogeneity was of 80.76% for proximal FA versus distal FA of 88.91%. The proximal ADC had a SMD of 0.792 with a CI of 0.622 to 0.961 at 95%. The distal ADC had a SMD of 0.804 with a CI of 0.634 to 0.974 at 95%. Study heterogeneity was of 79.75% for proximal ADC versus distal ADC of 81.06%. Additionally the mean age for CTS patients was 49 years, with 78%-22% of women to men. For healthy control patients the mean age was 44 years, with 75%:25% ratio of women to men. Overall there was a mean sensitivity of 82.8% and mean specificity of 77.8% for FA

CONCLUSION

Most studies performing DTI concluded that CTS has a significant lower FA and higher ADC compared to healthy controls.

CLINICAL RELEVANCE/APPLICATION

A systematic review can help standardize diffusion tensor imaging as a new method of diagnosing carpal tunnel syndrome.

RC504-14 Postoperative Evaluation of Wrist and Hand

Wednesday, Nov. 30 11:40AM - 12:00PM Room: S406B

Participants

Robert S. Campbell, MBBCh, Liverpool, United Kingdom, (rob.campbell@rlbuht.nhs.uk) (*Presenter*) Royalties, Reed Elsevier

LEARNING OBJECTIVES

1) The common surgical procedures utilised in sports injuries of the hand and wrist. 2) The typical complications arising from surgical procedures of the hand and wrist. 3) The choice of imaging modality required to demonstrate complications of surgery of the hand and wrist. 4) The radiological appearances of the normal and abnormal post-operative hand and wrist.

ABSTRACT

This presentation will include discussion on the indications for surgical intervention, and surgical technique in sports injuries of the hand and wrist. Topics will include: TFC debridement and repair, ligament repair and reconstruction, tendon repair and stabilisation. The discussion will focus on post-operative complications, and the appearances of normal and abnormal post-operative radiological investigations.

RC505

Neuroradiology Series: Spine

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

NR

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

FDA

Discussions may include off-label uses.

Participants

Peter G. Kranz, MD, Durham, NC, (peter.kranz@duke.edu) (*Moderator*) Research Consultant, Cephalogics, LLC Research Consultant, Biogen Idec Inc
Eu-Meng Law, MBBS, Los Angeles, CA, (meng.law@usc.edu) (*Moderator*) Speakers Bureau, Toshiba Corporation; Medical Advisory Board, Guerbet SA; Medical Advisory Board, Bracco Group; Medical Advisory Board, FUJIFILM Holdings Corporation; Medical Advisory Board, GibLib; Speaker Siemens AG;

Sub-Events

RC505-01 Overutilization of Expensive Technology in Spine Trauma for no Proven Benefit

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

Participants

Adam E. Flanders, MD, Narberth, PA, (adam.flanders@jefferson.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the most appropriate use of MRI in spinal trauma and spinal cord injury. 2) Classify unstable spinal injuries. 3) Explain the variety of soft tissue injuries depicted by MRI. 4) Recommend the best imaging pathway to follow for spinal trauma and spinal cord injury.

ABSTRACT

RC505-02 The Sensitivity of Image Guided Needle Biopsy in Infectious Discitis: A Systematic Review and Meta-Analysis

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

Participants

Alyssa McNamara, BA, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Elliot Dickerson, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Diana M. Gomez-Hassan, MD, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Sandro Cinti, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Ashok Srinivasan, MD, Canton, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To apply systematic review and meta-analysis to estimate the sensitivity of image guided biopsy in infectious discitis.

METHOD AND MATERIALS

A comprehensive literature search was performed using four databases: Pubmed, Cochrane CENTRAL, Embase, and Scopus as well as relevant references from identified systematic reviews. Articles containing the Medical Subject Headings and text words as well as all synonyms for the terms "discitis" and "biopsy" were included. There were no publication date or language restrictions. Two authors independently screened the studies for relevance based on title and abstract. The relevant articles were then screened for eligibility based on fulfillment of the following criteria: (a) peer-reviewed journal publication on human subjects, (b) patients were clinically suspected of having infectious discitis prior to biopsy, (c) biopsy samples were obtained via imaging guided procedure, and (d) reported data sufficient for calculation of true positives and false negatives. Data was extracted including overall numbers for true positives and true negatives and, if reported, false positives, and false negatives. Subgroup analysis was performed for sensitivity following antibiotic administration, and open surgical biopsy versus needle biopsy.

RESULTS

The literature search identified 1814 articles. An initial screen of the titles and abstracts identified 88 potentially relevant articles. Data was extracted for 55 articles found to be eligible for inclusion in the meta-analysis. The pooled sensitivity was 53.6% (1659/3097) patients. Significant predictors of biopsy sensitivity from subgroup analysis include prior antibiotic exposure: sensitivity of 21% (17/81; Fisher's test p-value of <0.0001). Compared to image guided biopsy, open biopsy had a greater sensitivity of 76.2% (125/164; Fisher's test p-value <0.0001).

CONCLUSION

Image guided biopsy has a moderate sensitivity of approximately 53% for the diagnosis of infectious discitis which compares poorly with the open biopsy. Antibiotic administration prior to biopsy harms diagnostic yield by reducing sensitivity.

CLINICAL RELEVANCE/APPLICATION

This study indicates image guided biopsy in suspected discitis is moderately sensitive for detection of the infectious organism.

RC505-03 How Effective is Surgical Pathology as an Adjunct in Directing Treatment in Patients with Suspected Discitis/Osteomyelitis?

Awards

Student Travel Stipend Award

Participants

Kiyon Naser-Tavakolian, Burlington, VT (*Presenter*) Nothing to Disclose
David M. Johnson, MD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose
Christine O'Neill, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose
Grant J. Linnell, DO, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to determine the utility of surgical pathology from a disc/bone biopsy in guiding treatment of patients with suspected discitis/osteomyelitis. This study calls into question the percentage yield of routine surgical pathology from image guided percutaneous biopsy in a setting with high clinical suspicion of vertebral osteomyelitis.

METHOD AND MATERIALS

A retrospective review was conducted of 97 spinal biopsies performed between 2010 and 2015. Clinical presentation and imaging findings were used as the reference for a patient actually having discitis/osteomyelitis. Pathologic examination was used as an adjunct in directing treatment in patients. Surgical pathology was compared to the microbiological yield from blood and bone cultures in the setting of positive imaging and clinical presentation. Histologic yield, sensitivity and specificity were determined for surgical pathology.

RESULTS

A total of 97 spinal biopsy procedures were performed on 93 patients. The sensitivity and specificity of the surgical pathology results when compared to the bone microbiology were 69% (95% CI 48.1-84.9) and 69% (56.7-79.1) respectively. Histological yield for surgical pathology was 41%. Blood cultures were positive in 11/97 cases (11.3%). Of those positive blood cultures 9/11 (81%) had the same organism as the bone biopsy culture. In other words, most (81%) of the blood cultures that were positive were in concordance with the bone biopsy cultures. However, blood cultures have a low yield (11.3%) in the general setting of vertebral osteomyelitis. Of those 9 concurrent blood cultures, 5 had antibiotics prior to blood draw.

CONCLUSION

In patients with a clinical and imaging presentation consistent with discitis/osteomyelitis, surgical pathology has limited usefulness. Identifying the causative microbe via blood or bone cultures is most helpful in directing antimicrobial therapy. Unfortunately, blood and bone cultures uncommonly detect the causative agent. Surgical pathology, despite a relatively useful sensitivity and specificity for vertebral osteomyelitis, can only rarely identify an organism. Therefore, use of this laboratory examination should be reserved for patients with a low pre-biopsy probability of discitis/osteomyelitis.

CLINICAL RELEVANCE/APPLICATION

We aim to determine the usefulness of surgical pathology in directing treatment in the setting of high clinical suspicion of discitis/osteomyelitis.

RC505-04 Role of Diffusion-Weighted MR Imaging in Differentiation of Infectious Spondylodiscitis and Spinal Malignancy

Wednesday, Nov. 30 9:20AM - 9:30AM Room: E451B

Participants

Supika Wansophonkul, MD, Bangkok, Thailand (*Presenter*) Nothing to Disclose
Theeraphol Panyaping, Ratchathewi, Thailand (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare ADC values between infectious spondylodiscitis and spinal malignant tumors. In addition, to determine sensitivity, specificity, accuracy, PPV and NPV using ADC value cutoff point for diagnosis of infectious spondylodiscitis.

METHOD AND MATERIALS

Eighteen patients with 53 vertebral marrow lesions suspected infectious spondylodiscitis or spinal malignant tumors acquired between March 2015 to March 2016, were prospectively performed diffusion weighted MR imaging (b value = 400 and 800) with ADC mapping. The radiologist measured the minimal ADC, mean ADC and maximal ADC values of the enhancing lesions or hyperintense T2 marrow lesions. These parameters were compared between infectious spondylodiscitis and spinal malignant tumors, to find the ADC value cutoff point for diagnosis of infectious spondylodiscitis. Using the cutoff point, the intraobserver agreement, sensitivity, specificity, accuracy, PPV and NPV were calculated.

RESULTS

The mean ADC values of the infectious spondylodiscitis are significantly higher than of the spinal malignant tumors, $1.30 \pm 0.28 \times 10^{-3} \text{ mm}^2/\text{s}$ and $1.10 \pm 0.20 \times 10^{-3} \text{ mm}^2/\text{s}$, respectively. Sensitivity, specificity, accuracy, PPV and NPV of the diagnosis of infectious spondylodiscitis using mean ADC value cutoff points of $1.116 \times 10^{-3} \text{ mm}^2/\text{s}$ are 75%, 68%, 71.7%, 72.4% and 70.8%, respectively. The intraobserver agreement of mean ADC value using concordance correlation coefficient showed 95% limits of agreement between 0.350×10^{-3} and $0.372 \times 10^{-3} \text{ mm}^2/\text{s}$.

CONCLUSION

Diffusion-weighted MR imaging has role in differentiating between infectious spondylodiscitis and spinal malignant tumors, especially when imaging findings on conventional images are inconclusive.

CLINICAL RELEVANCE/APPLICATION

Diffusion-weighted MR imaging with mean ADC value of the spinal marrow lesion may distinguish infectious spondylodiscitis from spinal malignant tumors. It has role for differential diagnosis especially when imaging findings on conventional images are

inconclusive.

RC505-05 Vertebral Augmentation in Multiple Myeloma Patients with Spinal Fractures: A Population Analysis of Major Medical Complications Using SEER-Medicare Data

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

Participants

Falgun H. Chokshi, MD, Marietta, GA (*Presenter*) Nothing to Disclose
David H. Howard, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Richard Duszak JR, MD, Atlanta, GA (*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

PURPOSE

To evaluate the impact of vertebral augmentation on the incidence of major medical complications in multiple myeloma patients with spinal fractures.

METHOD AND MATERIALS

Using 2005-2012 SEER-Medicare data, we identified multiple myeloma patients who did (intervention group) and did not (control group) undergo vertebral augmentation within 60 days of an index spinal fracture. Our primary outcome was major medical complications within 1 year after intervention (e.g., myocardial infarction, pulmonary embolism, pneumonia, stroke). After randomly matching patients in both groups, we used a complication competing risk regression model to compute hazards ratios (HR) and cumulative incidence of time to medical complications. Covariates included age, race, gender, poverty level, education level, Medicaid inclusion status, comorbidity count, National Cancer Institute hospital status, spinal fracture claim before myeloma diagnosis, hospitalization for index fracture, and presence of two or more index spinal fractures. All confidence intervals (CI) were at 95% significance.

RESULTS

Of 3,492 myeloma patients identified with spinal fractures, 635 (18.2%) underwent vertebral augmentation. Although the cumulative incidence of time to major medical complications was shorter in the intervention group, there was no significant difference in adjusted hazards ratios between both groups (HR 1.12, CI 0.98-1.28). Women had a lower hazard of medical complication (HR 0.84, CI 0.75-0.94). Patients with spinal fractures before a myeloma diagnosis (HR 1.54, CI 1.35, 1.76) and hospitalization for fracture had a higher hazard of medical complication (HR 1.27, CI 1.12-1.43).

CONCLUSION

In myeloma patients with spinal fractures there was no significant difference in the relative likelihood of major medical complications in patients undergoing vertebral augmentation vs. controls. However, the medical complications occurred earlier in patients who undergoing vertebral augmentation. Patients in the intervention group may be more likely to seek and receive care for complications, potentially biasing results against finding an advantage for the intervention group.

CLINICAL RELEVANCE/APPLICATION

Myeloma patients with spinal fractures undergoing vertebral augmentation may not have different relative likelihoods of medical complications compared with controls, but may be getting their care earlier.

RC505-06 Who Should Be Reading 24/7 Spine Trauma

Wednesday, Nov. 30 9:40AM - 10:10AM Room: E451B

Participants

Eu-Meng Law, MBBS, Los Angeles, CA, (meng.law@usc.edu) (*Presenter*) Speakers Bureau, Toshiba Corporation; Medical Advisory Board, Guerbet SA; Medical Advisory Board, Bracco Group; Medical Advisory Board, FUJIFILM Holdings Corporation ; Medical Advisory Board, GibLib; Speaker Siemens AG;

LEARNING OBJECTIVES

1. To determine the most optimal interpretations of spine trauma (during and after hours) should be done by neuroradiologists, ER/trauma radiologists, neuroradiology fellows, neuroradiology residents, general radiologists
2. To determine which group (above) provides the most efficient turnaround time
3. To determine which group (above) provides the most optimal educational experience for our residents and fellows

ABSTRACT

LEARNING OBJECTIVES

1) To discuss who should be best to read emergency spine/neuroradiology studies? Are ED cases at night covered: Neuroradiology versus general radiology? Local radiology versus teleradiology? Staff or trainees? Final reads versus preliminary reads? 2) To determine if there is a discrepancy between different readers? What constitutes a significant clinical discrepancy? How can we assess the accuracy of ER night attending and teleradiology reads? What is the level of resident (R2/R2 vs R3/R4), fellow, neuroradiologist, ER radiology, teleradiology discrepancy rate (Can we measure with call back rate)? Do residents or fellows have a lower discrepancy rate than ER attendings with subspecialty neuroradiology cases? 3) To determine what is the impact on turnaround times, What is the impact on patient care? Are turn-around times and accuracy of readings related? What is the financial impact of slower turnaround time? 4) To determine what is the impact on resident and fellow education? What proportion of ER neuro is learned from day Neuro v night ER? (Do they need to learn neuro at night?) What do residents and fellows prefer? Is there a difference in quality between residents in programs with night ER attending coverage v night neuroradiology attending v teleradiology reads (how could this be accurately determined? What is the role of neuroradiology fellow on at night, can the fellow provide final reports in your practice/state? 5) To determine what is the role of the ER radiologist overnight What cases are within scope of ER rad knowledge/responsibility? Basic neuro spine trauma Complex spine trauma MRI cord compression . Do ordering physicians know the difference if an ER radiologist vs Neuroradiologists vs teleradiologist reads their study? Do they care? 6) To determine what impact teleradiology has had on the commoditization of radiology? Has healthcare reform, QA metrics, turnaround times commoditized radiology? Has teleradiology commoditized radiology? Can we save neuroradiology?

ABSTRACT

Who should read after hours Emergency Neuroradiology and Spine ER studies? Residents vs Fellows vs Neuroradiologists vs ER Radiologists vs Teleradiology? See Learning Objectives

RC505-07 Vertebral Augmentation (To Be or Not to Be)

Wednesday, Nov. 30 10:20AM - 10:50AM Room: E451B

Participants

Allan L. Brook, MD, Bronx, NY, (Abrook@montefiore.org) (*Presenter*) Nothing to Disclose

RC505-08 Use of Contrast in Initial Screening MRI Lumbar Spine for Degenerative Disease: Evaluating Diagnostic Utility and Cost Effectiveness

Wednesday, Nov. 30 10:50AM - 11:00AM Room: E451B

Participants

Vistas J. Daruwalla, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Salah Abdelhadi, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Aravind N. Mohandas, MD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Hamza M. Beano, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Mounika Gunduru, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Maera Haider, MBBS, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Tagwa K. Khairalseed, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Conor Zuk, DO, DETROIT, MI (*Abstract Co-Author*) Nothing to Disclose
Kamran A. Shah, MD, Catonsville, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether addition of contrast in MRI lumbar spine scans for the initial screening of degenerative disease improves the diagnostic assessment. Cost effectiveness of such an addition is also evaluated.

METHOD AND MATERIALS

A retrospective analysis of 500 MRI lumbar spine scans with and without contrast (W/W/O) in last 3 months for the initial pilot study was performed. Patients with history of cancer, prior surgeries, demyelinating diseases, trauma and suspicion for infection were excluded. A total of 152 patients who underwent initial screening for uncomplicated back pain, lower leg weakness and radiculopathy secondary to degenerative disease were identified. Two independent reviewers evaluated the scans for the utility of contrast and disagreements between the reviewers were resolved by consensus. MRI scan time and cost at our institution for lumbar spine W/W/O and without contrast is 45 minutes and 745 \$ and 30 minutes and 545 \$ respectively, were considered for evaluating the cost effectiveness.

RESULTS

The pilot study evaluated 152 patients, including 74 females and 78 men with average age of 53.26 years. Back pain (72%) and radiculopathy (16%) were the most common indications for study. Evaluation by two independent reviewers identified only 6 cases (4%) where addition of contrast may have benefited the diagnostic assessment. These 6 cases included findings such as neuroma, myxopapillary ependymoma, abscess, osteomyelitis/diskitis, leptomeningeal neoplastic or granulomatous deposit and paraganglioma. 96% of cases demonstrate no added diagnostic value of contrast enhanced studies. Our institution performs about 1500 MRI lumbar spine W/W/O scans/year with approximately 500 scans/year are ordered to screen for back pain secondary to degenerative disease. Use of contrast costs an extra 200\$/ scan and additional 15 minutes of scan acquisition time for these 500 scans which leads to a cost burden of 236,250\$/year.

CONCLUSION

Despite ACR recommendation for non contrast examinations in uncomplicated back pain, overuse of contrast is routinely seen in clinical practice. Our study highlights the lack of diagnostic value of contrast addition and the growing costs associated with such misuse.

CLINICAL RELEVANCE/APPLICATION

Recommend use of non contrast MRI lumbar spine for initial screening of uncomplicated degenerative disease as addition of contrast lacks diagnostic utility and adds to the economic burden.

RC505-09 Complex Segmentation and On-site 3D Printing of Severe Scoliotic Spine for Pre-Surgical Planning and Intra-Operative Visualization

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

Participants

Javin Schefflein, MD, New York, NY (*Presenter*) Nothing to Disclose
Joseph Borrello, BEng, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Thomas P. Naidich, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Nathaniel Swinburne, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
John Caridi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Anthony Costa, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We report strategies and methods for image acquisition, data segmentation, and rapid on-site printing of a full-scale 3D model of a highly complex spinal malformation including very severe thoracolumbar scoliosis, multilevel malsegmentations of the vertebrae and ribs, and Type I diastematomyelia for use in surgical planning.

METHOD AND MATERIALS

CI was obtained of the full spinal column and proximal ribs. Initial seeding for the segmentation was completed via high-contrast thresholding of the image. A connected component growth model with origins from the seed mask completed the rough mask of all bony components. The model was refined using a low-propagation level-set model. Geometry-preserving Taubin smoothing followed by quadratic edge collapse decimation yielded the final model, which was printed at a 1:1 scale with ProJet 660 Pro gypsum powder-based 3D printer.

RESULTS

The specific aspects of the surgery were planned while physically rotating the printed model in space to see the interconnections among fused ribs, fused vertebrae, anterior and posterior attachments of the bone spur, and the relationships of all the spinal curves to the plane of the pelvis. Thereafter, the child underwent two-stage surgery involving laminectomy, resection of a midline bony spur, spinal cord detethering, asymmetric pedicle subtraction osteotomy, and long-segment posterior fusion. At each stage of surgery, a member of the surgical staff held up and manipulated the model so the surgeon could "visualize" and account for the portions of the spinal anatomy immediately deep to his exposure.

CONCLUSION

Successful surgical repair of complex spinal malformations requires precise pre-operative planning and an accurate three dimensional understanding of the malformations. Using on-site segmentation and 3D printing, a physical model was produced for pre-surgical planning and intra-operative visualization for a patient with very severe thoracolumbar scoliosis and a multitude of associated abnormalities.

CLINICAL RELEVANCE/APPLICATION

On-site data segmentation and 3D modeling provides surgeons with an accessible tool for preoperative planning and intraoperative visualization of complex pathologies.

RC505-10 Dual-Energy Computed Tomography of the Spine: Improved Lesion-to-Spine Contrast with a Noise-Optimized Advanced Monoenergetic Post-Processing Algorithm

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

Awards

Student Travel Stipend Award

Participants

Mareen S. Kraus, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose

Jakob Weis, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Fabian Bamberg, MD, MPH, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Research Grant, Siemens AG;

Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG

Mike Notohamiprodjo, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Ahmed Othman, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study was to evaluate the effect of advanced monoenergetic postprocessing (MEI+) on visualization of intraspinal lesions in contrast-enhanced dual-energy CT (DE-CT).

METHOD AND MATERIALS

Twenty-six patients (age 60.54 ± 16.54) with previously identified intraspinal lesions were included in this study. All patients underwent contrast-enhanced dual-energy CT in a 3rd generation dual-source CT scanner. Image acquisition was in dual-energy mode (100/Sn150kV) with activated tube current modulation 90 seconds after contrast agent administration (Imeron 400, Bracco, Italy). Subsequently, virtual monoenergetic images (MEI+) were reconstructed at four different keV levels (40; 60; 80; 100) and compared to the standard CTpv. Image quality was assessed qualitatively (conspicuity, delineation, sharpness, noise, confidence; two independent readers; 5-point Likert scale; 5=excellent) and quantitatively by calculating signal-to-noise (SNR) and contrast-to-noise-ratios (CNR).

RESULTS

Best contrast of intraspinal lesions was observed in MEI+ at 40 keV with significant differences to CTpv and high keV reconstructions (60, 80, 100; $p < 0.001$). Highest conspicuity, delineation, sharpness were observed in MEI+ at 40 keV with significant differences to CTpv ($p < 0.001$). Similarly, MEI+ at 40 keV yielded highest diagnostic confidence (4.6 ± 0.6) also with significant differences to CTpv (3.45 ± 0.9 , $p < 0.001$) and to high keV reconstructions (80, 100; $p \leq 0.001$), as shown in figure 1. Image noise significantly increased in 40 keV MEI+ as compared to all other MEI+ reconstructions and CTpv ($p < 0.001$). CNR calculations revealed highest scores for MEI+ at 40 keV followed by 60 keV and CTpv with significant differences to high keV MEI+. SNR did not show significant differences in MEI+ or CTpv.

CONCLUSION

Computed MEI+ at low keV levels can significantly improve image quality and delineation of intraspinal lesions in patients with portal-venous phase CT scans due to increased CNR and tolerable image noise.

CLINICAL RELEVANCE/APPLICATION

Advanced virtual monoenergetic reconstructions at low keV levels, specifically 40 keV, provide improved intraspinal tissue contrast, thus enabling greater lesion detectability and subsequent monitoring of recurrent disease, thereby influencing clinical management.

RC505-11 Diffusion Tensor Imaging: A Valuable Neuroimaging Biomarker in Predicting Long Term Outcome in Acute Blunt Cervical Spinal Injury

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

Participants

Kathirkamanathan Shanmuganathan, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jiachen Zhuo, Baltimore, MD (*Presenter*) Nothing to Disclose
Hegang H. Chen, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Bizhan Aarabi, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jason Adams, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jay Menakar, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In this prospective longitudinal study, we investigate if hyperacute admission diffusion tensor imaging (DTI) parameters measured at cervical spinal cord injury (CSCI) can predict patient long-term neurological and functional outcome.

METHOD AND MATERIALS

The study included 30 blunt CSCI patients admitted to our trauma center, with 16 of them followed up to 1 year, and 15 volunteers as controls. All magnetic resonance imaging examinations were performed within 24 hours of injury. Regional DTI values were measured on contusions (avoiding hemorrhage) and at corresponding upper/middle/lower regions in controls. Stepwise regression analysis was performed to find relevant parameters (normalized DTI values, age, gender, hemorrhagic contusion (HC) or non-HC) that correlated with patient International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) motor and Spinal Cord Independence Measure (SCIM) III scores at 1 year.

RESULTS

Among all DTI measures, axial diffusivity (AD) most strongly correlated with both motor ($r=0.76$, $p<0.01$) and SCIM III scores ($r=0.77$, $p<0.01$) at 1 year. Further stepwise regression indicate that including AD ($p = 0.0001$) and presence of HC ($p<0.0001$) in the regression model provided the best model fit for 1 year ISNCSCI ($r^2=0.93$). As AD is a specific parameter for axonal injury, this may indicate that axonal injury in the cord is the main factor affecting patient recovery.

CONCLUSION

Our study demonstrates hyperacute DTI measurements at the CSCI are valuable neuroimaging biomarkers in predicting long-term neurological and functional outcome in blunt CSCI.

CLINICAL RELEVANCE/APPLICATION

The robust correlation between admission DTI measurements and long-term outcome demonstrated in this study indicates AD is a valuable neuroimaging marker predicting outcome and triaging patients to appropriate new novel treatments and rehabilitation. **Acknowledgments:** This material is based on research sponsored by 711 HPW/XPT under Cooperative Agreement number FA8650-11-2-6142 and FA8650-11-2-6D07. The U.S. Government is authorized to reproduce and distribute reprints for Governmental purposes notwithstanding any copyright notation thereon.

RC505-12 Epidural Injections for Back Pain: Which Injectate?

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

Participants

Wende N. Gibbs, MD, MA, Los Angeles, CA, (wende.gibbs@med.usc.edu) (*Presenter*) Research Grant, Vivex Biomedical, Inc

LEARNING OBJECTIVES

1) Review the current debate over efficacy, cost-effectiveness, and safety of epidural steroid injections. 2) Compare the mechanism of action, safety, and effectiveness of traditional and investigative injectates. 3) Appraise and debate additional issues, such as: a. Which type of back pain (radicular, stenosis, discogenic) should be treated with steroid injection? b. Which route of injection is the safest and most efficacious? c. Does the type of image guidance make a difference? d. Does specialty of the practitioner make a difference?

ABSTRACT

Bread and Butter Sinus Imaging: Telling Your Referrers What They Need to Know

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



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

Participants

Sub-Events

RC506A Sinonasal Anatomy: Drainage Pathways and Important Variants

Participants

Michelle A. Michel, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the anatomy of the paranasal sinus drainage pathways using multiplanar imaging. 2) Recognize patterns of inflammatory disease based upon the anatomy of the sinus drainage pathways. 3) Identify important anatomic variations in the sinonasal cavities that may predispose a patient to recurrent inflammatory disease or complications during endoscopic surgery. 4) Recognize imaging findings in acute & chronic rhinosinusitis. 5) Recognize orbital & intracranial complications of rhinosinusitis. 6) Recognize the imaging appearance of early acute fulminant invasive fungal sinusitis on CT and MRI. 7) Recognize the intraorbital and intracranial complications of IFS and bacterial rhinosinusitis. 8) Recognize imaging features which suggest neoplasm rather than inflammatory sinus disease.

ABSTRACT

Knowledge of multiplanar CT anatomy of the sinonasal cavities is of utmost importance to the imager given advances in endoscopic sinus surgery (ESS). It is the role of the radiologist to provide an accurate surgical roadmap for our surgical colleagues. Knowledge of normal anatomy, sinus drainage pathways, and anatomic variants allows one to recognize patterns of inflammatory disease, to assess potential causes of recurrent inflammatory disease, and to identify variants that may make a patient more prone to a complication during ESS. Normal and variant anatomy of the nasal cavity and paranasal sinuses will be discussed, with an emphasis on drainage pathways and variants of particular clinical relevance. Rhinosinusitis is a common clinical problem which affects > 16% of the US population annually and results in significant expenditure of health care dollars. I will review the epidemiology and imaging findings of acute & chronic rhinosinusitis, including silent sinus syndrome. CT and MRI findings of orbital and intracranial complications of bacterial sinusitis will be presented. I will also cover the imaging findings in polyposis, allergic fungal sinusitis, non-invasive fungal disease and mucocoeles. A specific search pattern and certain red flags will help the audience to suspect more aggressive infection, inflammation or tumor rather than routine sinusitis on the initial workhorse non-contrast sinus CT. Both CT and MR imaging play an important role in the timely diagnosis of aggressive sinonasal processes, especially invasive fungal sinusitis (IFS). Early CT imaging findings will be reviewed, along with the clinical presentation and population at risk, in order to emphasize the importance of high clinical suspicion and early diagnosis. The complimentary role of MRI to characterize late complications of bacterial and fungal infection and also to distinguish tumor from inflammatory sinus disease will also be covered.

Active Handout: Michelle Anne Michel

[http://abstract.rsna.org/uploads/2016/16001285/RC506A Sinonasal Anatomy.pdf](http://abstract.rsna.org/uploads/2016/16001285/RC506A_Sinonasal_Anatomy.pdf)

RC506B Acute and Chronic Rhinosinusitis

Participants

Deborah R. Shatzkes, MD, New York, NY (*Presenter*) Nothing to Disclose

Active Handout: Rebecca Sue Cornelius

[http://abstract.rsna.org/uploads/2016/16001286/ACTIVE RC506B rsna 2016 pdf.pdf](http://abstract.rsna.org/uploads/2016/16001286/ACTIVE_RC506B_rsna_2016_pdf.pdf)

RC506C When It's NOT Routine Sinusitis: Sinonasal Tumors and Aggressive Inflammatory Disease

Participants

Ashley H. Aiken, MD, Atlanta, GA, (ashley.aiken@emoryhealthcare.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the imaging appearance of early acute fulminant invasive fungal sinusitis on CT and MRI. 2) Recognize the intraorbital and intracranial complications of IFS and bacterial rhinosinusitis. 3) Recognize imaging features which suggest neoplasm rather than inflammatory sinus disease.

ABSTRACT

Presentation Summary: A specific search pattern and certain red flags will help the audience to suspect more aggressive infection, inflammation or tumor rather than routine sinusitis on the initial workhorse non-contrast sinus CT. Both CT and MR imaging play an important role in the timely diagnosis of aggressive sinonasal processes, especially invasive fungal sinusitis (IFS). Early CT imaging findings will be reviewed, along with the clinical presentation and population at risk, in order to emphasize the importance of high clinical suspicion and early diagnosis. The complimentary role of MRI to characterize late complications of bacterial and fungal infection and also to distinguish tumor from inflammatory sinus disease will also be covered. References: 1. Epstein VA and Kern RC. Invasive Fungal Sinusitis and Complications of Rhinosinusitis. *Otolaryngol Clin North Am.* 2008 Jun; 41(3): 497-524. 2. Aribandi M, McCoy V, Bazan C. Imaging Features of Invasive and Noninvasive Fungal Sinusitis: A Review. *Radiographics.* 2007 Sep-Oct; 27 (5):

1283-963. Gillespie B, O'Malley B, Francis H. An Approach to Fulminant Invasive Fungal Rhinosinusitis in the Immunocompromised Host. *Arch Otolaryngol Head Neck Surg.* 1998; 124:520-526. DelGaudio J, Swain R, Kingdom T, Muller S, Hudgins P. Computed Tomographic Findings in Patients With Invasive Fungal Sinusitis. *Arch Otolaryngol Head Neck Surg.* 2003; 129:236-240. Silverman CS, Mancuso AA. Periantral soft-tissue infiltration and its relevance to the early detection of invasive fungal sinusitis: CT and MR findings. *AJNR Am J Neuroradiol.* 1998;19:321-325

RC507

A Case-based Audience Participation Session (Genitourinary) (An Interactive Session)

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

GU

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

Participants

Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (*Coordinator*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Advisory Board, Bayer AG
William W. Mayo-Smith, MD, Boston, MA (*Presenter*) Author with royalties, Reed Elsevier; Author with royalties, Cambridge University Press
Andrea G. Rockall, MRCP, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will be introduced to a series of Genitourinary 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 Genitourinary 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. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

ABSTRACT

The extremely popular audience participation educational experience is back! GU Diagnosis Live is an expert-moderated session featuring a series of interactive Genitourinary case studies that will challenge radiologists' diagnostic skills and knowledge. Building on last year's successful Diagnosis Live premiere, GU Diagnosis Live is a lively, fast-paced game format: participants will be automatically assigned to teams who will then use their personal mobile devices to test their knowledge of GU radiology in a fast-paced session that will be both educational and entertaining. After the session, attendees will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance.

Emergency Radiology Series: Contemporary Topics in Imaging of Trauma

Wednesday, Nov. 30 8:30AM - 12:00PM Room: S405AB

ER

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

Participants

Scott D. Steenburg, MD, Zionsville, IN, (ssteenbu@iuhealth.org) (*Moderator*) Nothing to Disclose
Clint W. Sliker, MD, Ellicott City, MD (*Moderator*) Nothing to Disclose
Bharti Khurana, MD, Boston, MA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of radiology in the setting of mass casualty scenarios. 2) Discuss the current role of imaging in the assessment of liver injuries. 3) Discuss the role of medical imaging in the setting of hip trauma. 4) Discuss the role of CT angiography for the evaluation of suspected peripheral vascular injuries. 5) Assess and evaluate current trauma radiology research and its relevance to clinical practice.

Sub-Events

RC508-01 Disaster/Mass Victim Imaging

Wednesday, Nov. 30 8:30AM - 9:00AM Room: S405AB

Participants

Ferco H. Berger, MD, Toronto, ON, (fhberger@gmail.com) (*Presenter*) Nothing to Disclose

Active Handout: Ferco H. Berger

http://abstract.rsna.org/uploads/2016/16000643/RC508_01_MCI_-_handout.pdf

LEARNING OBJECTIVES

1) Describe the setting of a mass casualty incident. 2) Develop participation of the radiology department in preparation for disaster management plan activations. 3) Explain why simulation is crucial and recommend strategies to increase effectiveness of simulation drills.

ABSTRACT

In the setting of mass casualty incidents (MCI), hospitals need to divert from normal routine to delivering the best possible care to the largest number of victims. This should be accomplished by activating an established hospital Disaster Management Plan (DMP), known to all staff through prior training drills. Over the recent decades, imaging has increasingly been used to evaluate critically ill patients. It can be used as well to increase the accuracy of triaging MCI victims, since over-triage and under-triage can severely impact resource availability and mortality rates. This presentation emphasizes the importance of including the radiology department in hospital preparations for an MCI, and highlights factors expected to influence performance during hospital DMP activation including issues pertinent to effective simulation.

RC508-02 Damage Control Surgery: Significance of CT Imaging in the 24 Hour Window

Wednesday, Nov. 30 9:00AM - 9:10AM Room: S405AB

Awards

Student Travel Stipend Award

Participants

Armonde Baghdanian, MD, Boston, MA (*Presenter*) Nothing to Disclose
Arthur Baghdanian, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Tina Shiang, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Christina A. LeBedis, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Royalties, Reed Elsevier

PURPOSE

To retrospectively investigate the imaging findings, diagnostic accuracy, and clinical significance of CT imaging within 24 hours of Damage Control Surgery in abdominal trauma.

METHOD AND MATERIALS

This is a retrospective IRB approved and HIPAA compliant study. Informed consent was waived. All patients that sustained abdominal trauma and underwent immediate damage control surgery upon presentation were included if they had a diagnostic CT within 24 hours. From 3/2006-8/2013, 49 patients (46 male, 3 female; age range, 17-73 years) met our inclusion criteria. Two radiologists blinded to original radiology reports retrospectively reviewed CT examinations and recorded acute findings in consensus. A third investigator compared traumatic injuries from the original radiology reports, retrospective imaging reports, and original operative notes to determine the incidence of injuries in our patient cohort. A CT examination was categorized as missing a traumatic injury if the injury was identified on both retrospective imaging review and at surgery. In addition, an exploratory laparotomy was categorized as missing a traumatic injury if it was diagnosed on retrospective imaging review. Finally, a missed injury on either CT or surgery was categorized as clinically significant if it necessitated a repeat operation.

RESULTS

The etiology of trauma was blunt in 13/49 (26.5%) and penetrating in 36/49 (73.4%) patients. Overall incidence of injuries in our patient cohort included: diaphragm 6/49 (12.2%), liver 23/49 (46.9%), spleen 11/49 (22.4%), pancreas 4/49 (8.2%), bowel 38/49 (77.6%), adrenal 4/49 (8.2%), kidney 18/49 (36.7%), ureter 5/49 (10.2%), bladder 4/49 (8.2%), osseous (fracture) 34/49 (69.4%), and vascular 20/49 (40.8%). Significant CT findings were seen in 17/49 (34.7%) of which 6/17 were secondary to failed surgical repairs. 8/17 were in surgically explored areas and 9/17 were in unexplored areas. 5/17 radiology reports missed clinically significant findings found on follow up imaging or surgery.

CONCLUSION

Trauma patients that undergo Damage Control Surgery upon presentation have a broad spectrum of clinically significant injuries that are not diagnosed at laparotomy and therefore benefit from diagnostic CT imaging in the first 24 hours.

CLINICAL RELEVANCE/APPLICATION

Knowledge of surgical approaches and potential surgical and imaging pitfalls can aid in detection of injuries on MDCT in patients that undergo Damage Control Surgery.

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

RC508-03 Measuring the Impact of Whole Body Computed Tomography (CT) on Emergency Department (ED) Length of Stay in Blunt Trauma

Wednesday, Nov. 30 9:10AM - 9:20AM Room: S405AB

Awards

Student Travel Stipend Award

Participants

Jessica Chan, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Marta E. Heilbrun, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Christopher S. Johnson, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Tom H. Greene, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Whole-body CT (WBCT) imaging has become commonplace in many emergency departments (ED) in the adult blunt trauma setting, despite a growing body of research that has found no mortality or hospital length of stay (LOS) benefit for patients who received WBCT. The purpose of this study was to assess the value that WBCT imaging contributes to ED work flow, in blunt trauma patients by retrospectively comparing ED LOS between WBCT and selective CT imaging.

METHOD AND MATERIALS

This study is IRB approved. The Institutional Trauma Registry Database was cross-referenced with our radiology information system database to identify adult patients who sustained blunt trauma between July 2011- June 2013, and received CT imaging. Propensity score weighting was utilized to achieve balance in baseline covariates, including demographics, hemodynamic stability, Glasgow coma scale, and socio-economic factors. We generated standardized differences between imaging groups both before and after propensity-score weighting to assess the effectiveness of our model. A linear regression with log-transformed ED length of stay was used to assess percent change in the geometric means between imaging strategies.

RESULTS

2,291 patients were identified meeting inclusion criteria, of which 333 (14.5%) underwent WBCT imaging. After propensity score weighting, the arithmetic mean ED LOS was 55 ± 105 min and 83 ± 56 min for WBCT and selective CT patients respectively. Overall, there was a 21.2% (95% CI 29.4%, 11.9%) reduction in the geometric mean of ED LOS (in minutes) for those receiving whole-body scans compared to those receiving selective CT ($p < 0.001$), after propensity score adjustment for baseline covariates. Without adjustment, we found a 38.7% (95% CI 45.3%, 31.3%) reduction in the geometric mean of ED LOS (in minutes) for those receiving WBCT compared to those receiving selective CT ($p < 0.001$).

CONCLUSION

WBCT imaging was associated with a statistically and clinically significant reduction in ED LOS for blunt trauma patients.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that WBCT in the blunt trauma setting significantly reduces ED length of stay, thus improving efficiency and workflow within the ED, and leads to downstream health care cost savings.

RC508-04 The Role of Post Mortem CT in Determining Major Pathological Abnormalities Related to the Cause of Death with Autopsy Comparison

Wednesday, Nov. 30 9:20AM - 9:30AM Room: S405AB

Participants

Yuichi Sugino, MD, Tsu, Japan (*Presenter*) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (*Abstract Co-Author*) Departmental Research Grant, Siemens AG; Departmental Research Grant,

Bayer AG; Departmental Research Grant, Guerbet SA; Departmental Research Grant, DAIICHI SANKYO Group; Departmental Research Grant, FUJIFILM Holdings Corporation; Departmental Research Grant, Nihon Medi-Physics Co, Ltd
Atsuhiko Nakatsuka, MD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the role of whole-body postmortem CT (PMCT) in determining major pathological abnormalities related to the cause of death.

METHOD AND MATERIALS

From September 2012 to March 2016 PMCT was performed to investigate the causes of death in 507 cases. Among them, the causes (e.g. bleeding, massive trauma, major aortic disease) in 241 cases (47.5%, 241/507) were established by PMCT and 94 cases (18.5%, 94/507) underwent autopsy because of unknown cause of death from clinical course. Fifty-five (58.5%, 55/94) cases were in-hospital death, 17 (18.1%, 17/94) cases were out-of-hospital cardiac arrest (OHCA) and 22 (23.4%, 22/94) patients were forensic cases. All cases were performed PMCT within 24 hours after death and two board-certified radiologists were evaluated the detection of cause of death comparing autopsy.

RESULTS

Autopsy diagnosed the cause of death including acute heart failure (n=14, 14.9%, 14/94), malignancy (n=13, 13.8%, 13/94), liver failure (n=8, 8.5%, 8/94), pneumonia (n=8, 8.5%, 8/94), trauma (n=7, 7.4%, 7/94), infection (n=5, 5.3%, 5/94), GI bleeding (n=4, 4.3%, 4/94), major vascular disease (n=2, 2.1%, 2/94), and others or unknown (n=26, 27.7%, 26/94). PMCT obtained the findings of the suspected cause of death in 43 cases (45.7%, 43/94) including 27 of 55 (49.1%) in-hospital death cases, 7 of 17 (41.1%) OHCA cases, and 9 of 22 (40.9%) forensic cases. There were no significant differences between PMCT and autopsy in detection of the cause of death among in-hospital death cases, OHCA cases, and pre forensic cases. PMCT accurately diagnosed major pathological abnormalities related to death significantly in pulmonary disorders [odds ratio (OR) = 54.5, P = 0.0016], malignancy (OR=27.8, P =0.005), liver failure (OR=14.7, P =0.015), and trauma related findings (OR=12.7, P =0.04). There were no significant differences between PMCT and autopsy in identification of cause of death in acute heart failure, major vascular disease, GI bleeding, and infection.

CONCLUSION

PMCT could accurately detect the cause of death in pulmonary disorders, malignancies, liver failures, and trauma related findings.

CLINICAL RELEVANCE/APPLICATION

PMCT provides diagnostic information about pulmonary disorders, malignancies, liver failure, and trauma related findings.

RC508-05 Update on Imaging of Hepatic Injuries

Wednesday, Nov. 30 9:30AM - 10:00AM Room: S405AB

Participants
Stuart E. Mirvis, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

Honored Educators

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Stuart E. Mirvis, MD - 2015 Honored Educator

RC508-06 Emergency CT for Assessment and Management of Splenic Traumatic Injuries in a Level-I Trauma Center: 10-year Study

Wednesday, Nov. 30 10:00AM - 10:10AM Room: S405AB

Participants
Sergio Margari, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Diana Artioli, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Ettore Colombo, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Fabrizio Sammartano, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefania Cimbanassi, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Osvaldo Chiara, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Angelo Vanzulli, MD, Segrate, Italy (*Abstract Co-Author*) Travel support, Bracco Group

PURPOSE

Assessing the role of emergency CT in guiding management modality (Operative Management-OM or Non-Operative Management-NOM) in patients with splenic traumatic injuries.

METHOD AND MATERIALS

We retrospectively analyzed 280 traumatic splenic injuries in 4659 patients, admitted to the emergency room of a Level-I Trauma Center from October 2002 to December 2013. Based on CT imaging, splenic injuries were classified into 5 degrees from I (the mildest) to V (the severest), according to the Organ Injury Scale (OIS) of the American Association for the Surgery of Trauma. Moreover, we considered intraparenchymal (bleed A) or extraparenchymal (bleed B) contrast blush (the active extravasation of the contrast medium in arterial phase CT scans) as an independent parameter.

RESULTS

We performed 202 CT scans (78 patients were excluded due to hemodynamic instability) and patients were classified on the basis of OIS degrees (29 OIS I, 46 OIS II, 87 OIS III, 35 OIS IV, 5 OIS V). Moreover, we identified 86 vascular lesions (13 pseudoaneurysms, 34 pseudoaneurysms with blush, 11 bleed A, 7 bleed B, 21 bleed A+B). There were 136 patients treated with OM (48.57%). Statistically significant predictors of OM were systolic blood pressure <90 mmHg, OIS degrees IV and V, bleed B ($p<0.05$). On the other hand, 144 patients underwent NOM (51.43%), all hemodynamically stable or stabilized, and with OIS \leq III in 94.4%. NOM failed (FNOM) in 23 patients (15.97%): 2 OIS I, 4 OIS II, 16 OIS III, 1 OIS IV. FNOM occurred in 75% of cases within 30 hours from damage, without significant correlation to OIS degree and without increase of death rate. Arterial blush was predictive of FNOM ($p<0.05$).

CONCLUSION

Contrast enhanced CT scan is a useful diagnostic tool for the management of splenic traumatic injuries.

CLINICAL RELEVANCE/APPLICATION

CT-imaging permits an accurate assessment of splenic traumatic injuries by identifying parenchymal damage (OIS degrees) and vascular lesions (mainly arterial blush). CT scan safely influences emergency management of splenic trauma, allowing splenectomy sparing without any increase in mortality.

RC508-07 Whole-Body Computed Tomography in Trauma Patients: Optimized Patient Positioning Allows a Significant Shorter Examination Time While Maintaining Image Quality

Wednesday, Nov. 30 10:10AM - 10:20AM Room: S405AB

Participants

Tilman Hickehier, MD, Cologne, Germany (*Presenter*) Nothing to Disclose
Kamal Mammadov, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
Bettina Baessler, MD, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
David C. Maintz, MD, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose
De-Hua Chang, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Whole-body computed tomography (WBCT) plays a key role in the management of severely injured patients, but still no broad consensus exists regarding the ideal examination procedure. Hence, we compared examination time and artifact vulnerability of WBCTs performed either using a conventional or an optimized patient positioning.

METHOD AND MATERIALS

In 200 trauma patients who received a WBCT (with additional head and neck CTA (hnCTA) in 84 patients) the time from initiation of the scan to completion of the last series was measured. The presence of image artifacts in the most relevant regions was assessed using a 4-points Likert-scale (1=no artifacts, 2=minor artifacts without relevance, 3=stronger artifacts but maintained diagnostic image quality (IQ), 4= severe artifacts with non-diagnostic IQ).

In 100 patients (including 41 hnCTAs) the arms were positioned alongside the body for imaging of head and neck, followed by repositioning of the arms over the head for imaging of the trunk (group "A"). In the other 100 patients (including 43 hnCTAs) the arms were flexed on a pillow anteriorly to the chest with continuous acquisition of all study regions without need for repositioning (group "B").

RESULTS

The total duration of the procedure was significant shorter in "B" than in "A" for patients with hnCTA ($6:55\pm 1:54$ min vs. $10:54\pm 2:04$ min; $p<.001$) and without hnCTA ($6:46\pm 1:49$ min vs. $10:19\pm 2:42$ min; $p<.001$) resulting in a time saving of $3:59$ min or $3:33$ min respectively.

Artifacts in aorta, liver and spleen occurred more commonly in patients from "B", which resulted in a slight decline in IQ (mean score for lung 1.07 ± 2.56 "A" vs. 1.02 ± 1.41 "B", $p=0.09$; aorta 1.07 ± 2.93 vs. 1.27 ± 4.46 , $p<.001$; liver 1.09 ± 3.21 vs. 1.43 ± 5.55 , $p<.001$; spleen 1.05 ± 2.19 vs. 1.20 ± 4.49 , $p<.001$). No artifacts were observed in the spine and there was no examination with non-diagnostic IQ.

Random forests and logistic regression analyses showed that the increase in artifacts was not only due to the optimized positioning itself but also to amendable causes (foreign objects/positioning faults).

CONCLUSION

The continuous acquisition of all study regions by using an optimized positioning protocol for WBCT in trauma patients allows reducing the examination time by more than 30% while maintaining diagnostic image quality.

CLINICAL RELEVANCE/APPLICATION

A significant reduction in examination time allows a faster diagnosis of severely injured patients and a smoother workflow for the involved medical employees.

RC508-08 Low-Dose CT with the Adaptive Statistical Iterative Reconstruction (ASIR)-V Technique in Abdominal Organ Injury Grading: Comparison with Routine-Dose CT with Filtered Back Projection (FBP)

Wednesday, Nov. 30 10:20AM - 10:30AM Room: S405AB

Participants

Nam Kyung Lee, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jeongmyeong Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Suk Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Hyun Lee, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ga Jin Han, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Whole-body multidetector CT examination has been proposed to evaluate patient who has sustained multisystem trauma. However, whole-body exposure leads to an increase in radiation dose. Most recently, a novel iterative reconstruction technique, ASIR-V has

potential for significant dose reduction with better image quality than conventional ASIR, at real time speed. Thus, the purpose is to evaluate American association for the surgery of trauma (AAST) abdominal organ injury grading in low-dose CT with ASIR-V, in comparison with routine-dose CT with FBP.

METHOD AND MATERIALS

Eighty-three trauma patients underwent both routine-dose CT using FBP and low-dose CT using ASIR-V in the abdomen. Two readers reviewed the presence, absence, and the grading of abdominal organ injuries (liver, kidney, spleen or pancreas) using AAST scales. CT detection rates of abdominal organ injury, and AAST grading were compared between two different CT protocols, using McNemar test. Additionally, objective image noise was compared between two CT protocols, using paired t-test.

RESULTS

The radiation dose for low-dose CT with ASIR-V was 3.4 mSv, in comparison with 8.8 mSv for routine-dose CT with FBP. Abdominal organ injury was detected in 33 organs of 21 patients on routine-dose CT with FBP, and 29 organs in 20 patients on low-dose CT with ASIR-V. The detection rate was not significantly different between two different protocols ($p > 0.05$). The diagnostic performance of the AAST grading was also not significantly different between two different protocols ($p > 0.05$). Image noise was significantly lower in low-dose CT with 50% ASIR-V than routine-dose CT with FBP ($p < 0.001$).

CONCLUSION

Low-dose CT with ASIR-V may assess multi-organ abdominal trauma without impairment of image quality, compared to routine-dose CT with FBP.

CLINICAL RELEVANCE/APPLICATION

Low-dose CT with ASIR-V can allowed reduction of radiation exposure while maintaining the diagnostic performance in the evaluation of multi-organ trauma.

RC508-09 Imaging of Hip Trauma

Wednesday, Nov. 30 10:30AM - 11:00AM Room: S405AB

Participants

Bharti Khurana, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

Honored Educators

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Bharti Khurana, MD - 2014 Honored Educator

RC508-10 A Pathomorphometric Study of Pelvic Ring Reduction by Binders after Trauma and Effects on Hemorrhage Control

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S405AB

Participants

David Dreizin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

Daniel C. Mascarenhas, BS, Cinnaminson, NJ (*Abstract Co-Author*) Nothing to Disclose

Jason Nascone, MD, Baltimore, MD (*Abstract Co-Author*) Royalties, Johnson & Johnson Consultant, Smith & Nephew plc Royalties, Imaging Diagnostic Systems, Inc

PURPOSE

Clinical markers of hemorrhage and unidimensional plain film measurements are limited for determining benefit from pelvic binders. We assessed adequacy of reduction in 3 orthogonal planes at CT and effects on segmented pelvic hematoma volumes (HMVs) for 3 major classes of instability

METHOD AND MATERIALS

The CT studies of 56 consecutively selected patients with binders were compared to 53 non-binder controls frequency-matched to within 15% differences for a given Tile grade determined by an orthopedist (Tile A-stable, B-rotationally unstable, C- rotationally and vertically unstable). All underwent CT prior to any surgery. CT measurements of pubic symphysis diastasis/offset (PSD) and SI joint diastasis/offset (SID) were made (mm) in 3 planes (AP/lateral/vertical). Semi-automated region-growing segmentation (iNtuition) was used to determine pelvic HMVs for each study.

RESULTS

Binders and controls had similar distributions of age, gender, and no significant difference in pelvic AIS or ISS. In Tile A (11 binders; 17 controls), there was no significant difference in morphometric measurements or HMVs, which were 80 mL and 107.2 mL respectively ($p=0.32$). In Tile B (rot unstable- 22 binders; 20 controls), AP PSD (1.91 vs 0.59), vert PSD (1.75 vs 1.12), and vert SID (0.44 vs 0.43) in binders vs controls were not significantly different, but lat PSD, lat SID, and HMVs were lower (6.82 vs 12.6, $p=0.02$; 2.45 vs 4.87, $p < 0.0001$; and 160 vs 325 mL respectively, $p=0.01$) with binders. In Tile C (globally unstable) (21 binders; 16 controls), lat PSD (9.93 vs 10.3) & lat SID (7.72 vs 8.34) were not significantly different. There was substantial vert SID (4.56 vs 5.00, $p=0.80$) in Tile C, which did not reduce w binders. AP PSD (8.51 vs 1.88, $p = 0.03$), and vert PSD (8.22 vs 1.95, $p < 0.0001$) were increased w binders. AP SID (4.96 vs 2.44, $p=0.09$) increased in binders, approaching significance. Pubic bone override was only seen in the Tile C binder group (5 patients). HMVs were not decreased w/ binders (269 vs 255 mL, $p=0.56$)

CONCLUSION

Binders effectively reduce Tile B injuries and decrease hematoma volumes. In Tile C, binders increase distortion and fail to decrease hematoma volumes.

CLINICAL RELEVANCE/APPLICATION

Binders are thought to limit hemorrhage by reducing the pelvic ring. We show that this is the case for rotationally unstable injuries, but binders further distort the globally unstable pelvis, and fail to reduce hemorrhage in these injuries.

RC508-11 CT Angiography of Peripheral Vascular Imaging

Wednesday, Nov. 30 11:10AM - 11:40AM Room: S405AB

Participants

Scott D. Steenburg, MD, Zionsville, IN, (ssteenbu@iuhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

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

ABSTRACT

Peripheral vascular injuries constitute between 40-75% of vascular injuries in civilian trauma centers, and may result from blunt or penetrating trauma. These injuries place the patient at risk for fatal exsanguination, multi-organ failure from hemorrhagic shock and limb loss. "Hard" signs of peripheral vascular injuries strongly correlate with the presence of injury, however injuries may still exist even in the absence of positive clinical findings. Thus, imaging supplementation is an important part of comprehensive patient evaluation. A multi-modality approach to peripheral vascular injuries will be presented, and reflecting current trends, emphasis will be placed on evaluation with MDCT angiography. The imaging appearances of the most common types of vascular injuries will be presented using a case based approach.

RC508-12 Outcome in Renal Trauma: Is it Time to Revise the AAST Renal Injury Scale? A Retrospective Study in 367 Patients

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S405AB

Participants

Anna Luger, Innsbruck, Austria (*Presenter*) Nothing to Disclose

Bernhard Glodny, MD, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose

Alexander Loizides, MD, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose

Johannes Petersen, MD, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose

Leonhard Gruber, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose

Peter Rehder, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of the study was to apply the AAST Renal Injury Scale (AAST RIS) in a large cohort, to show the weakness of the Scaling System and to find significant parameters for a new classification.

METHOD AND MATERIALS

All renal traumas over the last 10 years were analyzed, including demographics, the Injury Scaling System, accompanying injuries and radiologic methods. Cross-section of hematomas, infarcts and depth of lacerations were measured. Active bleeding, urinoma, persisting nephrogram, congenital abnormalities and all accompanying injuries were documented. We performed regression analysis in order to predict therapeutic procedures such as angiography and surgery in renal trauma.

RESULTS

A total of 367 patients (61 female) with a mean age of 36.4 ± 19.5 years had blunt renal trauma. In 277 (60%) renal injuries the AAST Scale was not applicable. The main causes were undefined tissue infarction, persisting nephrograms, active bleeding and adjacent renal vessels involved in trauma. Furthermore the AAST Score could not predict outcome, therapy or even length of hospitalization. Our findings indicate active bleeding as a predictor for angiography and the cross-section dimension of hematoma, infarction and depth of laceration as predictors for surgery.

CONCLUSION

The AAST Renal Injury Scale does not predict therapeutic procedures and is not applicable in 60 % of injured kidneys. Our findings indicate the needs to develop of a new Scaling System including significant parameters like active bleeding, cross-section dimension of hematoma and injuries like persisting nephrogram and adjacent renal vessel bleeding.

CLINICAL RELEVANCE/APPLICATION

The proposed predictors may change the current AAST Classification in order to enhance prognostic power in therapy.

RC508-13 Trends in the Volume of Computed Tomography Imaging in Trauma

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S405AB

Awards

Student Travel Stipend Award

Participants

Michael J. Hsu, MD, Boston, MA (*Presenter*) Nothing to Disclose

Michael Wasserman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Jennifer Xiao, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Venkata Satyam, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Tina Shiang, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Deepan Paul, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ahmed Y. El-Araby, MD, West Warwick, RI (*Abstract Co-Author*) Nothing to Disclose
Vaeman Chintamaneni, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Robert Burns, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Arthur Baghdanian, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Christina A. LeBedis, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Royalties, Reed Elsevier
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to examine seasonal trends in the volume of CT trauma imaging, and to determine what environmental and circumstantial factors influence the quantity of studies performed.

METHOD AND MATERIALS

This HIPAA-compliant, retrospective study performed at our urban academic teaching hospital was approved by the Institutional Review Board (IRB); informed consent was waived. The daily volume of trauma CT examinations performed at our urban Level 1 trauma center over a two-year period was collected. Our institution is located in a major city with large seasonal variations in weather. The effects of the time of day, day of the week, month of the year, as well as weather, on trauma imaging volume was analyzed.

RESULTS

When analyzed as a function of the time of day, there are hourly variations in volume of trauma CT imaging performed throughout the day. Uptrends in activity begin at 10 AM and 7 PM. There is a plateau of high volume from 8 PM to 12 AM. There is an additional peak at 4 AM. The lowest volume of trauma CT imaging is performed from the hours of 5 AM to 9 AM.

When analyzed as a function of the day of the week, the highest volume of trauma CT imaging was performed on Saturday, followed by Friday and Sunday. There is a gradual downtrend from Monday to Thursday. When analyzed as a function of the month of the year, there are monthly variations in trauma imaging volumes with an 88% increase in CT trauma imaging during the peak month of July as compared to the nadir of April. When analyzed as a function of weather, the lowest months of activity coincide with the winter and there is strong correlation between volume of CT imaging and higher temperatures. There is also an inverse relationship between snowfall and quantity of trauma CT imaging.

CONCLUSION

There are predictable patterns in trauma CT imaging volume based on the time of day, day of the week and month of the year. Seasonal variations in temperature, snowfall and sunlight also affect volume. There is particularly high volume in the month of July.

CLINICAL RELEVANCE/APPLICATION

Identifying factors that influence changes in CT imaging volume is important for allocating departmental resources to appropriately address predictable variations in the amount of trauma imaging performed.

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

RC509

GI Fluoroscopy: Don't Bury 'em Yet!

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

GI

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

FDA

Discussions may include off-label uses.

Participants

Sub-Events

RC509A Post-op Assessment of Esophagus and Stomach

Participants

Cheri L. Canon, MD, Birmingham, AL, (ccanon@uabmc.edu) (*Presenter*) Author with royalties, The McGraw-Hill Companies

LEARNING OBJECTIVES

1) Protocol fluoroscopic examination for safe evaluation and diagnosis. 2) Identify normal postoperative anatomy of the esophagus and stomach. 3) Diagnose radiographic complications in these patients.

ABSTRACT

Fluoroscopic evaluation of postoperative patients continues to grow in volume and complexity. In many cases, the fluoroscopic approach is superior to CT and requires the radiologist to have a fundamental understanding of the surgical anatomy. This presentation will review the approach and diagnosis of patients after undergoing surgery of the upper GI tract (esophagus and stomach). Safe fluoroscopic technique will be discussed. Normal postoperative anatomy and surgical complications will be reviewed.

RC509B Imaging the Non-operative Esophagus and Stomach

Participants

Laura R. Carucci, MD, Midlothian, VA, (laura.carucci@vcuhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the continued importance of fluoroscopic evaluation of the esophagus and stomach. 2) Describe examination techniques for the esophagus and stomach. 3) Review the radiologic diagnosis of pathologic conditions involving the esophagus and stomach.

ABSTRACT

Despite an overall trend towards a decreasing number of fluoroscopic procedures, the number of esophagography studies has increased in recent years. Fluoroscopy remains the primary modality for evaluation the esophagus. In addition, fluoroscopy provides a noninvasive means to evaluate for benign and malignant gastric pathology. Radiologists should be able to perform and interpret esophagography and upper GI studies. A spectrum of benign and malignant processes that may affect the esophagus and stomach will be discussed.

RC509C Large Bowel

Participants

Christine O. Menias, MD, Chicago, IL, (menias.christine@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review role of Contrast Enemas in case-based format. 2) Highlight common indications for Fluoroscopy. 3) Review cases in the pre-operative and post-operative colon. 4) Emphasize imaging features that should not be overlooked.

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/>

Christine O. Menias, MD - 2013 Honored Educator
Christine O. Menias, MD - 2014 Honored Educator
Christine O. Menias, MD - 2015 Honored Educator
Christine O. Menias, MD - 2016 Honored Educator

RC509D Defecography: Pearls and Pitfalls

Participants

Dean D. Maglinte, MD, Indianapolis, IN, (dmaglint@iupui.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To define the role of fluoroscopic defecography in the evaluation of anorectal dysfunction and pelvic organ prolapse. 2) To demonstrate how it should be done to avoid technical and interpretive pitfalls. 3) To illustrate how to report a clinically relevant functional pelvic floor examination.

ABSTRACT

Despite advances in other imaging methods, fluoroscopic defecography has remained a practical cost effective procedure in the evaluation of anorectal and pelvic floor dysfunction. Dynamic cystocolpodefecography (DCP) has evolved from a method of evaluating the anorectum for functional disorders to its current status as a functional method of evaluating the global pelvic floor for defecatory disorders and pelvic organ prolapse (POP). It provides the maximum stress to the pelvic floor resulting in levator ani relaxation accompanied by rectal emptying needed to diagnose defecatory disorders and organ specific quantitative information on POP.

RC510

Liver Doppler, Contrast and Elastography

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



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

Discussions may include off-label uses.

Participants

LEARNING OBJECTIVES

1) Understand the normal anatomy, anatomic variants of the hepatic vasculature. 2) Identify the normal Doppler flow profiles of the hepatic vasculature. 3) Understand the hemodynamic principles of portal hypertension and how they impact the Doppler waveforms of the hepatic arteries, portal veins and hepatic veins. 4) Understand the role of ultrasound in the evaluation of variceal pathways. 4) Indications when to use contrast enhanced ultrasound (CEUS) in focal liver diseases. 5) Kinetics of US contrast agents 6) Learning about the importance of the three contrast phases, how CEUS performs in detecting and characterizing focal liver lesions. 7) Learning about the potential value as well as the limitations of CEUS in liver disease. 8) Learning how CEUS performs when compared to B-mode, color Doppler, CT and MRT imaging. 9) Understand the concept of liver fibrosis grading and the implications for healthcare management. 10) Review the basis for the assessment of liver fibrosis using elastography, with emphasis on the different techniques. 11) Understand the differences in the techniques and the variability in measurement assessment. 12) Achieve and overview of the need and position of this technique in clinical care.

Sub-Events

RC510A Imaging and Doppler of Portal Hypertension

Participants

Myron A. Pozniak, MD, Madison, WI, (mpozniak@uwhealth.org) (*Presenter*) Stockholder, Celectar Biosciences, Inc; Support, General Electric Company

LEARNING OBJECTIVES

1) Understand the normal anatomy, anatomic variants of the hepatic vasculature. 2) Identify the normal Doppler flow profiles of the hepatic vasculature. 3) Understand the hemodynamic principles of portal hypertension and how they impact the Doppler waveforms of the hepatic arteries, portal veins and hepatic veins. 4) Understand the role of ultrasound in the evaluation of variceal pathways.

ABSTRACT

Active Handout: Myron Andrew Pozniak

[http://abstract.rsna.org/uploads/2016/16000408/ACTIVE RC510A PH talk .pdf](http://abstract.rsna.org/uploads/2016/16000408/ACTIVE_RC510A_PH_talk.pdf)

RC510B Contrast Ultrasound of the Liver

Participants

Hans-Peter Weskott, MD, Hannover, Germany, (weskotthp@t-online.de) (*Presenter*) Speaker, General Electric Company; Speaker, Bracco Group

LEARNING OBJECTIVES

1) Indications when to use contrast enhanced ultrasound (CEUS) in focal liver diseases. 2) Kinetics of US contrast agents 3) Learning about the importance of the three contrast phases, how CEUS performs in detecting and characterizing focal liver lesions. 4) Learning about the potential value as well as the limitations of CEUS in liver disease. 5) Learning how CEUS performs when compared to B-mode, color Doppler, CT and MRT imaging.

ABSTRACT

In patients with favorable scanning conditions CEUS is at least as sensitive as contrast enhanced CT (CECT) and in most cases MRI in detecting malignant liver lesions. Due to its high temporal resolution, even a hyper-enhancement of a few seconds can be seen, thus improving the characterization of focal liver lesions. A majority of malignant lesions can therefore be characterized as iso- or hyper-enhancing. During the arterial phase the tumor's vessel architecture and direction of contrast filling helps in characterizing a lesions character. Metastases and intrahepatic cholangiocarcinoma wash out at the end of the arterial or early portal venous phase, while HCC may wash out later. When using high spatial resolution contrast modes washed out lesions down to 3mm in size can be detected. CEUS characterizes focal liver lesions with a much higher diagnostic confidence than conventional US and is comparable to CT and MRI. CEUS also improves intraoperative tumor detection and characterization. Using time intensity analysis a change in contrast enhancement and kinetics helps in estimating tumor response to chemotherapy. CEUS is also used to monitor local ablation therapy and is a useful imaging tool to detect early tumor recurrence.

RC510C Liver Elastography

Participants

Paul S. Sidhu, MRCP, FRCR, London, United Kingdom, (paulsidhu@nhs.net) (*Presenter*) Speaker, Koninklijke Philips NV; Speaker, Bracco Group; Speaker, Hitachi, Ltd; Speaker, Siemens AG

LEARNING OBJECTIVES

1) Understand the concept of liver fibrosis grading and the implications for healthcare management. 2) Review the basis for the

1) Understand the concept of liver fibrosis grading and the implications for healthcare management. 2) Review the basis for the assessment of liver fibrosis using elastography, with emphasis on the different techniques. 3) Understand the differences in the techniques and the variability in measurement assessment. 4) Achieve and overview of the need and position of this technique in clinical care.

ABSTRACT

Liver fibrosis and cirrhosis from many causes is an important cause of long term morbidity and mortality. Most cases are a consequence of chronic viral disease (Hepatitis B and C) with alcoholic liver disease an important ethiological factor. The degree of liver fibrosis, and the presence of established cirrhosis confer different management strategies, with imaging playing an important role in the non-invasive assessment of patients with chronic liver disease. Fibrosis grading traditionally performed using the Metavir or Ishak scoring system is essentially a histological grading system. Ultimately the possibility to avoid a liver biopsy is the aim, if a non-invasive technique can stage the grade of fibrosis, establishing correct patient management. Liver ultrasound elastography is a developing technique that offers this possibility, with varying methods of assessment ranging from strain methods and shear wave methods. These techniques will be explained, the status of the current standing of the techniques will be summarised, and the level of technology offered by different machines will be reviewed. An overall summary of the current status and the implications for clinical practice will be discussed.

RC511

Advances in Cardiac Nuclear Imaging: SPECT/CT and PET/CT

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



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

Participants

LEARNING OBJECTIVES

1) Understand the technical advancements associated with new scintillation cameras and SPECT-CT and PET-CT cameras. 2) Appreciate the benefits of CT attenuation correction. 3) Appreciate the adjunctive benefits of anatomic definition provided with CT and physiologic/function information provided by SPECT and PET. 4) Improve interpretive skills related to SPECT and PET-CT.

ABSTRACT

Camera and software technology recently has rapidly advanced, providing improved SPECT image resolution and increased counting statistics. These advancements in turn have provided the possibility of reduced-time and reduced radiopharmaceutical dose image acquisitions. Moreover, increased flexibility in imaging protocols has been realized. Future development of these methods hold promise in increasing diagnostic accuracy and expanding diagnostic applications. The addition of CT to SPECT and PET has afforded the ability to perform attenuation correction, thereby minimizing attenuation artifacts and increasing diagnostic specificity. With CT acquisitions of sufficient resolution, complementary anatomic diagnostic information is provided. In addition, more precise anatomic localization of SPECT and PET abnormalities significantly increases clinical applicability.

Sub-Events

RC511A Advances in Cardiac SPECT

Participants

E. Gordon Depuey, MD, New York, NY (*Presenter*) Steering Committee, Adenosine Therapeutics, LLC;

LEARNING OBJECTIVES

1) Implement protocols that facilitate patient-centered imaging and that reduce patient radiation exposure. 2) Understand software methods to cope with lower SPECT counting statistics in order to reduce scan acquisition time and/or radiopharmaceutical injected activity and their clinical impact. 3) Understand instrumentation advances that allow new cameras to perform SPECT with markedly reduced acquisition times and/or less radiopharmaceutical activity and their clinical impact. 4.) Review myocardial perfusion SPECT scans systematically to avoid artifacts and maximize diagnostic accuracy.

ABSTRACT

There has been an intersocietal effort to promote patient-centered imaging with a focus on appropriateness guidelines, cost-containment, radiation dose reduction, and the selection of the most appropriate imaging test and protocol to suit particular patient needs. The following technical advancements described facilitate implementation of patient-centered imaging. New software methods and new innovative hardware now allow for significantly shortened SPECT acquisition times without a decrease in image quality. Advancements include iterative reconstruction, resolution recovery, and noise reduction software, and focused collimation and solid state detectors incorporated into new camera designs. Attenuation correction increases diagnostic specificity and facilitates stress-only protocols. Software advancements such as high resolution imaging, scatter correction, and respiratory gating increase diagnostic sensitivity. Even with such technical advancements, however, attention to technical detail is essential to assure optimal image quality. Camera and radiopharmaceutical quality control deserve the highest priority. A systematic review of myocardial perfusion SPECT images is essential to recognize artifacts and optimize diagnostic accuracy. Case examples will be presented to reinforce this approach.

RC511B Advances in Cardiac PET

Participants

Sharmila Dorbala, MBBS, Boston, MA (*Presenter*) Research Grant, Astellas Group; Stockholder, General Electric Company; ; ; ;

LEARNING OBJECTIVES

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

ABSTRACT

Novel advances in PET detectors, radiotracer availability, clinical software, as well as hybrid PET/CT and PET/MR scanners have revolutionized the clinical and investigative applications of cardiac PET. Cardiac PET myocardial perfusion imaging, in the 1970's, was a predominantly investigative tool, with home-grown software, available at select major academic centers with access to a cyclotron. Over the last decade, with easy access to PET scanners, and to positron emitting perfusion tracers, the use of cardiac PET has exploded—well beyond major academic centers to several hospitals and to large office-based practices. Commercially available software has made quantitative myocardial blood flow assessment, a main-stream clinical application. Hybrid PET/CT scanner applications—calcium score and CT based coronary angiography—have further advanced the applications of cardiac PET. PET/MR is an emerging technology with promising cardiovascular applications. Each of these exciting developments has transformed cardiac PET from a predominantly investigative tool of the 1970's to the advanced clinical tool of the 2016. The primary goal of this session is to discuss the present-day clinical and emerging applications of cardiac PET/CT and PET/MR using a practical case-based approach.

Thoracic Aortic Emergencies (An Interactive Session)

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



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

Participants

Dominik Fleischmann, MD, Palo Alto, CA (*Moderator*) Research support, Siemens AG;

Sub-Events

RC512A The Spectrum of Type A Dissection

Participants

Anne S. Chin, MD, Palo Alto, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

- 1) Review the pathology, epidemiology, and natural history of acute type A aortic dissection.
- 2) Describe the imaging strategies for acute aortic syndromes.
- 3) Review the recent classification of acute aortic dissection.
- 4) Illustrate imaging findings of the spectrum of acute type A aortic dissection, with a focus on recognizing subtle CT angiographic findings related to the lesser known 'Class 3' aortic limited intimal tear or 'limited dissection.'

ABSTRACT

The traditional Stanford classification distinguishes between dissections involving the ascending aorta (Type A) from those that do not involve the ascending aorta (Type B). Type A aortic dissection is rare, but remains the most lethal of aortic disorders requiring prompt surgical intervention. The common pathologic denominator in patients with acute dissection is an abnormal aortic media ('cystic medial necrosis') which can be found in genetic/inherited diseases (e.g. Marfan's) but also in patients with severe hypertension. The CT imaging strategy of suspected acute aortic syndrome should always include (i) non-enhanced images to assess for intramural hematoma (IMH); when the index of suspicion for aortic dissection is high, also consider (ii) EKG-gating for motion-free evaluation of the aortic root/ascending aorta, and (iii) including common femoral arteries in the CTA scan range to assess lesion extent and identify a percutaneous access route. The spectrum of aortic dissection has recently been classified as the following: Class 1 classic dissection with true and false lumen separated by an intimal flap; Class 2 IMH; Class 3 limited intimal tear or limited dissection; Class 4 penetrating atherosclerotic ulcer (PAU); and Class 5 iatrogenic/traumatic. A clarification and modified conceptual classification of aortic dissection will be provided, along with illustrative examples of these aortic lesions. Particular focus will be given to the lesser known Class 3 'limited dissection' which is described as a subtle and eccentric bulge of the aortic wall. While it has been reported to elude current imaging techniques, emphasis will be made on recognizing subtle CTA imaging findings characteristic of this uncommon but important dissection variant.

RC512B Acute and Chronic Complications of Aortic Dissection

Participants

Anna M. Sailer, MD, MBA, Maastricht, Netherlands, (anni.sailer@hotmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

- 1) Describe the natural history and radiological patterns of early and late complications of Type B aortic dissections.
- 2) Differentiate the mechanisms of branch ischemia and false lumen dilatation.
- 3) Assess different treatment strategies for acute and chronic dissections.

ABSTRACT

RC512C Traumatic Aortic Injuries

Participants

Savvas Nicolaou, MD, Vancouver, BC (*Presenter*) Institutional research agreement, Siemens AG

LEARNING OBJECTIVES

- 1) Discuss the different mechanisms of injuries, pathophysiology, and types of traumatic aortic injuries including aortic dissection, laceration, transection, pseudoaneurysm and intramural hematoma.
- 2) Review techniques and advances in imaging including DECT/Spectral and ultra-high-pitch imaging to optimize imaging of traumatic aortic injuries and the role of gating, MRI, and TEE.
- 3) Discuss and demonstrate examples of the grading scheme for traumatic aortic injuries.
- 4) Demonstrate imaging pitfalls which can cause misinterpretation of traumatic aortic injuries.
- 5) Review the appropriate management and treatment options, including open surgical repair and percutaneous endovascular repair, for the traumatic aortic injuries.

ABSTRACT

Pediatric Series: Pediatric Oncology and Nuclear Medicine

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



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

FDA Discussions may include off-label uses.

Participants

Heike E. Daldrup-Link, MD, Palo Alto, CA, (heiked@stanford.edu) (*Moderator*) Nothing to Disclose
Susan E. Sharp, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose
Marguerite T. Parisi, MD, MEd, Seattle, WA (*Moderator*) Nothing to Disclose
Robert Orth, MD, PhD, Houston, TX, (rcorth@texaschildrens.org) (*Moderator*) Research support, General Electric Company;
Victor J. Seghers, MD, PhD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events**RC513-01 Management of Pediatric Thyroid Nodules**

Wednesday, Nov. 30 8:30AM - 8:50AM Room: E352

Participants

Marguerite T. Parisi, MD, MEd, Seattle, WA, (meg.pari@seattlechildrens.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the etiologies and imaging appearances of thyroid nodules in children. 2) Discuss the management of thyroid nodules and differentiated thyroid cancer in children and how this management differs from that in adults.

ABSTRACT**RC513-02 Ultrasonographic Malignancy Risk Stratification of Thyroid Nodules in Children: Comparison between K-TIRADS and KSThR Guidelines**

Wednesday, Nov. 30 8:50AM - 9:00AM Room: E352

Awards**Student Travel Stipend Award****Participants**

Young Jin Ryu, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jung-Eun Cheon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Hun Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Sun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
In-One Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji-Eun Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yu Jin Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To comparatively evaluate the new Korean Thyroid Imaging Reporting and Data System (K-TIRADS) and conventional Korean Society of Thyroid Radiology (KSThR) guidelines regarding the malignancy risk stratification of thyroid nodules in children.

METHOD AND MATERIALS

From January 2011 to February 2016, a total of 50 thyroid nodules in 46 children (mean age, 13.6 years, range 4-18 years) with final diagnoses through a fine needle aspiration or operation were included in this study. Ultrasonographic features of 50 nodules including solidity, echogenicity, shape, orientation, margin and presence of calcifications were retrospectively assessed and each nodule was classified according to the K-TIRADS (five categories from 1 to 5) and KSThR (three categories; probably benign, indeterminate, suspicious malignancy). The malignancy risks of the thyroid nodules were assessed according to each category, respectively.

RESULTS

Of the 50 thyroid nodules, 29(58%) were benign and 21(42%) were malignant. The probably benign nodules on KSThR guidelines(n=5) were all categorized into K-TIRADS category 2. Among the indeterminate nodules(n=25), 20 nodules were assigned to K-TIRADS 3 and 5 nodules were assigned to K-TIRADS 4. Suspicious malignant nodules(n=20) were classified to K-TIRADS 4 (n=6) or 5 (n=14). The malignancy rates with KSThR guidelines were 0% (0 of 5 nodules) for probably benign nodules, 16% (4 of 25 nodules) for indeterminate nodules and 85% (17 of 20 nodules) for suspicious malignancy, while the malignancy rates of K-TIRADS category 2, 3, 4, 5 nodules were 0% (0 of 5 nodules), 10% (2 of 20 nodules), 63.6% (7 of 11 nodules) and 85.7% (12 of 14 nodules), respectively. The area under the ROC curve (AUC) of K-TIRADS was slightly higher than that of KSThR (AUC = 0.885 and 0.869, respectively) without a significant difference (P=.608). Six nodules of 1 to 1.5cm in diameter which belong to the indeterminate category on KSThR and to category 3 on K-TIRADS were all confirmed as benign nodules and would have avoided a fine needle aspiration if K-TIRADS had been applied.

CONCLUSION

Application of K-TIRADS to thyroid nodules of children was feasible and resulted in more detailed stratification of thyroid nodules than KSThR guidelines. Introduction of K-TIRADS may reduce an unnecessary fine needle aspiration.

CLINICAL RELEVANCE/APPLICATION

Application of K-TIRADS may decrease needless aspiration by providing more specific malignancy risk stratification.

RC513-03 **Ultrasound Risk Stratification Using the 2015 American Thyroid Association Guidelines for Children with Thyroid Nodules**

Wednesday, Nov. 30 9:00AM - 9:10AM Room: E352

Participants

Iclal Erdem Toslak, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Khalid Alsabban, MBBS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Amany Aziz, MBCh, Maywood, IL (*Abstract Co-Author*) Nothing to Disclose
Jennifer E. Lim-Dunham, MD, Maywood, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine accuracy of categorization of nodule malignancy when applying risk stratification criteria from the 2015 American Thyroid Association (ATA) Guidelines for Children with Thyroid Nodules.

METHOD AND MATERIALS

Thirty-nine thyroid nodules of 33 pediatric patients (28 female and 5 male, with age range 14-18 years) with histopathologically proven diagnosis were retrospectively reviewed. Two radiologists independently rated the ultrasound images according to 2015 ATA Guideline criteria (composition, echogenicity, shape, size, margins, and echogenic foci) which were used to stratify nodules for risk of malignancy, ranging from very low to high suspicion. Vascularity was also assessed. In cases where the observers disagreed, consensus rating was performed. Multivariate analysis was used to measure performance of individual parameters in predicting malignancy. Kappa coefficients were calculated to measure inter-observer agreements for individual parameters.

RESULTS

Twenty seven nodules were benign and 12 malignant (10 papillary carcinoma, 2 follicular carcinoma). In 27 lesions, there was agreement between ultrasound risk stratification and pathology. Overall accuracy of risk stratification was 69.23%, with sensitivity of 100%, specificity of 56 %, and area under the ROC curve of .79. Individual features which were best predictors of malignancy were irregular/lobulated margins (55 times as likely to be malignant), hypoechogenicity (6 times) and taller than wide shape (3 times). Inter-observer agreement for individual parameters were as follows: almost perfect for overall level of suspicion ($k=0.83$); substantial for nodule composition ($k=0.80$), echogenic foci ($k=0.77$), and vascularity ($k=0.76$); moderate for margins ($k=0.60$); and fair for shape ($k=0.29$).

CONCLUSION

ATA Guideline ultrasound parameters allow for appropriate stratification of malignancy risk for thyroid nodules in children prior to tissue diagnosis. Addition of vascularity may contribute to the accuracy.

CLINICAL RELEVANCE/APPLICATION

ATA Guideline ultrasound criteria are useful for directing management and fine needle aspiration recommendations for pediatric thyroid nodules.

RC513-04 **Papillary Thyroid Carcinoma Arising in Children and Adolescent Hashimoto's Thyroiditis: Ultrasonographic and Pathologic Findings**

Wednesday, Nov. 30 9:10AM - 9:20AM Room: E352

Participants

Sun Hye Jeong, MD, Bucheonsi, Korea, Republic Of (*Presenter*) Nothing to Disclose
Eun Hye Lee, MD, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun-Sook Hong, MD, PhD, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong Ja Kwak, Bucheon-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We compared the ultrasonography and pathology features of papillary thyroid carcinoma (PTC) in pediatric and adolescents with Hashimoto's thyroiditis (HT) with those of non-HT patients.

METHOD AND MATERIALS

Eleven patients who were surgically confirmed to have pediatric or adolescent PTC from 2006 to 2014 were included in this study. We retrospectively analyzed the preoperative ultrasonography and pathology features of PTC arising in HT and non-HT patients.

RESULTS

On ultrasonography, thyroid gland was lobulated and enlarged, with many scattered microcalcifications in four of five HT patients. Four of six non-HT patients had suspicious masses with calcifications. The diffuse sclerosing variant of PTC (DSVPTC) was found in three of five HT patients, but none in non-HT patients. Macroscopic or microscopic extrathyroidal extension was evident in all of the HT patients and four of the non-HT patients. Neck lymph node metastases were in all HT patients and five of non-HT patients.

CONCLUSION

Three of five PTCs in pediatric and adolescent HT patients were DSVPTC, whereas all PTCs of the non-HT patients were classic type. On ultrasonography, thyroid gland was diffusely enlarged with scattered microcalcifications in four of five HT patients. All five HT cases had aggressive disease, including extrathyroidal extension and cervical lymph node metastases.

CLINICAL RELEVANCE/APPLICATION

Some evidence suggests that HT patients are at an increased risk of PTC compared to the general population. However, as PTC is

rare in pediatric and adolescent HT patients, the carcinoma has been poorly studied. Therefore, we compared the ultrasonography and pathology features of PTC arising in pediatric and adolescent HT, and non-HT patients.

RC513-05 Textural Analysis Differentiation of Benign and Malignant Lymph Nodes on Contrast Enhanced CT in Pediatric Patients

Wednesday, Nov. 30 9:20AM - 9:30AM Room: E352

Participants

Aoife Kilcoyne, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose
Azadeh Tabari, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sarabjeet Singh, MD, Boston, MA (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Toshiba Corporation; Research Grant, General Electric Company; Research Grant, Koninklijke Philips NV
Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the performance of CT textural analysis in differentiating malignant from benign lymph nodes in a pediatric population.

METHOD AND MATERIALS

In this HIPAA compliant, IRB approved single institution retrospective study, a radiology report database identified pediatric patients <18 years old who had contrast-enhanced CT studies performed from 2005-2015. CT images and electronic records were reviewed to identify lymph nodes 10-20mm in short axis and confirm final diagnosis (lymphoma, metastasis from other primary, or inflammation from Crohn's disease or appendicitis). CT textural analysis (CTTA) was performed using a commercially available research software program (TexRAD). This applies a filtration-histogram technique to characterize tumor heterogeneity. The filtration step selectively filters and extracts texture features at different anatomical scales varying from 2mm (fine features) to 6mm (coarse features). Receiver operating characteristic (ROC) analysis was performed to identify optimum threshold values for differentiating benign and malignant lymph nodes and test performance characteristics were calculated.

RESULTS

53 patients were identified [n = 18 lymphoma, n = 17 metastasis (5 neuroblastoma, 3 wilms tumor, 3 ewings sarcoma, 2 fibrolamellar HCC, 1 rhabdomyosarcoma, 1 testicular carcinoma, 1 colorectal carcinoma, 1 hepatoblastoma), n = 18 inflammation]. Classifying the patient groups into malignant (n = 35) and benign (n = 18), there were statistically significant differences at a low filter (SSF 2) for mean (p < 0.0001), standard deviation (p = 0.0013), mpp (p < 0.0001) and skewness (p = 0.001). Entropy and kurtosis were not demonstrated to be statistically significant (p = 0.75 and 0.12) respectively. ROC analysis (AUC=0.95) revealed an optimum mean gray level intensity cutoff of < 20 on SSF 2 to have 78% sensitivity, 91% specificity, 89% positive predictive value, and 82% negative predictive value for the detection of a malignant lymph node.

CONCLUSION

Performing CT textural analysis on lymph nodes in a pediatric patient cohort can reliably differentiate between benign and malignant lymphadenopathy.

CLINICAL RELEVANCE/APPLICATION

Addition of CT textural analysis may reduce the potential risks associated with serial CT imaging or tissue sampling for enlarged lymph nodes identified in pediatric patients.

RC513-06 A Pilot Study of Integrating Computational Image Features and Molecular Subtypes in Medulloblastoma

Wednesday, Nov. 30 9:30AM - 9:40AM Room: E352

Participants

Mu Zhou, PhD, Mountain View, CA (*Presenter*) Nothing to Disclose
Darvin Yi, Menlo Park, CA (*Abstract Co-Author*) Nothing to Disclose
Eric Tranvinh, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Bryan A. Lanzman, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Sridhar Vajapeyam, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Tina Y. Poussaint, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael Iv, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Kristen W. Yeom, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Olivier Gevaert, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To build an association map between computational image features on MRI and molecular subtypes for medulloblastoma, a pediatric malignant brain tumor.

METHOD AND MATERIALS

In this IRB-approved study, we included 29 children with medulloblastoma who had preoperative MRIs with T2-weighted images and tumor tissue specimens collected at an academic medical center. Three radiologists delineated tumor boundaries on multiple contiguous T2-weighted images of each tumor. We developed a computational framework to extract 249-dimensional image features capturing a variety of tumor phenotypic characteristics including tumor intensity, histogram, gabor filters, shape, and edge sharpness features. In addition, a molecular subtype (of the four previously described subtypes: WNT, SHH, Subgroup3, and Subgroup4) was identified in each case. We performed feature association between molecular subtypes and computational image features using the Pearson correlation metric and reported significantly correlated features using P-values and False Discovery Rates (FDR) to control for multiple testing.

RESULTS

There are 61 statistically significant pairwise correlations between MRI-defined computational features and medulloblastoma

molecular subtypes (P-value<0.05 and FDR<0.01). A majority of image features reflecting molecular subtypes (up to 96.72%) belonged to four feature types: intensity histogram (n=10), edge sharpness (n=4), daube texture (n=37), and edge shape/Local Area Integral Invariant (LAI) (n=8). In the category of edge sharpness, for example, two features of scale median (P-value=0.036) and window histogram (P-value=0.032) were correlated to the molecular subtypes in medulloblastoma. Shape compactness, another descriptor defining tumor sphericity, was also found to correlate with molecular classes (P-value=0.03). The most significant image feature was the skewness of Local Area Integral Invariant (LAI) that measured the local shape variance of tumor (P-value=0.005), suggesting its strong association with molecular subtypes in medulloblastoma.

CONCLUSION

MRI-defined computational image features, specifically tumor shape, can be used to predict molecularly-defined subtypes of medulloblastoma.

CLINICAL RELEVANCE/APPLICATION

Computational image features on MRI are associated with molecular subtypes of medulloblastoma, allowing for non-invasive assessment of molecular signatures in this malignant childhood brain tumor.

RC513-07 Pediatric Solid Tumors: Image Based Therapy Decisions

Wednesday, Nov. 30 9:40AM - 10:00AM Room: E352

Participants

Ethan A. Smith, MD, Saline, MI, (ethans@med.umich.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the staging systems of common pediatric solid tumors, including Wilms tumor, neuroblastoma, hepatoblastoma and lymphoma. 2) To understand the imaging findings which correspond to critical branch points in treatment algorithms and which will change clinical management in pediatric solid tumor patients.

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/>

Ethan A. Smith, MD - 2016 Honored Educator

RC513-08 Optimization of Pediatric PET-CT

Wednesday, Nov. 30 10:20AM - 10:40AM Room: E352

Participants

Susan E. Sharp, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss preventable PET/CT artifacts common in pediatric patients. 2) Discuss protocol options for optimizing radiation dose during pediatric PET/CT imaging.

ABSTRACT

RC513-09 Value of Whole-Body 18F-FDG-PET/MRI in Pediatric Oncology: Comparison to Conventional Imaging Modalities

Wednesday, Nov. 30 10:40AM - 10:50AM Room: E352

Awards

Student Travel Stipend Award

Participants

Sergios Gatidis, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose

Brigitte Gueckel, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Ilias Tsiflikas, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Ines Ketelsen, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Matthias Reimold, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG

Nina Schwenzler, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Juergen F. Schaefer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Simultaneous 18F-FDG-PET/MRI is a promising modality for staging and response imaging in solid malignancies especially in pediatric patients. However, there is a need for evidence when using PET/MRI as standard method. The aim of this study was to assess the diagnostic performance of 18F-FDG PET/MRI compared to conventional imaging modalities (CIM) in a pediatric oncologic population.

METHOD AND MATERIALS

This prospective monocentric trial was approved by the local IRB. All parents gave their informed consent. 56 whole-body 18F-FDG-PET/MR examinations were performed in 28 patients (16 female, 13±5 years; the baseline and the first response control in each patient) with solid tumors (13 Hodgkin lymphoma, 4 NHL, 10 sarcoma, 1 adrenal carcinoma). Reading was performed by a radiologist

and a nuclear medicine physician in consensus. A maximum of one target lesion was recorded for each anatomical region. Lesions were interpreted by classification into 3 classes (benign – unclear – malignant). Histopathological results and follow-up examinations were used to define the gold standard for lesion interpretation. PET/MR findings were compared to findings reported in the otherwise available CIM, mainly consisting of ultrasound, plain radiographs and CT or MRI.

RESULTS

A total of 253 target lesions were detected in the baseline examination. 3% (7/253) of these lesions were only detected in PET/MRI; 1 lung lesion was only detected by CIM. In 85% (207/245) of lesions, CIM and PET/MRI showed concordant results concerning lesion interpretation; In 12%/3% of lesions, PET/MRI led to downgrading/upgrading of lesion interpretation. 175 lesions were detected in response control. Response assessment was concordant between PET/MRI and CIM in 63%; in 2%/35 of lesions, PET/MR led to an upgrading/downgrading.

CONCLUSION

PET/MR allows for comprehensive oncologic imaging in pediatric oncology with possible advantages over CIM.

CLINICAL RELEVANCE/APPLICATION

The use of PET/MR may improve diagnostic specificity in pediatric oncology, especially for response assessment under therapy.

RC513-10 Tumor Textural Features in Baseline FDG PET Predicts Survival in Pediatric Osteosarcoma: A Prospective Study

Wednesday, Nov. 30 10:50AM - 11:00AM Room: E352

Participants

Hyung-Jun Im, MD, Madison, WI (*Presenter*) Nothing to Disclose
Chihwa Song, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Yi Zhang, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Huiyun Wu, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Jianrong Wu, Memphis, WI (*Abstract Co-Author*) Nothing to Disclose
Barry L. Shulkin, MD, MBA, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Steve Cho, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In this study, we evaluated the prognostic value of tumor textural features of the baseline FDG PET scan in pediatric patients with osteosarcoma.

METHOD AND MATERIALS

Thirty-four patients with osteosarcoma were enrolled prospectively and underwent baseline FDG PET/CT. The patients received neoadjuvant chemotherapy (CTX), and subsequent surgical resection. Metabolic tumor volume (MTV) of the primary tumor, a previously reported prognostic factor in osteosarcoma, was measured using a standardized uptake value (SUV) threshold of 2.5. Thirty-nine different FDG PET tumor textural features were analyzed for all primary tumor volumes. Histological response after tumor resection was evaluated. Each parameter was divided into two groups using an optimal cut off defined by ROC analysis. Association of baseline FDG PET textural features with histologic response, tumor recurrence, event free survival (EFS), and overall survival (OS) were evaluated.

RESULTS

Among 34 enrolled patients, 15 were classified as responders after CTX, 15 experienced recurrences, and 10 died during the follow up period. Neither the FDG PET/CT textural features nor MTV were associated with histologic response. Four textural features (energy, gray-level nonuniformity (GLN), maximum probability (MP), and run percentage (RP)) and MTV were associated with tumor recurrence (Wilcoxon test, P value = 0.035, 0.016, 0.0025, 0.013, and 0.01) and predictive of EFS (log rank test, P value = 0.022, 0.003, 0.0004, 0.001, and 0.002). Six textural features (area under curve (AUC), correlation, GLN, MP, run-length nonuniformity (RLN), and RP) and MTV were associated with survival (Wilcoxon test, P value = 0.014, 0.011, 0.0005, 0.011, 0.004, 0.0005 and 0.0006) and predictive of OS (log rank test, P value = 0.005, 0.006, 0.0002, 0.006, 0.0001, 0.0003, and 0.001). On multivariable Cox regression analysis, only MP was an independent prognostic factor for EFS (P = 0.025) and none of the textural features was an independent factor for OS.

CONCLUSION

FDG PET osteosarcoma textural features at baseline were predictive of EFS and OS. MP was an independent prognostic factor for EFS on multivariate analysis.

CLINICAL RELEVANCE/APPLICATION

Baseline FDG PET textural features may be an important parameter for risk stratification of pediatric patients with osteosarcoma, requiring further validation.

RC513-11 Whole Body Functional and Anatomical MRI: Accuracy in Staging and Treatment Response Monitoring in Childhood and Adolescent Hodgkin's Lymphoma Compared to Conventional Multimodality Imaging

Wednesday, Nov. 30 11:00AM - 11:10AM Room: E352

Participants

Stuart A. Taylor, MBBS, London, United Kingdom (*Abstract Co-Author*) Research Consultant, Robarts Clinical Trials, Inc
Shonit Punwani, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Arash Latif, London, United Kingdom (*Presenter*) Nothing to Disclose
Paul D. Humphries, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Leon J. Menezes, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Deena Neriman, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Stephen Daw, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ananth Shankar, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Paul Smith, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Bilyana? Popova?, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ka Man Condne, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andre Lopes, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare whole body MRI (WB-MRI) & conventional investigations for staging & treatment response monitoring in childhood Hodgkin's lymphoma

METHOD AND MATERIALS

A total of 50 patients (32 male, median age 16, range 6-19) prospectively underwent WB-MRI in addition to conventional CT and PET CT at initial staging and during response assessment (n=37) after 2 chemotherapy cycles. WB-MRI included axial/coronal FS T2/T1 TSE, axial FS DWI (5 b values 0 to 800), & dynamic contrast enhanced T1 FLASH through the liver/spleen. The reference standard disease status at 30 sites (17 nodal, 13 extra nodal) & Ann Arbour stage was assigned by a multidisciplinary committee using PET CT and CT, based on EURONET trial criteria (nodal positivity >2cm and/or focal 18-FDG uptake above background). Treatment response (progression, none, partial inadequate (PRI), partial adequate (PRa) and complete) was defined using nodal volume change & FDG avidity. WB-MRI was read in consensus by 2 radiologists blinded to conventional imaging. Based on pilot data, nodal positivity was defined as >2cm &/or mean ADC < 1.2 x10⁻³mm² s⁻¹. Nodes 1 to 2cm with ADC 1.2-1.8 were equivocal. Treatment response was assigned using nodal volume change and rise in ADC (cut off of 70% to differentiate between PRI & PRa). Agreement between WB-MRI and the reference was expressed as percentage concordance for all reported disease sites, & kappa statistics. Equivocal sites were treated as disease positive. Results are uncorrected for discrepancies in nodal site description

RESULTS

A total of 44 (88%) patients were concordant for at least 80% of nodal sites, although only 12 (24%) achieved 100% concordance between WB-MRI and the reference standard. Equivalent results for extra nodal disease were 48 (96%) and 34 (68%) respectively. There was 72% agreement for stage (36/50), (kappa 0.56-moderate), with 10 (20%) patients under staged by WB-MRI and 4 (8%) over staged. There was 68% agreement for response classification (25/37) (kappa 0.34-fair) with response over estimated by WB-MRI in 4 (11%) & under estimated in 8 (22%)

CONCLUSION

WB-MRI holds promise as an alternative to conventional staging modalities using ionising radiation, but levels of discordance suggest it is not ready to fully replace them

CLINICAL RELEVANCE/APPLICATION

WB-MRI is attractive as a staging modality for paediatric lymphoma but disagreement with standard modalities suggests caution must be applied before introducing into staging algorithms

RC513-12 Whole-Body MRI for Staging, Therapy Monitoring and Follow-up of Pediatric Malignancies- Comparison with Established Imaging Methods

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E352

Participants

Guenther K. Schneider, MD, PhD, Homburg, Germany (*Presenter*) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group;
Jonas Stroeder, MD, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Philippe Jagoda, MD, Homburg/Saar, Germany (*Abstract Co-Author*) Nothing to Disclose
Paul S. Raczeck, MD, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Arno Buecker, MD, Homburg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Consultant, Bracco Group; Speaker, Bracco Group; Consultant, Medtronic plc; Speaker, Medtronic plc; Research Grant, Novartis AG; Research Grant, GlaxoSmithKline plc; Research Grant, Biotest AG; Research Grant, OncoGenex Pharmaceuticals, Inc; Research Grant, Bristol-Myers Squibb Company; Research Grant, Eli Lilly & Company ; Research Grant, Pfizer Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, sanofi-aventis Group; Research Grant, Merrimack Pharmaceuticals, Inc; Research Grant, Sirtex Medical Ltd; Research Grant, Concordia Healthcare Corp; Research Grant, AbbVie Inc; Research Grant, Takeda Pharmaceutical Company Limited ; Research Grant, Merck & Co, Inc; Research Grant, Affimed NV; Research Grant, Bayer AG; Research Grant, Johnson & Johnson; Research Grant, Seattle Genetics, Inc; Research Grant, Onyx Pharmaceuticals, Inc; Research Grant, Synta Pharmaceuticals Corp; Research Grant, Siemens AG; Research Grant, iSYMED GmbH; Research Grant, St. Jude Medical, Inc; Co-founder, Aachen Resonance GmbH;

PURPOSE

In 68 pediatric patients with malignant tumors whole body MRI was performed and evaluated as the sole staging and follow-up procedure during and post therapy including evaluation of the lungs. Results were compared with established staging procedures as PET, MIBG or bone scintigraphy, CT and ultrasound.

METHOD AND MATERIALS

A total of 321 whole body examinations were performed for staging and follow-up of different malignant tumors, including 21 lymphoma, 31 solid tumors (neuro-, nephro- and hepatoblastoma) as well as 16 pts. with different types of sarcoma. The MR protocol incl. T1w dynamic CE GRE sequences of the abdomen post CM injection (0,05 mmol/kg BW Gd-BOPTA / MultiHance) and during the liver specific phase. DWI (free breathing) and transversal T2w TSE sequences with navigator triggering and a composed whole-body STIR-sequence in coronal orientation completed the imaging protocol. Depending on findings in this basic protocol, additional sequences for example to allow for local staging of soft-tissue- or bone-tumors were performed.

RESULTS

Differences between MRI and CT were seen regarding the number of detected small lung mets (< 3mm), however relevant lesions for staging were correctly diagnosed. Advantages for WB-MRI were seen in follow-up of diffuse T-cell Lymphoma, in which MRI could show residual disease under chemotherapy, although PET imaging showed complete metabolic response. Further advantages could be demonstrated in local staging of sarcoma, but also in initial staging of Ewing sarcoma, in which small lesions missed on PET imaging and confirmed by MR-guided biopsy could be detected. Due to the possibility to repeat MRI in shorter intervals in follow-up, recurrent disease in two cases of Hodgkin- and 3 cases of Non-Hodgkin-Lymphoma were diagnosed primarily by WB-MRI. Similarly

MRI correctly facilitated detection of recurrent tumors and restaging in different solid tumors.

CONCLUSION

Whole body imaging can correctly stage and diagnose a variety of malignant tumors in pediatric patients and allows for accurate patient management during therapy and follow-up. Advantages of established imaging methods were only seen for detection of small lung metastases on pulmonary CT, however differences seen did not result in a change of patient management.

CLINICAL RELEVANCE/APPLICATION

This study demonstrates the potential of whole body MRI for initial diagnosis, therapy monitoring and follow-up of pediatric malignancies.

RC513-13 Diffusion-Weighted MRI in Diagnostic Work-up of Neuroblastoma: Potential Role as Prognostic Marker?

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E352

Participants

Ilias Tsiflikas, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Marcel Barreuther, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Roland Bares, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
Juergen F. Schaefer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate diffusion-weighted MRI (DWI) as a complementary prognostic marker in comparison to established semiquantitative metaiodobenzylguanidine (mIBG) scoring methods in patients with stage 4 neuroblastoma.

METHOD AND MATERIALS

IRB waived informed consent and approved this retrospective, HIPAA-compliant study. 17 patients (13 boys, age 5 ± 3 years; range 10 months – 12 years) with stage 4 neuroblastoma were examined with whole-body MRI including whole-body DWI as baseline and/or for follow-up between January 2010 and April 2015. All patients received also a mIBG scan within +/- 30 days. In all patients we performed established CURIE and SIOPEN scoring for mIBG scans and also adapted the scoring for DWI.

RESULTS

In total there were 52 matched examinations of DWI and mIBG scan. 2 examinations were at baseline, 43 examinations in follow-up during/after therapy and 7 examinations at recurrence. Assessed Curie and SIOPEN scores showed excellent correlation for DWI and mIBG scans ($r=0.91$; $r=0.76$) in baseline and recurrence examinations. In contrast in interim examinations there was only a poor correlation for DWI and mIBG scans (Curie score $r=0.18$; SIOPEN score $r=0.25$).

CONCLUSION

DWI could serve as a complementary prognostic marker in baseline and recurrence examination of neuroblastoma. Poor correlation of DWI and mIBG scans in interim examinations could be an expression of different aspects of tumor biology and should be further evaluated.

CLINICAL RELEVANCE/APPLICATION

DWI can play an important role as a complementary prognostic marker in stage 4 neuroblastoma.

RC513-14 Second Generation Ultrasound Contrast Agents in an Assessment of Solid Tumors in Children-Do We Need Them?

Wednesday, Nov. 30 11:30AM - 11:40AM Room: E352

Participants

Maciej Piskunowicz, MD, PhD, Gdansk, Poland (*Presenter*) Nothing to Disclose
Wojciech Kosiak, Gdansk, Poland (*Abstract Co-Author*) Nothing to Disclose
Tomasz Batko, Gdansk, Poland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We present the possible application of contrast enhanced ultrasound (CEUS) in pediatric patients with solid tumors based on single-center experience. We would like to underline advantages and disadvantages of CEUS in comparison to the imaging modalities like magnetic resonance imaging (MRI), computed tomography (CT), b-mode ultrasound throughout the initial diagnosis, treatment, monitoring the therapy and monitoring of residual tumor tissue after the treatment of children solid tumors.

METHOD AND MATERIALS

Between November 1st, 2011 and October, 31st, 2015, 152 children (range ten days - 16.0 years) underwent CEUS and were consequently enroll to the prospective study according to the protocol. From the study cohort, we selected group of 20 children with solid tumors. There were cases with the following diagnoses: nephroblastoma, neuroblastoma, mesenteric fibromatosis, osteosarcoma, rhabdomyosarcoma, ganglioneuroma, lipoblastoma, adrenal hematoma. CEUS examinations were performed for distinguishing benign masses from malignant, evaluating the malignant tumor vasculature, monitoring vasculature changes during the treatment, and assessment the residual lesions. The correlation between CEUS and MRI/CT/b-mode ultrasound was performed (if applicable).

RESULTS

In all cases, CEUS examination obtained relevant from the clinical point of view information. In comparison to MRI/CT imaging, CEUS

reveals in real time additional features like tumor vascularity/supplying vessels what was crucial to established initial diagnosis. In the case of biopsy, CEUS proved high accuracy in estimating areas of necrosis. The quantitative assessment of tumor vascularity changes during treatment and monitoring of residual tumor tissue after the treatment was also possible. In 8 cases, CEUS allowed abandoning MRI/CT scans.

CONCLUSION

The results of our study are suggestive of the increasing significance of CEUS exams in the initial diagnosis and treatment monitoring of solid tumors in children. Additional data about tumor vascularity could shorten the diagnostic imaging process. Moreover, the lack of nephrotoxicity, ionizing radiation and no need for general anesthesia is especially advantageous in children. The study was financed from the means of the National Science Centre granted on the basis of the decision No DEC-2012/05/B/NZ5/01554.

CLINICAL RELEVANCE/APPLICATION

The CEUS could reduce the number of X-ray examination in children with solid tumors.

RC513-15 Abdominal Complications of Pediatric Cancer Therapy

Wednesday, Nov. 30 11:40AM - 12:00PM Room: E352

Participants

M. Beth McCarville, MD, Memphis, TN (*Presenter*) Consultant, General Electric Company

LEARNING OBJECTIVES

1) The benefits of ultrasound for the evaluation of the colon in children with suspected neutropenic typhlitis/colitis. 2) Imaging features of sinusoidal-obstruction-syndrome. 3) Imaging features of hemorrhagic cystitis.

ABSTRACT

Interventional Series: Non-Vascular Interventions

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

IR

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

FDA

Discussions may include off-label uses.

Participants

Peter R. Mueller, MD, Boston, MA (*Moderator*) Consultant, Cook Group Incorporated
Jonathan M. Lorenz, MD, Chicago, IL (*Moderator*) Nothing to Disclose

ABSTRACT

Sub-Events

RC514-01 Treating Ascites: Paracentesis, TIPs, PleuRx, Denver Shunt. Which One and Why?

Wednesday, Nov. 30 8:30AM - 8:45AM Room: S102AB

Participants

Albert A. Nemcek JR, MD, Chicago, IL, (aan728@northwestern.edu) (*Presenter*) Consultant, B. Braun Melsungen AG

LEARNING OBJECTIVES

1) Analyze the etiology of ascites as a prelude to therapy. 2) Discuss options for treatment of symptomatic benign and malignant ascites. 3) Comprehend advantages and disadvantages of the various treatment options.

ABSTRACT

RC514-02 Transthoracic Biopsy Considerations

Wednesday, Nov. 30 8:45AM - 9:00AM Room: S102AB

Participants

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

RC514-03 Biopsy of Abdominal Focal Lesions under Contrast-Enhanced Ultrasound Guidance: A Multicenter Study

Wednesday, Nov. 30 9:00AM - 9:10AM Room: S102AB

Participants

Giampiero Francica, MD, Castel Volturno, Italy (*Presenter*) Nothing to Disclose
Ilario De Sio, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Maurizio Pompili, MD, Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Eugenio Caturelli, Viterbo, Italy (*Abstract Co-Author*) Nothing to Disclose
Maria Franca Meloni, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Maddalena Iadevaia, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Laura Riccardi, Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Angela Sannino, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Paola Roselli, Viterbo, Italy (*Abstract Co-Author*) Nothing to Disclose
Mariano Scaglione, MD, Castel Volturno, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Aim of this study was to quantify the use of Contrast-Enhanced Ultrasound (CEUS) as guidance technique for biopsy of Abdominal Focal Lesions (AFL) in field practice of five centers with high volume of ultrasound interventional activity

METHOD AND MATERIALS

The five participating centers retrospectively selected all patients in whom biopsy needles had been positioned into AFL during CEUS with a Low Mechanical Index Ultrasound Contrast Agent. The rate of CEUS-guided biopsies was calculated on the whole biopict activity of each center between 2005 and 2015. In addition, contrast media consumption, procedure indications, diagnostic yield and complications were evaluated.

RESULTS

CEUS-guided biopsy of AFL was carried out in 73 patients (47 M / 26 F, mean age 65.7 yrs.) with 63 liver focal lesions (mean size 26.8 mm) and 10 extra-hepatic abdominal masses (mean size 53.9 mm) by using cutting needles (18-20g) in 65 cases (89%). The interventional maneuver under CEUS guidance represented 2.2% (range 0.8-6.6%) of 3321 biopsies on AFL carried out at the participating centers. 18 out of 73 patients (24.6%) had a previous non-diagnostic cyto-histological exam performed under non-enhanced ultrasound (US) guide. Indications to CEUS-guided biopsy were: a target lesion not visible on non-enhanced US (23.3%), improvement of conspicuity of the target (32.9%), choice of non-necrotic area inside the target (43.8%). A single needle pass and single standard dose (2,4 ml) of medium contrast were used in 40 patients (54.8%). Biopict samples yielded a specific diagnosis in 69 cases (94.5%): 60 AFL proved to be malignant (82.2%), mostly primary or secondary liver tumors (51 out of 60). No complications ensued either biopsy or infusion of contrast medium.

CONCLUSION

To the best of our knowledge it is the first time that the use of CEUS as guidance system for abdominal biopsy has been

To the best of our knowledge, it is the first time that the use of CEUS as guidance system for abdominal biopsy has been quantified. In experienced hands such a procedure seems to have limited indication (2.2% of 3321 biopsies), but is deemed necessary to reach both small, ill-defined focal lesions and non-necrotic areas in complex targets, even of large size.

CLINICAL RELEVANCE/APPLICATION

Quantification of the use of CEUS-guided biopsy for abdominal focal lesions in field practice of high-volume ultrasound interventional centers

RC514-04 Intrabiliary Radiofrequency-Enhanced Local Chemotherapeutic Deposit in Bile Duct Walls Using a Needle-Integrated Balloon Catheter: A Feasibility Study on Survival Pigs

Wednesday, Nov. 30 9:10AM - 9:20AM Room: S102AB

Participants

Feng Zhang, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Jun Gao, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Yin Jin, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Xiaoming Yang, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the feasibility and safety of using intrabiliary radiofrequency hyperthermia (RFH) to enhance local chemotherapeutic drug deposit in bile duct walls of survival pigs with a needle-integrated balloon catheter.

METHOD AND MATERIALS

Ten pigs were randomly allocated into two survival study groups: (i) five pigs received intrabiliary chemodrug delivery alone; and (ii) five pigs received a combination of intrabiliary chemotherapeutic drugs plus RFH at 42 °C. Via a transcholecystic approach and under fluoroscopy guidance, a mixture of 10mg 5-fluorouracil (5-FU) and 125µg motexafin gadolinium (MGd) was injected into common bile duct wall through a needle-integrated balloon catheter (Mercator Medsystem). Then, pigs were kept alive for 24 hours. 5-FUs in bile duct tissues were extracted and quantified using high performance liquid chromatography (HPLC). The harvested bile duct tissues were further assessed by optical imaging and confocal microscopy to confirm the penetration and distribution of MGd in bile duct walls. Subsequent histology was used to correlate imaging findings and examine potential bile duct injuries. The quantities of 5-FU in two groups were statistically compared.

RESULTS

All pigs survived very well without any abnormalities of vital signs. Immediate cholangiograms after intrabiliary chemotherapeutic drug injection and RFH showed no extravasation of agents outside bile duct lumens. Histology confirmed no bile duct injuries. HPLC analysis demonstrated a higher content of 5-FU in bile ducts treated with intrabiliary injection of chemotherapeutic drugs and RFH, compared to bile ducts with injection of 5-FU alone (5-FU, 6.4±0.19mg VS 2.7±0.21mg, P<0.0001), which indicates RFH can enhance the deposit of 5-FU in pig bile duct tissues. Optical imaging and confocal microscopy further confirmed diffusive fluorescence of MGd throughout bile walls.

CONCLUSION

It is safe and effective using intrabiliary RFH to enhance the deposit of intrabiliary delivered chemotherapeutics with a needle-integrated balloon catheter, which provides an alternative to treat pancreatobiliary malignancies.

CLINICAL RELEVANCE/APPLICATION

The technique of intrabiliary radiofrequency hyperthermia-enhanced chemotherapy has the great potential to be translated to clinical practice for effectively managing obstructive pancreatobiliary malignancies.

RC514-05 Correlation of Height Restoration and Kyphosis with Clinical Outcome after Percutaneous Vertebroplasty in Patients with Vertebral Compression Fractures

Wednesday, Nov. 30 9:20AM - 9:30AM Room: S102AB

Participants

Tao Pan, MD, PhD, Nanjing, China (*Presenter*) Nothing to Disclose
Hai-Dong Zhu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Shi-Cheng He, MEd, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Jin-He Guo, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Gao-Jun Teng, MD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Percutaneous vertebroplasty (PVP) is widely used for the treatment of painful vertebral compression fractures (VCFs). It is unclear whether height restoration affects clinical outcome and whether kyphosis should be improved. The objective is to evaluate the correlation of restoration of vertebral body height and kyphosis with pain relief and clinical outcome after PVP in patients with VCFs.

METHOD AND MATERIALS

Between January 2007 and December 2013, 241 patients with VCFs who had failed conservative treatment and underwent PVP were included. Restoration of vertebral body height and kyphosis were measured on standardized radiographs. Pain and clinical outcome were assessed using the visual analogue scale (VAS) score and the Ronald Morris Disability Questionnaire (RMDQ) score, respectively. Pre- and post-operative restoration of vertebral body height and kyphosis and VAS and RMDQ scores were compared using the paired t test. Correlations between the height restoration and kyphosis and VAS and RMDQ scores were determined via Pearson correlation coefficient (r).

RESULTS

The height, wedge angle and local angle of the fractured vertebral body, and VAS and RMDQ scores, improved significantly after PVP. VAS and RMDQ scores correlated positively with the height restoration and kyphosis; the highest correlation was between the VAS score and wedge angle (r=0.95).

CONCLUSION

PVP is a simple and viable treatment for VCFs patients as most patients experienced pain relief and improvement of clinical function after the pressure. In terms of VAS and RMDQ scores, preoperative height restoration and kyphosis can be prognostic indicators for the outcome of PVP.

CLINICAL RELEVANCE/APPLICATION

PVP is a simple and viable treatment for VCFs patients and preoperative height restoration and kyphosis can be prognostic indicators for the outcome.

RC514-06 Refractory Abscess Management

Wednesday, Nov. 30 9:30AM - 9:45AM Room: S102AB

Participants

Rakesh C. Navuluri, MD, Chicago, IL, (IR@uchicago.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss strategies for treating refractory and complex abscesses. 2) Gain a greater appreciation for the role of IR as an integral component of the multidisciplinary team.

RC514-07 Cholecystostomy: An update for 2016

Wednesday, Nov. 30 9:45AM - 10:00AM Room: S102AB

Participants

Charles T. Burke, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Gain a broad understanding for the management of acute cholecystitis. 2) Gain a better understanding of the usage of cholecystostomy catheters in the current healthcare environment.

RC514-08 Celiac Plexus and Other Abdominal Blocks

Wednesday, Nov. 30 10:15AM - 10:30AM Room: S102AB

Participants

Mitchell T. Smith, MD, Golden, CO (*Presenter*) Consultant, Cook Group Incorporated

RC514-09 Primary Biliary Stenting

Wednesday, Nov. 30 10:30AM - 10:45AM Room: S102AB

Participants

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

RC514-10 Thoracic Duct Embolization

Wednesday, Nov. 30 10:45AM - 11:00AM Room: S102AB

Participants

Chieh-Min Fan, MD, Boston, MA, (cfan@partners.org) (*Presenter*) Nothing to Disclose

Handout:Chieh-Min Fan

[http://abstract.rsna.org/uploads/2016/16001210/TD Embo talk RSNA Final.pdf](http://abstract.rsna.org/uploads/2016/16001210/TD%20Embo%20talk%20RSNA%20Final.pdf)

LEARNING OBJECTIVES

1) Differentiate between thoracic duct embolization and thoracic duct disruption as methods for thoracic duct ablation in terms of technique and clinical efficacy. 2) Describe the anatomy of the truncal lymphatic system. 3) Identify patients appropriate for referral for thoracic duct embolization.

RC514-11 Comparison of Intranodal Lymphangiography Thoracic Duct Embolization and Thoracic Duct Disruption in Percutaneous Management of Chylous Leaks: A Single-Center Experience of 62 Patients Over 5 Years

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S102AB

Awards

Student Travel Stipend Award

Participants

Michael P. Yannes, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Donghoon Shin, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose

Ernesto Santos, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Chylous leaks are infrequent, often post-surgical, effusions. Pedal lymphangiography has become a percutaneous treatment with high clinical success rates. A new therapy, intranodal lymphangiography (INL), is less well studied. INL has the potential to reduce total examination time, since contrast material is infused at the groin versus the foot. The clinical benefit of performing INL in combination with thoracic duct embolization (TDE) and disruption (TDD) is not well known. This study is the largest to date to evaluate the clinical success of INL.

METHOD AND MATERIALS

Patients over a five-year period were included. Procedures were performed or supervised by a single senior Interventional Radiologist. All patients underwent INL. Patients preferentially underwent TDE if the thoracic duct could be cannulated. Clinical success was defined as avoidance of subsequent surgery and removal of draining catheters. Fisher's Exact Test was performed to compare clinical success between TDD and TDE. A Kaplan-Meier curve was then calculated based on median time to clinical resolution between TDD and TDE.

RESULTS

62 patients underwent evaluation. INL was technically successful in 60/62 patients. 23 patients underwent INL only. 24 patients underwent INL and TDE. 13 patients underwent INL and TDD.

The clinical success rate of all therapies was 70%; when a leak was identified, the clinical success rate was 74%. Patients who underwent INL with TDE were more likely to achieve clinical success compared to TDD ($p=0.0425$), regardless of whether a leak was identified during INL. Patients undergoing TDE had earlier clinical resolution compared to patients undergoing TDD, with a median time to resolution of 3 days versus 7 days ($p=0.0055$).

CONCLUSION

Patients undergoing INL have similar clinical success rates to those reported with pedal lymphangiography. Patients who underwent TDE were more likely to achieve clinical resolution, and more likely to achieve clinical resolution earlier. This was independent of fluoroscopic identification of a leak. Findings suggest that TDE may be superior to TDD with respect to clinical resolution.

CLINICAL RELEVANCE/APPLICATION

Prior treatments for chylous leaks have mainly consisted of dietary adjustment, surgery, and/or pedal lymphangiography. In this abstract, we investigate the clinical efficacy of one center's experience with a new percutaneous therapy, intranodal lymphangiography.

RC514-12 Thoracic Ductography by Transvenous Retrograde Cannulation: Initial Experience

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S102AB

Participants

Shuji Kariya, MD, PhD, Hirakata, Japan (*Presenter*) Nothing to Disclose
Miyuki Nakatani, Hirakata, Japan (*Abstract Co-Author*) Nothing to Disclose
Rie Yagi, Hirakata, Japan (*Abstract Co-Author*) Nothing to Disclose
Yutaka Ueno, Hirakata, Japan (*Abstract Co-Author*) Nothing to Disclose
Asami Yoshida, Hirakata, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Komemushi, MD, PhD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Noboru Tanigawa, MD, Hirakata, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to report our initial experience with transvenous retrograde cannulation of the thoracic duct.

METHOD AND MATERIALS

The subjects were 12 patients in whom transvenous retrograde cannulation of the thoracic duct was indicated for the purposes of diagnosing the site of chylous leakage or embolization for leakage. Lymphangiography was performed, and the junction of the thoracic duct with the vein from where lipiodol in the thoracic duct was discharged into the vein was identified. A microcatheter was inserted into the thoracic duct retrogradely via the thoracic duct-vein junction from the vein. Successful transvenous thoracic ductography was defined as the case in which the entire thoracic duct and cisterna chyli were visualized by injecting contrast media via the microcatheter.

RESULTS

The catheter was successfully inserted to the cervical part, thoracic part, and cisterna chyli in 11, 8, and 6 of the patients, respectively (91.7%, 66.7%, and 50.0%). Successful transvenous thoracic ductography was performed in 7 of 12 patients (58.3%). The microcatheter could be inserted into the thoracic duct beyond the junction of the thoracic duct and vein, but the cervical part of the thoracic duct was branched into a plexiform configuration beyond which the microcatheter could not be advanced to reach the thoracic part in three unsuccessful cases.

CONCLUSION

Transvenous thoracic ductography was successful in 7 of 12 patients (58.3%). In cases in which the cervical part of the thoracic duct had a plexiform configuration, the catheter could not be passed retrogradely through that point.

CLINICAL RELEVANCE/APPLICATION

Transvenous retrograde cannulation to the thoracic duct is a safe method with low invasiveness; thus, in cases of chylous leakage, diagnosis and embolization with this technique may be indicated before conservative treatment.

RC514-13 Push versus Pull Gastrostomy: A Single Center Retrospective Analysis of Complications and Technical Success Rates

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S102AB

Awards

Student Travel Stipend Award

Participants

Brian M. Currie, MD, New York, NY (*Presenter*) Nothing to Disclose
George I. Getrajdman, MD, New York, NY (*Abstract Co-Author*) Medical Advisory Board, CareFusion Corporation
Anne M. Covey, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
William Alago Jr, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Joseph P. Erinjeri, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Majid Maybody, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Franz E. Boas, MD, PhD, New York, NY (*Abstract Co-Author*) Co-founder, ClariPACS

PURPOSE

To compare the technical success and complication rates of push versus pull gastrostomy tubes in cancer patients.

METHOD AND MATERIALS

We performed a retrospective review of 304 patients between July 2000 and October 2015 who were referred for primary gastrostomy tube placement (excluding secondary replacements or exchanges), 88 of whom had a previously unsuccessful attempt at percutaneous endoscopic gastrostomy (PEG) placement. Variables that were analyzed included method of insertion (push versus pull), clinical indications for gastrostomy, technical success rates, operator experience level, and minor and major procedure-related complications up to 30 days after placement.

RESULTS

This was a varied population of cancer patients: 156 had head and neck cancer, 121 had abdominal and pelvic malignancies, and 27 had other malignancies. The indication for gastrostomy placement was feeding in 189 patients and palliative decompression in 115 patients. Technical success was 91%--78% after endoscopy had previously been unsuccessful and 96% when excluding failures associated with prior endoscopy. In the first 30 days, there were 29 minor complications (17.2%, most commonly dislodgement) in patients who received a push gastrostomy, and only 8 minor complications (7.5%, most commonly clogging) in patients who received a pull gastrostomy ($p < 0.05$); there was no significant difference in major complications (push gastrostomy 5.3%, pull gastrostomy 5.6%). There was no difference in complications or technical success rates for more versus less experienced operators.

CONCLUSION

Pull gastrostomy tube placement had a lower rate of minor complications than push gastrostomy tube placement, and the same rate of major complications. The technical success rate was high, even after a failed attempt at endoscopic placement. Both the rates of success and complications were independent of operator experience.

CLINICAL RELEVANCE/APPLICATION

Pull gastrostomy tube placement may be preferable to push gastrostomy tube placement, due to a lower rate of complications. However, push gastrostomy tube placement may be preferable in patients with airway issues or head and neck cancer.

RC514-14 Debate: Push or Pull Gastrostomy

Wednesday, Nov. 30 11:30AM - 11:45AM Room: S102AB

Participants

Steven M. Zangan, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Peter R. Mueller, MD, Boston, MA (*Presenter*) Consultant, Cook Group Incorporated

LEARNING OBJECTIVES

1) Describe the different techniques: Push Gastrostomy vs Pull Gastrostomy. 2) Describe the advantages of each technique. 3) review the type and difference indications and complications for both techniques.

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/>

Peter R. Mueller, MD - 2012 Honored Educator
Peter R. Mueller, MD - 2013 Honored Educator

RC514-15 Advanced Genitourinary Procedures

Wednesday, Nov. 30 11:45AM - 12:00PM Room: S102AB

Participants

Charles T. Burke, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The learner will gain a better understanding in the use of a variety of tools available to the radiologist in treating complex problems of the genitourinary system.

RC515

Breast MR Imaging (An Interactive Session)

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



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

Participants

Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (*Moderator*) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC515A Scanning Wisely: Breast MRI Protocols

Participants

Christopher E. Comstock, MD, New York, NY (*Presenter*) Nothing to Disclose

RC515B MR BI-RADS 3

Participants

Mary C. Mahoney, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the definition and criteria used to designate a lesion as BI-RADS 3 on MRI. 2) Review the literature on outcomes of lesions designated as BI-RADS 3 on MRI.

ABSTRACT

RC515C Challenging Cases

Participants

Dorota J. Wisner, MD, PhD, San Rafael, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize common artifacts on breast MRI that may lead to interpretation errors. 2) Review common pitfalls of cross-modality breast imaging.

ABSTRACT

RC516

Women in Leadership (In Conjunction with the American Association for Women Radiologists)

Wednesday, Nov. 30 8:30AM - 10:00AM Room: N226

LM

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

Participants

Margaret M. Szabunio, MD, Lexington, KY, (Margaret.szabunio@uky.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

Sub-Events

RC516A Transitioning from Trainee to Attending

Participants

Meryle J. Eklund, MD, Charleston, SC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify common challenges faced in the transition from trainee to attending. 2) List strategies to embark on a successful career as an attending. 3) Compare differences in tactics employed by women and men at the start of their career.

ABSTRACT

RC516B Challenges in Climbing the Ladder

Participants

Rebecca J. Leddy, MD, Charleston, SC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Examine the value and identify opportunities for climbing the ladder of success. 2) Describe barriers and challenges to career development and achievement. 3) Develop goals and strategy to assist with effective advancement and promotion.

RC516C Getting Leadership Positions

Participants

M. Elizabeth Oates, MD, Lexington, KY, (meoate2@email.uky.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define personal goals regarding leadership positions. 2) Identify leadership positions worth seeking. 3) Apply strategies to secure leadership positions.

ABSTRACT

RC516D Why Women Don't Ask

Participants

Carol M. Rumack, MD, Aurora, CO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss why women don't ask. 2) Describe what happens if women don't ask. 3) Describe what happens if women do ask. 4) Use positive strategies to succeed at negotiation. 5) Understand what will happen if Radiology leaders encourage women to negotiate.

ABSTRACT

Women traditionally have not asked for what they need to be successful because of cultural expectations that they should wait to be asked. Highly accomplished women may not be recognized due to these social pressures. Both women radiologists and radiology leaders need to strongly support the inclusion of women at the highest levels of radiology organizations so that diversity will be a positive force for change.

RC517

Emerging Technology: Elastography - Opportunities and Challenges

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



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

Participants

Juergen K. Willmann, MD, Stanford, CA, (willmann@stanford.edu) (*Moderator*) 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

LEARNING OBJECTIVES

1) To understand how elastography measurements are integrated into the management of patients with chronic liver disease. 2) To learn imaging techniques and protocols of ultrasound and MR elastography. 3) To compare US and MR elastography in assessing liver fibrosis. 4) To review emerging clinical indications of US and MR elastography. 5) To understand limitations of current elastography techniques.

Sub-Events

RC517A Elastography of the Liver: What the Clinician Wants to Know

Participants

Mindie Nguyen, MD, Stanford, CA (*Presenter*) Consultant, Intercept Pharmaceuticals, Inc; Consultant, Johnson & Johnson; Consultant, Gilead Sciences, Inc; Consultant, Alynam Pharmaceuticals, Inc; Consultant, Dynavax Technologies Corporation; Research Grant, Johnson & Johnson; Research Grant, Gilead Sciences, Inc; Research Grant, Bristol-Myers Squibb Company

LEARNING OBJECTIVES

View learning objectives under the main course title.

RC517B Ultrasound Elastography: How and When?

Participants

Juergen K. Willmann, MD, Stanford, CA, (willmann@stanford.edu) (*Presenter*) 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

LEARNING OBJECTIVES

1) Understand the clinical indications of ultrasound elastography (USE). 2) Learn about the various techniques and imaging protocols of USE. 3) Review the diagnostic accuracy of USE in the assessment of elasticity in liver fibrosis and other clinical applications in the body. 4) Compare USE with MR elastography. 5) Understand current limitations of USE.

ABSTRACT

Ultrasound elastography (USE) is a general term for various techniques available for objectively and quantitatively assessing tissue stiffness using ultrasonic techniques, creating noninvasive images of mechanical characteristics of tissues. Elastography is based on the fact that the elasticity of a tissue is changed by pathological or physiological processes. For example, cancer or fibrosis associated with various disease processes including chronic liver disease or chronic pancreatitis result in increased tissue stiffness. Recently, various USE techniques have been cleared by the FDA and all major ultrasound companies offer different approaches of measuring tissue stiffness on their ultrasound machines. The objective of this talk is to familiarize the audience with the clinical indications, imaging techniques and protocols, interpretation, diagnostic accuracy, and limitations of the various USE technique for assessment of tissue stiffness, with special focus on assessment of fibrosis in chronic liver disease.

RC517C MR Elastography: How and When?

Participants

Richard L. Ehman, MD, Rochester, MN (*Presenter*) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc;

LEARNING OBJECTIVES

View learning objectives under the main course title.

Honored Educators

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Richard L. Ehman, MD - 2016 Honored Educator

RC518

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

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

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

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

Participants

LEARNING OBJECTIVES

1) Identify ultrasound features that differentiate between benign and malignant disease, particularly in the female pelvis. 2) Recommend specific scanning techniques and protocols for difficult cases. 3) Develop biopsy strategies for indeterminate masses that need tissue sampling for diagnosis. 4) To discuss newer MRI techniques that are now applied for body oncologic imaging that allows faster, better or more accurate disease diagnosis. 5) To highlight the applications and pitfalls of diffusion-weighted imaging for assessing upper abdominal cancers, peritoneal involvement, pelvic disease and bone marrow involvement (whole body MRI). 6) To survey the applications and limitations of motion insensitive radial-acquisition MR techniques for dynamic contrast enhanced imaging for cancer evaluation.

Sub-Events

RC518A **US**

Participants

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

LEARNING OBJECTIVES

1) Identify ultrasound features that differentiate between benign and malignant disease, particularly in the female pelvis. 2) Recommend specific scanning techniques and protocols for difficult cases. 3) Develop biopsy strategies for indeterminate masses that need tissue sampling for diagnosis.

ABSTRACT

The course will focus on benign and malignant masses that mimic each other, particularly in the area of gynecology. Emphasis is placed on the importance of knowing patient history and using good ultrasound technique in order to make accurate diagnoses with ultrasound alone. However, at times, further imaging and tissue sampling is necessary. The participant will be encouraged to "push the envelope" with ultrasound-guided biopsy for appropriate cases.

RC518B **CT**

Participants

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

Honored Educators

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Dushyant V. Sahani, MD - 2012 Honored Educator
Dushyant V. Sahani, MD - 2015 Honored Educator
Dushyant V. Sahani, MD - 2016 Honored Educator

RC518C **MRI**

Participants

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

LEARNING OBJECTIVES

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

RC520

Molecular and Functional Imaging/Surrogate Markers in Radiation Oncology

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



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

Participants

Nina A. Mayr, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events

RC520A Imaging Surrogate Markers in Liver Cancer

Participants

Mary U. Feng, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

RC520B Imaging Surrogate Markers in Lymphoma

Participants

John P. Plastaras, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how PET/CT scans after chemotherapy are used to make decisions about lymphoma treatment. 2) Describe how pre-chemotherapy PET/CT scans are used to define target volumes in involved site radiotherapy paradigm. 3) Propose prescription doses for lymphoma treatments based on PET/CT as an imaging biomarker.

ABSTRACT

RC520C Imaging Surrogate Markers in Esophageal Cancer

Participants

Steven H. Lin, MD, PhD, Houston, TX, (shlin@mdanderson.org) (*Presenter*) Research Grant, STCube Pharmaceuticals, Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Elekta AB; Research Grant, Peregrine Pharmaceuticals, Inc; Research Grant, Hitachi, Ltd; Speaker, AstraZeneca PLC; Speaker, ProCure Treatment Centers, Inc; Speaker, McKesson Corporation

LEARNING OBJECTIVES

1) Assess the critical role of imaging in the diagnosis and treatment of esophageal cancer. 2) Critically appraise the utility of FDG-PET imaging as a predictive and prognostic marker in esophageal cancer. 3) Describe the novel imaging approaches for improved imaging biomarkers for preoperative therapy.

RC520D Imaging Surrogate Markers in Head and Neck Cancer

Participants

Min Yao, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1. Review the application of FDG PET in head and neck cancer
2. Review how to use FDG PET in treatment planning
3. Review new tracers PET in head and neck cancer

RC521

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

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



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

Discussions may include off-label uses.

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 ;

LEARNING OBJECTIVES

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

ABSTRACT

Handout: Ehsan Samei

<http://abstract.rsna.org/uploads/2016/16001056/RSNA Presentation - Bolch - 30Nov16.pdf>

Sub-Events

RC521A Dose and Risk Characterization

Participants

Wesley E. Bolch, PhD, Gainesville, FL (*Presenter*) Nothing to Disclose

RC521B Image Quality Estimation

Participants

Guang-Hong Chen, PhD, Madison, WI, (gchen7@wisc.edu) (*Presenter*) Research funded, General Electric Company Research funded, Siemens AG

LEARNING OBJECTIVES

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

ABSTRACT

RC521C Performance Evaluation, TG233

Participants

Ehsan Samei, PhD, Durham, NC (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG

LEARNING OBJECTIVES

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

ABSTRACT

RC522

Imaging for Personalized Medicine: Head and Neck

Wednesday, Nov. 30 8:30AM - 10:00AM Room: S102D

HN **NR** **RO** **PH**

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

Participants

Robert Jeraj, Madison, WI (*Moderator*) Founder, AIQ Services

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC522A IGRT and Anatomical Adaptation

Participants

Marija Popovic, PhD, Montreal, QC, (marija.popovic@mcgill.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the evolution of adaptive radiotherapy and relevant technological advances as they pertain to head and neck radiotherapy. 2) Understand the clinical rationale for plan adaptation in head and neck patient population. 3) Describe possible routes to clinical implementation. 4) Discuss risks associated with adaptive planning workflows and appropriate quality assurance.

ABSTRACT

This session will focus on the practical implementation of adaptive radiotherapy for head and neck cancer. Although the concept of adaptive radiation therapy (ART) has been around for more than two decades, routine plan adaptation has not become standard practice in the management of head and neck cancer despite huge technological advances in imaging, image registration software, and dose calculation speed. The remaining challenges in implementing ART for head and neck cancer in 2016 as well as an update of the demonstrated clinical need will be discussed. Features of successful adaptive radiotherapy implementations will be highlighted as well as a summary of useful clinical tools and required quality assurance.

RC522B Functional Targeting and Adaptation

Participants

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

LEARNING OBJECTIVES

1) To learn about appropriate anatomical and imaging modalities for selection and delineation of target volumes in HN. 2) To learn about biologically conformal approaches (dose painting) in HN. 3) To learn about quantitative imaging requirements for RT in HN.

ABSTRACT

Anatomical and molecular imaging is used to tailor radiation treatment by enabling proper selection and delineation of target volumes and organs, which in turn lead to dose prescriptions that take into account the underlying tumor biology. Dose modulation to different parts of target volume may also be used to match variable tumor radiosensitivity (so-called biologically conformal radiotherapy or dose-painting). For accurate implementation of targeted and adaptive IMRT, tools and procedures, such as accurate image acquisition and reconstruction, automatic segmentation of target volumes and organs at risk, non-rigid image and dose registration, and dose summation methods, need to be developed and properly validated.

RC523

Molecular Imaging Mini-Course: Clinical Applications of Molecular Imaging-Oncology

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



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

Discussions may include off-label uses.

Participants

Sub-Events

RC523A Diagnosis

Participants

Terence Z. Wong, MD, PhD, Chapel Hill, NC, (tzwong@med.unc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the value of combined FDG-PET and CT for diagnosing malignant disease. 2) Discuss selection of PET radiotracers the potential role of non-FDG PET tracers in managing patients with cancer.

RC523B Staging

Participants

Dominique Delbeke, MD, PhD, Nashville, TN, (dominique.delbeke@vanderbilt.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The potential clinical indications of PET and PET/CT in the evaluation of patients with malignancies. 2) The impact on patient care. 3) Recommendations for PET/CT in the NCCN guidelines.

Active Handout: Dominique Delbeke

http://abstract.rsna.org/uploads/2016/15002834/Handout_NCCN.pdf

RC523C Evaluation of Treatment

Participants

David A. Mankoff, MD, PhD, Philadelphia, PA, (david.mankoff@uphs.upenn.edu) (*Presenter*) Speaker, Koninklijke Philips NV; Consultant, General Electric Company; Advisory Board, RefleXion Medical Inc

LEARNING OBJECTIVES

1) List applications of quantitative imaging for clinical trials. 2) Describe the approach to the design of cancer imaging trials. 3) Discuss biomarkers application for cancer imaging.

Honored Educators

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David A. Mankoff, MD, PhD - 2013 Honored Educator

RC524

Becoming a Reviewer for the RSNA Journals (Sponsored by the RSNA Publications Council)

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



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

Participants

Herbert Y. Kressel, MD, Boston, MA (*Moderator*) Stockholder, Pfizer Inc; Stockholder, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) Discuss the similarities and differences in the peer review process for the RSNA journals. 2) Discuss the functions of the reviewer in the peer review process. 3) Enumerate the desired elements for peer review of a manuscript 4) Detail how a reviewer can receive AMA PRA Category 1 CME credit for manuscript review

ABSTRACT

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

Sub-Events

RC524A Reviewing for Radiology: Editor's Perspective

Participants

Herbert Y. Kressel, MD, Boston, MA (*Presenter*) Stockholder, Pfizer Inc; Stockholder, GlaxoSmithKline plc

LEARNING OBJECTIVES

View learning objectives under the main course title.

RC524B Reviewing for Radiology: How I Do It

Participants

Andrew J. Degnan, MD, MPhil, Pittsburgh, PA, (DegnanAJ@upmc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe approaches to reading, assessing and critiquing scientific manuscripts submitted to *Radiology* with an emphasis on critical appraisal. 2) Identify key components of a helpful review that assists editorial board members in deciding upon a manuscript's outcome. 3) Address challenges faced by reviewers including conflicts of interest, duplicate publication and other concerns.

ABSTRACT

Reviewers are vital to the mission of *Radiology* to present scientifically-sound and relevant research that advances imaging and medicine. In this talk, strategies to efficiently reading and critically evaluating scientific manuscripts will be explored from the perspective of a reviewer. This presentation will emphasize insights that can be provided from reviewers' clinical and research experience to provide quality reviews that address a manuscript's scientific merit and suitability for *Radiology*.

Active Handout: Andrew Joseph Degnan

<http://abstract.rsna.org/uploads/2016/16001985/Reviewing for Radiology RSNA Handout.pdf>

RC524C Reviewing for RadioGraphics: Editor's Perspective

Participants

Jeffrey S. Klein, MD, Burlington, VT, (jklein@rsna.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe how RadioGraphics identifies and solicits material for potential publication. 2) Detail the peer review process including criteria for acceptance/rejection of submitted papers. 3) List the benefits of becoming a peer reviewer for RadioGraphics, including CME credit for manuscript review, the editor's recognition award, and providing expert commentary for select papers.

ABSTRACT

The RSNA's journals rely upon the peer review process to identify the highest quality material for the society's journals. In this part of the presentation the editor of RadioGraphics will detail the solicitation and peer review processes for the journal. We will provide information on perquisites that peer reviewing offers the reviewer, including the opportunity to receive CME credits for high quality peer review, the Editor's Recognition Awards, expert commentaries that reviewers are sometimes invited to provide, and the selection of editorial board members for the journal.

RC524D Reviewing for RadioGraphics: How I Do It

Participants

Tara A. Morgan, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Determine whether they are an appropriate reviewer for a manuscript and identify specific reasons to accept or decline. 2) Determine whether a manuscript is suited for the targeted audience and message of RadioGraphics. 3) Assess the content of an article for its value, novelty, accuracy, and reader interest. 4) Assess appropriateness of an abstract, introduction, materials and methods, discussion, and conclusion.

ABSTRACT

Reviewing a manuscript can be an overwhelming task to a novice, however, a breakdown approach with a simple list of tasks can make for an efficient and effective reviewer. This presentation will give a step by step approach of how to review a Radiographics manuscript, starting with the decision of whether the manuscript and the reviewer are a good match, followed by a straightforward and repeatable assessment of the manuscript for its content by category.

RC525

Mini-course: Image Interpretation Science: Understanding What and How Radiologist See and Think-Clinical Foundations of Medical Image Perception-Why Study Radiologists

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



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

Participants

Sub-Events

RC525A Clinical Relevance of Perceptual Issues in Radiology

Participants

Francine L. Jacobson, MD, MPH, Boston, MA, (fjacobson@partners.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the perception factors and considerations in interpreting a medical image. 2) Delineate how perception considerations impact the radiologist's practice in terms of increasing sensitivity and reducing errors. 3) Describe perceptual factors while interpreting medical images including cognitive overload, satisfaction of search, CAD influence, color presentation, image processing, and graphical user interface.

ABSTRACT

In the 21st Century, technology has led to increased workloads for radiologists with advanced modalities and image processing dramatically increasing the volume of images to be studied by the Radiologist. Information overload is not limited to visual data as we enter the era of the electronic medical record. Increasingly, radiologists are being asked to perform the physical examination of the patient without the opportunity to interact with the patient directly. Such interaction provides important inputs including localization of pain and the opportunity to acquire additional history about prior illnesses and surgical treatments. Set against a background of changing diagnostic criteria and individualization of treatment, critical decisions are increasingly made by radiologists using a variety of diagnostic and non-diagnostic quality image displays. Perception science provides keys to evolving the human visual processes in evaluating medical images. It is through perception science that we can move with technology to newer image presentation paradigms and maintain the efficacy of radiology.

RC525B A Short History of Image Perception in Radiology

Participants

Elizabeth A. Krupinski, PhD, Atlanta, GA, (ekrupin@emory.edu ekrupin@emory.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the origins of the inter and intra-observer variability issue. 2) Trace the roots of visual search studies in radiology. 3) Show when Receiver Operating Characteristic (ROC) analysis comes into the picture. 4) Delineate why vision models are important for image perception research.

ABSTRACT

Research in medical image perception began in radiology soon after World War II when investigators observed that there was more variation in interpretation than expected. Since then we have developed a wide variety of tools and techniques to improve our understanding of how images are perceived, abnormalities detected and diagnostic decisions made. This understanding is critical in order to improve our understanding of why errors are made, what we can do to reduce them, and how we can better train residents to become expert radiologists and improve patient care and outcomes.

Active Handout: Elizabeth Anne Krupinski

http://abstract.rsna.org/uploads/2016/16001180/ACTIVE_RC525B.pdf

Academic and Community Practice Integration: Challenges and Strategies for Success

Wednesday, Nov. 30 8:30AM - 10:00AM Room: S104A

HP

AMA PRA Category 1 Credits™: 1.50

ARRT Category A+ Credits: 1.50

ParticipantsJason N. Itri, MD, PhD, Charlottesville, VA (*Moderator*) Nothing to DiscloseJason N. Itri, MD, PhD, Charlottesville, VA (*Coordinator*) Nothing to DiscloseMichael N. Patlas, MD, FRCPC, Hamilton, ON, (patlas@hhsc.ca) (*Presenter*) Nothing to DiscloseLaura K. Findeiss, MD, Knoxville, TN, (lfindeiss@utmck.edu) (*Presenter*) Nothing to DiscloseHoward B. Fleishon, MD, Johns Creek, GA (*Presenter*) Nothing to Disclose**LEARNING OBJECTIVES**

1) Discuss the challenges of running successful hybrid academic-community practice. 2) Highlight the unique advantages of academic subspecialty radiology group in providing quality service for the community. 3) Propose solutions for the successful integration of a joint academic and community practice.

ABSTRACT

There is increasingly blurring distinction between academic and community radiology practices. However, the duality brings multiple challenges to the management of a hybrid practice. Academic subspecialty trained radiologists may require retraining to cover a wider spectrum of modalities expected from the community imager. Similarly, community-based generalists can struggle to find a proper niche in a tertiary center, in terms of teaching, clinical research, and serving and collaborating successfully with specialized clinicians. The presentation will reflect on authors' leadership experience in a large academic-community hybrid radiology practice.

RC529

MR Series: The Added Value of DWI in Clinical Practice

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

BQ **MR**

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

FDA Discussions may include off-label uses.

Participants

Caroline Reinhold, MD, MSc, Montreal, QC (*Moderator*) Consultant, GlaxoSmithKline plc
Alexander R. Guimaraes, MD, PhD, Portland, OR (*Moderator*) Speakers Bureau, Siemens AG;
Hersh Chandarana, MD, New York, NY (*Moderator*) Equipment support, Siemens AG; Software support, Siemens AG; Advisory Board, Siemens AG;

Sub-Events

RC529-01 Diffusion Weighted Imaging in the Evaluation of Inflammatory Bowel Disease

Wednesday, Nov. 30 8:30AM - 8:50AM Room: E350

Participants

Stuart A. Taylor, MBBS, London, United Kingdom, (stuart.taylor1@nhs.net) (*Presenter*) Research Consultant, Robarts Clinical Trials, Inc

LEARNING OBJECTIVES

1) Explain the histopathological changes in inflammatory bowel disease that underpin abnormalities in diffusion weighted imaging. 2) Describe the advantages and pitfalls of adding diffusion weighted imaging to standard MR enterography protocols. 3) Appraise the current role of diffusion weighted imaging in the diagnosis and staging of inflammatory bowel disease.

ABSTRACT

To be confirmed

RC529-02 Comparison of Different MRE Sequences Strategies for Detecting Activity and Severity in Crohn's Disease: A Practical Approach for Clinical Trials

Wednesday, Nov. 30 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
Sonia Rodriguez, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Ingrid Ordas, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Elena Ricart, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Julian Panes, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare different MR sequences strategies for grading activity in patients with Crohn's disease (CD).

METHOD AND MATERIALS

MR enterography (MRE) and ileocolonoscopies performed within 1 month in 43 patients with CD were reviewed. Intestinal segments involved by CD were assessed using, T2, DWI or a combination of both, classified as inactive, active mild-moderate or active severe and compared with findings using contrast enhanced gadolinium sequences. Bowel DWI intensity (b=800) was classified as inactive when no signal was detected or active (presence of bright signal intensity). Activity based on T2 sequences included the detection of at least wall thickness >3mm, high signal intensity, or detection of ulcers. Segments were classified as severely inflamed on T2 sequences if they displayed edema and/or ulcers, and based on the DWI sequence if they displayed bright signal similar to the spleen. T2 and T1 with gadolinium sequences were reviewed for calculating MaRIA score also for each individual segment. Sensitivities and specificities of each sequence(s) for correctly classifying each segment in the aforementioned categories were compared. Simplified Endoscopy Score for CD (SES-CD) was the gold standard.

RESULTS

224 segments were included in the analysis. Sensitivities and specificities of T2, DWI or combination of both for detecting activity was 0.81, 0.78, 0.80; and 0.97, 0.72, 0.96 respectively. Sensitivity for diagnosing severe disease was 0.93, 0.3, 0.93 and specificity 0.88, 0.93 and 0.85 respectively for T2, DWI or a combination. For detecting active inflammation, T2 sequence has similar ($p > 0.05$) sensitivity and specificity to combined T2 and DWI findings, but has higher specificity than DWI. T2 had higher sensitivity than DWI for identifying severe disease. When comparing MaRIA index with T2, MaRIA only had higher specificity for identifying severe inflammation.

CONCLUSION

Our results support the use of a T2 sequence as a first screening step, and proceed only with a full MRE examination (including gadolinium) only when abnormal findings are identified in the initial T2 sequence. The addition of DWI does not improve the accuracy of MRE.

CLINICAL RELEVANCE/APPLICATION

MR enterography (MRE) is an accurate technique for grading activity in Crohn's disease (CD). DWI sequence has been suggested as an alternative to gadolinium for assessing CD.

RC529-03 Quantified Terminal Ileal Motility during MR Enterography as a Biomarker of Crohn's Disease Activity: A Prospective Study

Wednesday, Nov. 30 9:00AM - 9:10AM Room: E350

Participants

Alex Menys, London, United Kingdom (*Presenter*) Director, Feedback plc; Director, Motilent Ltd; Shareholder, Motilent Ltd
Carl A. Puylaert, MSc, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Charlotte J. Tutein Nolthenius, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Andrew Plumb, MBCh, MRCP, Stockport, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Jesica Makanyanga, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Douglas A. Pendse, FRCR, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Gauraang Bhatnagar, FRCR, Plymouth, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Frans M. Vos, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jaap Stoker, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Research Consultant, Robarts Clinical Trials
Stuart A. Taylor, MBBS, London, United Kingdom (*Abstract Co-Author*) Research Consultant, Robarts Clinical Trials, Inc

PURPOSE

To prospectively evaluate the predictive accuracy of quantified MRI small bowel motility for Crohn's disease (CD) inflammatory activity against histopathological and endoscopic reference standards and to compare with conventional magnetic resonance index of severity (MaRIA) scoring.

METHOD AND MATERIALS

82 subjects with CD (42 male, median age 32.5 years, range 16 to 70 years) were recruited prospectively from two European centres as part of the VIGOR++ study, undergoing ileocolonoscopy & MR enterography separated by median 5 days (range 0 to 14). The CD Endoscopic Activity Index (CDEIS—endoscopic standard) was scored at the terminal ileum (TI), & a histopathological activity score (eAIS—histopathological standard) was derived from multiple biopsies from the distal terminal ileum. TI motility was quantified using a validated software algorithm based on image registration applied to a breath hold 2D "cine" acquisition (BTfE, slice thickness 1cm, temporal resolution 1.1 images/s). The TI MaRIA score was also calculated by two experienced readers blinded to the clinical & motility data. A motility cut-off score (0.30) was pre-selected from a prior, retrospective study & the sensitivity & specificity of Motility & MaRIA (≥ 11) for disease activity (defined as eAIS ≥ 1 or CDEIS ≥ 4) was calculated. Motility was correlated with reference standards using Spearman's rank & Receiver Operating Characteristic (ROC) area under the curves (AUC) were constructed. Diagnostic performance was compared using McNemar's test.

RESULTS

Results: Against eAIS, motility had sensitivity & specificity of 92.3% and 75.6% for activity. Sensitivity but not specificity was significantly higher than MaRIA (80.0% $P=0.03$ & 79.1% $P=1.0$, respectively). Against CDEIS, motility had sensitivity & specificity of 93.3% & 74.0%, significantly higher (sens) & lower (spec) respectively than MaRIA (82% $P=0.03$ & 83.7% $P=0.05$). Motility had moderate negative correlations with eAIS ($R=-0.61$, $p<0.001$) & CDEIS ($R=-0.59$, $p<0.001$) & demonstrated a ROC AUC of 0.87 (eAIS) & 0.86 (CDEIS), respectively.

CONCLUSION

In this dual site prospective study, quantified motility appears a valid biomarker for endoscopic and histopathological activity in Crohn's disease.

CLINICAL RELEVANCE/APPLICATION

Motility assessment is rapid (<60s per case) with previously demonstrated good inter-reader agreement. This prospective validation study suggests clinical utility over and above existing time consuming manual MRI activity scores.

RC529-04 Quantitative Assessment of Bowel Inflammatory Severity of Crohn Disease on MR Enterography Using MaRIA Score: Comparison between Enteric and Portal Phases

Wednesday, Nov. 30 9:10AM - 9:20AM Room: E350

Participants

Hye Young Jang, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jin Sil Kim, 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
Jong Seok Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Jin Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ah Young Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The Magnetic Resonance Index of Activity (MaRIA) is a score system to quantitatively assess bowel inflammatory severity of Crohn disease (CD) on MR enterography (MRE), arguably the most widely adopted in clinical trials among MRE indices. MaRIA was originally developed for portal-phase imaging, while enteric phase is currently the primary contrast-enhanced imaging for MRE. This study was to compare MaRIA scores between enteric and portal phases.

METHOD AND MATERIALS

42 CD patients (M:F, 33:9; 27 ± 6.2 years) prospectively underwent MRE and ileocolonoscopy within 1 week. MRE was performed after oral administration of 1500mL 2.5% sorbitol over 80 min to achieve good fluid distention of the small bowel as well as the right-sided colon. Endoscopy recorded inflammatory activity according to CD endoscopic index of severity (CDEIS). 79 segments (39 terminal ilea and 40 right-sided colons) were finally analyzed. Three independent readers assessed MaRIA score for each segment separately using enteric (MaRIAE) and portal (MaRIAP) phases. Spearman correlation of MaRIAE and MaRIAP with CDEIS was analyzed and the two correlation coefficients were compared. Agreement between MaRIAE and MaRIAP was assessed using

Bland-Altman analysis. Interobserver agreement was analyzed using repeatability coefficient and intraclass correlation coefficient (ICC).

RESULTS

Correlation coefficients between MaRIA and CDEIS were 0.714 (MaRIA_e) vs. 0.727 (MaRIA_p) for reader 1 ($p=0.309$), 0.816 vs. 0.817 for reader 2 ($p=0.919$), and 0.778 vs. 0.776 for reader 3 ($p=0.844$), consistently demonstrating no significant difference between the two phases. Bland-Altman mean difference between MaRIA_e and MaRIA_p and repeatability coefficient were -0.36 and 1.12 for reader 1, -0.3 and 1.4 for reader 2, -0.35 and 0.9 for reader 3, indicating consistent minute systematic underestimation on enteric phase compared with portal phase. Repeatability coefficients among the three readers were approximately 15 for both phases and ICCs were 0.74 for both phases.

CONCLUSION

MaRIA_e and MaRIA_p deemed practically equivalent, given their highly comparable results and the fact that systematic underestimation on enteric phase was miniscule, particularly when compared with the magnitude of interobserver variability.

CLINICAL RELEVANCE/APPLICATION

MaRIA scores can practically be assessed using both enteric and portal phases allowing for more flexible use although constant use of a single phase may be ideal.

RC529-05 Whole Body DWI for Tumor Detection and Assessment of Response

Wednesday, Nov. 30 9:20AM - 9:40AM Room: E350

Participants

Anwar R. Padhani, MD, FRCR, Northwood, United Kingdom, (anwar.padhani@stricklandscanner.org.uk) (*Presenter*) Advisory Board, Siemens AG; Speakers Bureau, Siemens AG; Researcher, Siemens AG; Speakers Bureau, Johnson & Johnson

LEARNING OBJECTIVES

To provide a rationale for the use of whole body MRI when evaluating malignant disease extent and for therapy response assessment To show how measurements are acquired distinguishing between tumour detection (core) and response assessment (comprehensive) protocols that are MET-RADS compliant To provide interpretation guidelines including how to recognise false positive and negative cases in disease detection. To highlight and review the MET-RADS response assessment guidelines To provide the scientific evidence and illustrate by case reviews the efficacy of WB-MRI comparing with PET/CT, bone and CT scans including areas of potential synergy To highlight specific clinical indications for WB-MRI use and highlight patient and clinical pathway altering benefits and limitations

LEARNING OBJECTIVES

1) To provide a rationale for the use of whole body MRI when evaluating malignant disease extent and for therapy response assessment. 2) To show how measurements are acquired in the body and to distinguish between tumour detection and response assessment protocols. 3) To provide interpretation guidelines including how to recognise false positive and negative cases in disease detection and response assessment settings. 4) To provide the scientific evidence and illustrate by case reviews the efficacy of WB-MRI comparing with PET/CT, bone and CT scans including areas of potential synergy. 5) To highlight specific clinical indications for WB-MRI use and highlight patient and clinical pathway altering benefits and limitations.

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/>

Anwar R. Padhani, MD, FRCR - 2012 Honored Educator

RC529-06 Diagnostic Accuracy of Whole-body MR Imaging including Diffusion Weighted Imaging (DWI) for the Detection of Malignant Tumor Recurrence: Comparison with Whole-body PET/MRI

Wednesday, Nov. 30 9:40AM - 9:50AM Room: E350

Participants

Su Joa Ahn, 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
Seung Joon Choi, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Rihyeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Seok Bae, 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 compare whole-body (WB) PET/MRI with dedicated WB-MRI including DWI (WB-DW-MRI) for the detection of local recurrence or distant metastasis in patients with various primary malignant tumors.

METHOD AND MATERIALS

Whole-body PET/MRI with [18F]-fluoro-2-deoxy-glucose including dedicated WB-DW-MRI was performed in 181 consecutive patients for the detection of the tumor recurrence of various primary malignant tumors (colorectum=108, HCC=30, stomach=17, breast=7, others=19). Two radiologists reviewed the dedicated WB-DW-MRI and WB-PET/MR images with Dixon and T2WI for the

presence of malignancy in separate sessions. Presence of local recurrence, lymph node (LN) metastases and distant metastases were confirmed using histopathology or radiological/clinical follow-up within at least 6 months as the reference standard.

RESULTS

Tumor recurrence was found in 126 of 181 patients with 229 malignant foci: local recurrence (n=7) and metastases in the liver (n=147), LNs (n=33), lung (n=22), peritoneum (n=11), bone (n=4), and others (n=5). Overall diagnostic accuracy for WB-DW-MRI and PET/MRI were comparable: 98.3% (sensitivity 86.5%, specificity 99%) for WB-DW-MRI and 97.7% for (sensitivity 84.1%, specificity 98.5%) for PET/MR. Both modalities detected all seven local recurrences. PET/MRI detected significantly more LN metastases (sensitivity 97%, n=32/33) than WB-DW-MRI (sensitivity 72.7%, n=24/33, p=.03). For liver metastasis, WB-DW-MRI detected more liver metastases than PET/MRI (p=.01): sensitivities of 93.8% vs. 84.83%, and specificities of 94.7% vs. 98.7%, respectively. For pulmonary metastases, both WB-DWI-MRI and PET/MRI showed relatively low sensitivity (77%,64%) with comparable high specificity (98%, 98%), and accuracy (98%, 97%). Respective values for the detection of peritoneal seeding were 58%, 99%, and 98% for WB-DW-MRI, and 58%, 98%, and 97% for PET/MRI. Kappa values for whole-body MRI and PET/MRI interpretations were moderate to good.

CONCLUSION

WB-DW-MRI and PET/MRI provided comparable overall diagnostic accuracy for the detection of not only local recurrence but also distant metastasis in underlying malignant tumor patients.

CLINICAL RELEVANCE/APPLICATION

As WB-DW-MRI appears to provide a comparable diagnostic performance to FDG PET/MR, it can be a good alternative examination for evaluation of patients with abdominal malignancies.

RC529-07 FDG PET/MRI Quantitative Discrimination between Normal and Metastatic Liver Tissue using DTI Indices and SUV

Wednesday, Nov. 30 9:50AM - 10:00AM Room: E350

Participants

Dan Stein, Tel Aviv, Israel (*Presenter*) Nothing to Disclose
David Groshar, MD, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Hanna Bernstine, MD, Petah Tikva, Israel (*Abstract Co-Author*) Nothing to Disclose
Meital Nidam, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Liran Domachevsky, MD, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Ifat Abadi-Korek, PhD, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Dorit Stern, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Natalia Goldberg, MD, Petah Tiqwa, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To discriminate by quantitative PET/MRI metastatic liver tissue from normal liver tissue using diffusion tensor imaging (DTI) indices (FA and ADC) and fluorine 18 fluorodeoxyglucose (FDG) standardized uptake value (SUV).

METHOD AND MATERIALS

32 patients with known malignancy were enrolled in this IRB approved study after written informed consent. Data from 11 patients (6 women, 5 men, mean age 59±12) with visible liver metastases (VLM) were evaluated. All patients were injected with FDG and Gadolinium based contrast intravenously and underwent an abdominal examination on 3.0 T PET-MRI scanner, including Dixon and DTI protocols with simultaneous PET acquisition. Two independent radiologists and nuclear medicine specialists evaluated the images. Fractional anisotropy (FA), apparent diffusion coefficient (ADC) values as well as body weight peak SUV (pSUV) in metastatic lesions and in normal liver tissue (NL) were obtained by copying the volume of interest (VOI) between the registered scans. Tissue heterogeneity was calculated via the coefficient of variance (cv) $cv=sd\backslash\text{mean}$.

RESULTS

VLM\NL groups were respectively $SUVp=2.18\pm0.49\backslash 8.31\pm2.79$, $FA= 0.42\pm0.17\backslash0.35\pm0.13$, $ADC =1.16\pm0.1\backslash1.18\pm0.26$ and $cv(ADC)=0.28\pm0.08\backslash0.18\pm0.04$; only SUVp and cv(ADC) have shown significant differentiation between metastatic and normal liver tissue (p<0.001).

CONCLUSION

As far as we know this is the first quantitative comparison of FDG uptake values and DTI indices in the liver. This study has effectively demonstrated the feasibility of quantitative assessment of liver tissue using PET and MRI indices to differentiate metastatic disease from normal liver tissue. Furthermore, it introduces tissue heterogeneity as an important assessment tool.

CLINICAL RELEVANCE/APPLICATION

Using PET-MR, this study has demonstrated the high correlation between quantitative data extracted via each modality and demonstrated that tissue heterogeneity calculated via DTI may be applied as a strong diagnostic tool to discriminate metastases from normal liver tissue.

RC529-08 Prediction of Therapeutic Response to Sorafenib in Patients with Advanced Stage HCC using Diffusion Weighted Imaging with Intravoxel-Incoherent Motion

Wednesday, Nov. 30 10:00AM - 10:10AM Room: E350

Participants

Jeong Hee Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Grant, Bayer AG; Speaker, General Electric Company; Speaker, Koninklijke Philips NV; Speaker, Bayer AG
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
In Chan Song, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Mi Hye Yu, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate diffusion weighted imaging (DWI) in prediction of response of patients with hepatocellular carcinomas (HCCs) to treatment with Sorafenib assessed by mRECIST.

METHOD AND MATERIALS

In this IRB-approved prospective study, 15 patients (M: F= 11:4) with advanced HCC were enrolled and informed consent was obtained from all patients. Patients underwent DWI using nine b-values (0-800sec/mm²) at 3T before starting Sorafenib treatment. Intrahepatic target lesion (6.3±4.9cm, range 1.5-15cm) was determined on baseline computed tomography (CT) and progression of the disease was determined on 3 months follow-up CT scan by a radiologist who was blind to DWI results. DWI was analyzed using intravoxel incoherent motion (IVIM) model and parameters (apparent diffusion coefficient (ADC), pure diffusion (D), pseudodiffusion (D*) and perfusion fraction (f)) were compared between responders (complete response, partial response) and non-responders (stable disease, progressive disease) according to mRECIST criteria on 3 months follow-up CT scan.

RESULTS

After excluding three patients who withdrew informed consent, parameters of DWI were compared between responders (n=5) and non-responders (n=7). Initial tumor size was not significantly different between two groups (5.6±4.9cm vs. 6.9±5.2cm, P=0.67, respectively). Baseline ADC was significantly higher in responders than non-responders (1.42±0.3 mm²/sec vs. 1.09±0.08 mm²/sec, P=0.025) and D was significantly higher in responders (1.30±0.27 mm²/sec vs. 1.02±0.06 mm²/sec, P=0.024). In addition, baseline f was significantly higher in responders than non-responders (21.2±7.0% vs. 13.8±2.5%, P=0.025). However, D* showed significant overlap between two groups (37.5±11.6 mm²/sec vs. 44.3±13.6 mm²/sec, P=0.39).

CONCLUSION

Baseline DWI using IVIM may be able to characterize HCCs would be responsible for Sorafenib treatment in patients with advanced HCCs.

CLINICAL RELEVANCE/APPLICATION

Prediction of Sorafenib response on non-invasive imaging would be beneficial to avoid expensive, non-necessary treatment in advanced HCCs.

RC529-09 Can Simple DWI Signal Observation Determine Complete Response for Locally Advanced Rectal Cancer after Neoadjuvant Chemoradiotherapy?

Wednesday, Nov. 30 10:10AM - 10:20AM Room: E350

Participants

Xiao-Yan Zhang, Beijing, China (*Presenter*) Nothing to Disclose

Ying-Shi Sun, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We aimed to determine if high-signal observed on DWI after neoadjuvant chemoradiotherapy (CRT) in the tumor bed can accurately predict residual tumor for locally advanced rectal cancer, and if low- or iso- signal observed on DWI after neoadjuvant CRT can accurately predict pathological complete response (PCR) for locally advanced rectal cancer.

METHOD AND MATERIALS

One hundred and ninety five patients with locally advanced rectal cancer who underwent neoadjuvant CRT and subsequent surgery were included in this study. All patients were evaluated pre- and post-CRT by standardized turbo spin echo and DW-MRI. Pre- and post-CRT tumor and normal rectal wall signal intensity (SI) (which were simply scored as high-, iso-, and low-signal) were recorded and evaluated by one radiologist who was blinded with the pathological results. Complete response patients were determined combining T2WI and DWI signal from baseline and preoperative MRI, and then compared with the pathological results.

RESULTS

There are thirty three patients with pathological complete response in totally 195 rectal cancer patients (16.9%), 162 patients with residual tumor. In PCR group, 11 patients (33.3%) with complete tumor SI loss (low- or iso- signal) on DWI and T2WI were determined with complete response accurately. Other 22 patients were misdiagnosed with residual tumor because of high- or iso-signal on DWI and T2WI. In non-PCR group, 148 patients were determined with residual tumor accurately because of high- or iso-signal on DWI and T2WI. 14 patients were misdiagnosed as complete response because of complete tumor SI loss (low- or iso-signal) on DWI and T2WI. By the simple signal observation, the sensitivity, specificity, and accuracy for PCR is 33.3%, 91.4%, and 81.5%, respectively.

CONCLUSION

Only a few of PCR showed complete tumor SI loss on DWI, most PCR showed high SI on DWI because of edema, congestion, immature fibrosis, or other reasons. We cannot unequivocally determine a complete response by using simple signal observation.

CLINICAL RELEVANCE/APPLICATION

We cannot unequivocally determine a complete response by using simple signal observation on DWI.

RC529-10 Histogram Analysis of Diffusion-Weighted MR Imaging as a Biomarker for Colorectal Cancer

Wednesday, Nov. 30 10:20AM - 10:30AM Room: E350

Participants

Koichi Hayano, MD, Chiba, Japan (*Presenter*) Nothing to Disclose

Yumiko Takahashi, MD, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose

Gaku Ohira, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose

Hisahiro Matsubara, MD, PhD, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Abnormality in the tumor structure or vasculature is a well-recognized feature of malignancy. On the other hand, diffusion-weighted MR imaging (DWI) has been reported as a tool that can reflect tumor structures such as fibrosis, cellularity, and angiogenesis. The purpose of this study is to apply histogram analysis to DWI to quantify structural abnormality of colorectal cancer, and compare the histogram parameters with survival in colorectal cancer.

METHOD AND MATERIALS

43 patients (30 M / 13 W; median age: 66.0 years) with colorectal cancers were retrospectively evaluated. Median follow-up time was 65.7 months. DWI was performed before the therapy. Histogram parameters including kurtosis and skewness of the tumor were measured on DWI at $b=1000$, and apparent diffusion coefficient (ADC) of the tumor was also measured on ADC map generated by DWIs at $b=0$ and 1000 . Associations of tumor parameters (kurtosis, skewness, and ADC) with pathological features were analyzed, and these parameters were also compared with recurrence free survival (RFS), and overall survival (OS) using Cox regression and Kaplan-Meier analysis.

RESULTS

Low ADC value of tumor significantly associated with lymph node metastasis and synchronous distant metastasis (both $P=0.04$), while low kurtosis of tumor significantly associated with lymphnode metastasis ($P=0.0003$). In Cox regression analysis, no parameters showed significant correlations with OS, while only kurtosis showed a significant correlation with RFS ($P=0.04$). In Kaplan-Meier analysis, patients with higher kurtosis tumors (kurtosis > 2.23) showed a significantly better RFS ($P=0.03$, Wilcoxon test).

CONCLUSION

Pre-therapeutic tumor histogram parameter measured on DWI can be a useful imaging biomarker reflecting RFS in colorectal cancer patients.

CLINICAL RELEVANCE/APPLICATION

Histogram analysis of DWI can be a widely applicable imaging biomarker for colorectal cancer reflecting survival, and it would enable personalized therapy for colorectal cancer patients.

RC529-11 DWI Beyond ADC

Wednesday, Nov. 30 10:50AM - 11:10AM Room: E350

Participants

Bachir Taouli, MD, New York, NY, (bachir.taouli@mountsinai.org) (*Presenter*) Consultant, MEDIAN Technologies ; Grant, Guerbet SA

LEARNING OBJECTIVES

1) Review the current evidence on the use of quantitative ADC outside the brain. 2) Review limitations of ADC quantification. 3) Review the potential added value of non-mono exponential processing methods, including IVIM, stretched exponential and kurtosis for diffusion quantification.

ABSTRACT

LEARNING OBJECTIVES

1) Review current methods for obtaining ADC calculation. 2) Review clinical applications of ADC quantification in the Body. 3) Review advanced diffusion quantification methods beyond ADC, including bi-exponential and diffusion kurtosis, potential clinical applications, and limitations.

ABSTRACT

RC529-12 Comparison of Mono- and Bi-exponential Model of Diffusion-Weighted Imaging in Evaluation of Histological Differentiation of Hepatocellular Carcinoma (HCC) in Patients with Hepatitis B Virus Infection

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E350

Participants

Qungang Shan, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Tianhui Zhang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jin Wang, MD, Guangzhou, China (*Presenter*) Nothing to Disclose
Zhong-Ping Zhang, MMedSc, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yunhong Shu, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Bingjun He, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhuang Kang, Guang Zhou, China (*Abstract Co-Author*) Nothing to Disclose
Bing Wu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhenyu Zhou, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jingbiao Chen, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare diagnostic value of apparent diffusion coefficient (ADC) and intravoxel incoherent motion (IVIM) derived metrics in the evaluation of histological differentiation of hepatocellular carcinoma (HCC) in patients with hepatitis B virus (HBV) infection.

METHOD AND MATERIALS

Institutional approval and consent form were obtained for this study. 79 chronic HBV patients with 82 pathologically confirmed HCCs were enrolled in our study. The lesions were classified into three groups according to pathological results as following: well-differentiated ($n=24$), moderately-differentiated ($n=47$) and poorly-differentiated ($n=11$). All subjects underwent conventional MRI and DWI scans using a 3.0T MR system. Respiratory-triggered diffusion-weighted imaging (DWI) were performed using eleven b values ($b=0, 30, 50, 100, 150, 200, 300, 500, 800, 1000, 1500$ sec/ mm^2) and two b values ($b=0, 800$ sec/ mm^2) successively. D

(diffusion coefficient), D^* (pseudo-diffusion coefficient) and f (perfusion fraction) were calculated using bi-exponential model. $ADC_{0,800}$ and ADC_{total} were calculated by fitting $b=0$, 800 sec/mm² and all b values into mono-exponential model, respectively. All metrics were compared among HCCs with the three histological differentiation subtypes using Kruskal-Wallis test, Spearman rank correlation and receiver operating characteristic (ROC) analysis.

RESULTS

ADC_{total} , $ADC_{0,800}$, D and f values were significantly correlated with histological grades: $r = -0.686$ ($P < .001$), $r = -0.423$ ($P < .001$), $r = -0.497$ ($P < .001$) and $r = -0.323$ ($P = .004$), respectively. D^* did not differ among three groups. The area under the ROC curve (AUC-ROC) of ADC_{total} , $ADC_{0,800}$, D , and f for diagnosing well-differentiated HCCs was 0.937, 0.794, 0.863 and 0.790, respectively, and the AUC-ROC of the above metrics for diagnosing poorly-differentiated HCCs was 0.867, 0.709, 0.734 and 0.616, respectively.

CONCLUSION

ADC_{total} derived by mono-exponential model using multiple b -value DWI showed relatively higher diagnostic accuracy as compared with other metrics in evaluating histological differentiation of HBV-related HCCs.

CLINICAL RELEVANCE/APPLICATION

This study demonstrated that ADC_{total} , $ADC_{0,800}$, D and f were useful metrics in evaluating histological differentiation of HBV-related HCCs and they could be valuable in selecting the treatment strategy.

RC529-13 Intravoxel Incoherent Motion Diffusion-Weighted Magnetic Resonance Imaging Predicts Bevacizumab-Induced Transient Remodeling of the Vasculature in Colorectal Carcinoma Xenografts Model

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E350

Participants

Huanhuan Liu, Shanghai, China (*Presenter*) Nothing to Disclose
Yanfen Cui, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Caiyuan Zhang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Dengbin Wang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Increasing evidence suggests that vascular endothelial growth factor (VEGF) inhibition could boost transient "normalization" of tumor vasculature, thus improving tumor perfusion and therapeutic effect of chemotherapy. Our study was to investigate the value of intravoxel incoherent motion diffusion-weighted imaging (IVIM DWI) in predicting bevacizumab-induced transient remodeling of the vasculature in colorectal carcinoma (CRC) xenograft.

METHOD AND MATERIALS

Forty mice bearing HCT-116 CRC xenograft underwent IVIM DWI at baseline and 1, 3 and 7 days after administration of bevacizumab ($n=20$) or 0.9% NaCl solution intraperitoneally ($n=20$). Parameters of apparent diffusion coefficient (ADC), true diffusion coefficient (D), perfusion fraction (f), and blood pseudodiffusion coefficient (D^*) were compared between the two groups and within groups after treatment. Histopathological results were used as the standard reference.

RESULTS

After a single bevacizumab dose of 200 ug, the tumor microvessel density decreased to <35% of control within 7 days. Compared with the control group, the perfusion-related parameter D^* value increased on day 3 ($P=0.018$) and then decreased on day 7 significantly ($P=0.036$). The ADC and D values increased significantly on day 3 ($P=0.002$, $P=0.010$, respectively) and day 7 ($P=0.002$, $P=0.001$, respectively). A sustained decrease of the f value was observed within 7 days after bevacizumab-treatment, which showed a significant difference on day 3 ($P=0.044$) and day 7 ($P=0.012$). The ADC, D , D^* , and f values were constant within the control group. Endothelial cell density decreased and vessel maturity index (ratio of α -smooth muscle actin to CD31 pixels per tumor section) increased significantly on day 3 ($P=0.001$, $P=0.003$, respectively) and day 7 ($P<0.001$, $P<0.001$, respectively) in the treated group, indicating the "normalization" of the tumor vasculature.

CONCLUSION

IVIM DWI could be helpful for early prediction of the transient remodeling of vasculature in CRC non-invasively. The chemotherapy during the transient "normalization" window of tumor vasculature could increase the delivery of chemotherapeutic drugs and improve the therapeutic efficacy.

CLINICAL RELEVANCE/APPLICATION

IVIM DWI could predict the transient remodeling of vasculature in CRC non-invasively, thus to guide application time of chemotherapeutic drugs and improve the therapeutic efficacy.

RC529-14 Two-Dimensional US Elastography for Focal Lesions in Liver Phantoms: Influencing Factors for Stiffness Measurement of Small Lesions

Wednesday, Nov. 30 11:30AM - 11:40AM Room: E350

Participants

Jeong Ah Hwang, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Woo Kyoung Jeong, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyoung Doo Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Tae Wook Kang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyo Keun Lim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Eun Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

US elastography (USE) has been investigated for the purpose of estimating liver fibrosis, but 2-dimensional (2-D) USE can depict a

USE) has been investigated for the purpose of estimating liver fibrosis, but 2-dimensional (2-D) USE can depict a focal lesion with different elasticity with a color map. The purpose of this study is to determine accuracy and influencing factors of stiffness value of focal lesions in the phantoms using 2-D USE.

METHOD AND MATERIALS

Using two customized phantoms with different elasticity (4 ± 1 kilopascal [kPa], mimicking normal liver; 15 ± 2 kPa, mimicking liver cirrhosis [LC]) which have 9 spherical hypoechoic inclusions with same elasticity (23 ± 3 kPa), different size (20mm, 15mm and 10mm in a row) and different depth (3cm, 5cm and 7cm). Two radiologist investigated stiffness of inclusion bodies and background for each inclusions using in the region of interest (ROI). Mean stiffness and standard deviation (SD) in ROI were acquired, and the shape of inclusion was also assessed with a qualitative 5-graded scoring system about target visualization on color map. As possible influencing factors, the type of background phantom, depth of inclusions, size of inclusions, and observers were considered. We compared by Kruskal-Wallis test, and performed multiple regression tests to detect significant influencing factors about 2-D USE.

RESULTS

Measured mean stiffness value was significantly higher in LC phantom (10.50 kPa in normal, 13.81 kPa in LC; $p=0.013$), inclusions in 7cm of depth (10.94 kPa in 3cm, 11.20 kPa in 5cm and 15.59 kPa in 7cm; $p=0.001$). In multiple regression analysis in mean stiffness, there was significant difference of mean stiffness in type of phantom, depth and size of inclusions. Mean SD in ROI was also significantly larger in 7cm of depth (0.86 kPa in 3cm, 1.23 kPa in 5cm and 3.94 kPa in 7cm; $p=0.001$). In multiple regression analysis for SD in ROI, there were significant differences in type of phantom and depth of inclusions. Morphologic score was significantly different only in aspect of the size of inclusion bodies ($p<0.001$). Background stiffness was not different according to depth or observers ($p=0.491$ and 0.522 , respectively).

CONCLUSION

2-D USE for focal lesion evaluation could be influenced by different background stiffness, deep position of the lesion, and small size of lesion.

CLINICAL RELEVANCE/APPLICATION

Background liver stiffness, depth and size of the target lesion should be considered for focal hepatic lesion evaluation using 2-D USE.

RC529-15 Unresectable Hepatic and Pulmonary Tumors Show Different Responses to Oxygen Challenge in Blood Oxygen Level Dependent (BOLD) MRI

Wednesday, Nov. 30 11:40AM - 11:50AM Room: E350

Participants

Xiangyu Yang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Eric D. Miller, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Preethi Subramanian, MS, BEng, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Terence M. Williams, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Presenter*) Nothing to Disclose

PURPOSE

To investigate whether oxygen challenge triggers similar Blood Oxygen Level Dependent (BOLD) responses in MRI in different types of tumors.

METHOD AND MATERIALS

Ten patients (6 male/4 female, 69 ± 10 y.o.) with unresectable hepatic ($n=6$) or pulmonary ($n=4$) lesions were imaged with the BOLD MRI technique prior to stereotactic body radiation therapy (SBRT). The MRI was performed on an Ingenia CX 3T scanner using a dStream WholeBody coil. The BOLD MRI sequence is a dynamic multi-echo turbo field echo (TFE) fast T2* mapping sequence with the following sequence parameters: 350 mm FOV, 176×174 matrix, 10 slices with 5 mm thickness, TR 34.8 ms, 16 TEs ranging from 1.38 to 17.17 ms, 25° flip angle, 20 dynamics, scan time 10'32". Oxygen challenge started at the 11th dynamic scan, delivered through a high flow nasal cannula at a flow rate of 15 L/min. Patients were instructed to keep a smooth, shallow breathing pattern during the scan. Regions of interest (ROIs) were defined by a radiation oncologist on target lesions. BOLD response was quantified as the percent change in R2* relaxation rate, and statistical significance was determined with the Student's t-test. The influence of fat-water phase interference in liver was corrected for by including three fat peaks at 3.8, 3.4, and 2.6 ppm in R2* fitting.

RESULTS

Ten hepatic lesion (fat content 5-29%) and four pulmonary lesion ROIs (fat content 2-3%) were defined. During the oxygen challenge, tumor R2* decreased by -3-15% (median 7%) in hepatic lesions, and increased by -3-11% (median 2%) in pulmonary lesions. The BOLD response is statistically significant ($p<0.05$) in 6 of the 10 hepatic lesions but none of the 4 pulmonary lesions.

CONCLUSION

In MRI, pulmonary lesions have substantially weaker BOLD response to oxygen challenge than hepatic lesions, likely due to a more deoxygenated blood supply.

CLINICAL RELEVANCE/APPLICATION

BOLD MRI contrast appears to be tumor type dependent and such difference needs to be considered when assessing tumor perfusion and/or hypoxia.

RC529-16 Feasibility of Multi-parametric Quantitative MR Imaging for the Characterization of HCC

Wednesday, Nov. 30 11:50AM - 12:00PM Room: E350

Participants

Yong Eun Chung, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Joonseok Lim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Chansik An, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Mi-Suk Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin-Young Choi, 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 investigate the feasibility of quantitative MR imaging for the characterization of HCC

METHOD AND MATERIALS

This prospective study enrolled 56 patients (56.7 ± 8.7 years old, M:F = 51:5) who were planned for surgery due to suspected HCC in the liver. Multi-parametric quantitative MR including T1, T2 and T2* relaxometry and multi-frequency (transducer frequency: 28Hz, 56Hz, 84Hz) MR elastography (MRE) were obtained before surgery. Quantitative parameters were measured both in the liver and within the tumor in possible all slices and the average value was calculated. Pathologic characteristics of HCC including intra-tumoral necrosis, hemorrhage, fatty change, Edmondson-Steiner grade were acquired after surgery. Paired t test was used for comparing MR parameters between adjacent liver and focal liver lesion. Correlation between MR parameters and pathologic characteristics were evaluated with Pearson correlation coefficient. A P value less than 0.05 was considered as statistically significant.

RESULTS

Among 56 patients, 40 patients were finally diagnosed as HCC (43.2 ± 21.0 cm) after surgery. Other 6 patients were confirmed as cholangiocarcinoma (n=4), hepatic adenoma (n=1) and dysplastic nodule (n=1). All relaxation time was significantly longer in HCC (T1, 1172.2 ms; T2, 84.9 ms; T2*, 26.1 ms) compared to that of adjacent liver (T1, 786.6 ms; T2, 49.7 ms; T2*, 13.9 ms, $P < 0.001$). Storage modulus, loss modulus and shear modulus in all transducer frequencies were significantly higher in HCC than that of adjacent liver ($P < 0.05$), except loss ($P = 0.847$) and shear modulus ($P = 0.133$) in 28Hz. There was a significant negative correlation between T2* relaxation time of HCC and proportion of intra-tumoral hemorrhage ($r = -.335$, $P = 0.020$). There was no significant correlation between other relaxation times or MRE parameters and pathologic characteristics of HCC ($P > 0.05$).

CONCLUSION

Although there was a significant difference of quantitative MR parameters between adjacent liver parenchyma and HCC, they did not provide additional information for the pathologic characteristics of HCC, except T2* relaxation time which represent intra-tumoral hemorrhage.

CLINICAL RELEVANCE/APPLICATION

Quantitative MR parameters may not represent pathologic characteristics of HCC, except short T2* relaxation time which suggest intra-tumoral hemorrhage.

RC531

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

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



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

Participants

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

LEARNING OBJECTIVES

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

ABSTRACT

Sub-Events

RC531A Pre- and Post Biopsy Assessment

Participants

Richard Silbergleit, MD, Royal Oak, MI (*Presenter*) Consultant, Relieva Medsystems, Inc

LEARNING OBJECTIVES

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

RC531B Equipment Used for Image-guided Biopsies of the Spine

Participants

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

LEARNING OBJECTIVES

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

RC531C Thoracic and Lumbar Biopsies

Participants

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

LEARNING OBJECTIVES

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

ABSTRACT

RC531D Cervical Spine Biopsies

Participants

A. Orlando Ortiz, MD, MBA, Mineola, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

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

ABSTRACT

Cervical spine biopsies can be challenging procedures to perform, hence they tend to be performed by a limited number of proceduralists. C-spine biopsy is often performed to evaluate potential neoplastic or infectious processes of the cervical spine. The key to performing these procedures effectively and safely is in appropriate patient selection, careful image analysis in order to properly position the patient and choose an approach, identification of critical structures (such as the carotid artery) and neck

spaces that should be avoided, and use of coaxial biopsy techniques. The procedure can be safely performed with CT and/or CT fluoroscopy. Specimen sampling principles and specimen handling are also discussed they can help to optimize this procedure.

RC531E Disc Biopsy and Aspiration

Participants

Amish H. Doshi, MD, New York, NY, (amish.doshi@mountsinai.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the indications for spinal biopsies in the setting of discitis and osteomyelitis of the spine. 2) The various techniques and imaging modalities for these biopsies will be reviewed. 3) Sample collection and analysis as well as typical diagnostic yield will also be reviewed.

ABSTRACT

RC532

Hospital Contracting: The Radiologist's and The Attorney's Perspectives

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

LM

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

Participants

LEARNING OBJECTIVES

1) Identify the important elements of a hospital professional services agreement (radiology contract). 2) Describe the principles of negotiations that will benefit radiologists in their interactions with hospital administrators. 3) Discuss the roles of the radiologist and the attorney in hospital contract negotiations.

Sub-Events

RC532A The Attorney's Perspective

Participants

William K. Davis Jr, JD, Chicago, IL, (ken.davis@kattenlaw.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the important elements of a hospital professional services agreement (radiology contract). 2) Describe the principles of negotiations that will benefit radiologists in their interactions with hospital administrators. 3) Outline a process for hospital contract negotiations.

ABSTRACT

Negotiating a Difficult Hospital Contract: The Attorney's Perspective

W. Kenneth Davis, Jr, Chicago, IL

ABSTRACT

This course is structured to explore the issues and opportunities involved in the process of negotiating a hospital radiology professional services agreement (hospital radiology contract). The principles of contract negotiations will be discussed. Potentially problematic clauses will be presented, and suggestions will be made to modify or eliminate these clauses. The importance of having the practice integrated into the medical, social, and political fabrics of the hospital and the community will be stressed. The faculty will introduce the concept of power in a negotiation, and they will define common negotiation terms. Issues of radiology group communication and unity during the process will be discussed. There will be sufficient time for questions from the attendees.

Active Handout: William Kenneth Davis

http://abstract.rsna.org/uploads/2016/15002297/ACTIVE_RC532A.pdf

RC532B Hospital Contracting: The Radiologist's Perspective

Participants

Lawrence R. Muroff, MD, Tampa, FL, (LRMuroff@hotmail.com) (*Presenter*) CEO, Imaging Consultants, Inc; President, Imaging Consultants, Inc;

LEARNING OBJECTIVES

View learning objectives under main course title. Attendees at this lecture, at its conclusion, should be able to: 1) Identify potentially problematic hospital contract clauses that could negatively impact your practice 2) Discuss alternative contract clauses that will satisfy both the hospital and the radiology group 3) Describe ways to align the interests of the hospital with those of the practice

ABSTRACT

This course is structured to explore the issues and opportunities involved in the process of negotiating a hospital radiology professional services agreement (hospital radiology contract). The principles of contract negotiations will be discussed, and the role of both the radiologist and the radiology-knowledgeable attorney will be covered. How the radiology leadership and the practice attorney interact will be explored. Potentially problematic clauses will be presented, and suggestions will be made to modify or eliminate these clauses. The importance of having the practice integrated into the medical, social, and political fabrics of the hospital and the community will be stressed. The faculty will introduce the concept of power in a negotiation, and they will define common negotiation terms. Issues of radiology group communication and unity during the process will be discussed. There will be sufficient time for questions from the attendees.

Techniques of Musculoskeletal Interventional Ultrasound (Hands-on)

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



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

Participants

Veronica J. Rooks, MD, Honolulu, HI (*Presenter*) Nothing to Disclose
 Stephen C. O'Connor, MD, Boston, MA (*Presenter*) Nothing to Disclose
 Mabel Garcia-Hidalgo Alonso, MD, Majadahonda, Spain (*Presenter*) Nothing to Disclose
 Patrick Warren, MD, Columbus, OH (*Presenter*) Nothing to Disclose
 Carmen Gallego, MD, Madrid, Spain, (cgallego@salud.madrid.org) (*Presenter*) Nothing to Disclose
 James W. Murakami, MD, Columbus, OH (*Presenter*) Nothing to Disclose
 Michael A. Mahlon, DO, Tacoma, WA (*Presenter*) Nothing to Disclose
 Paolo Minafra, MD, Pavia, Italy (*Presenter*) Nothing to Disclose
 Nathalie J. Bureau, MD, MSc, Montreal, QC, (Nathalie.bureau@umontreal.ca) (*Presenter*) Equipment support, Siemens AG
 Michael A. Dipietro, MD, Ann Arbor, MI (*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
 Horacio M. Padua JR, MD, Boston, MA (*Presenter*) Nothing to Disclose
 Peter L. Cooperberg, MD, Vancouver, BC (*Presenter*) Nothing to Disclose
 Ebonee Carter, MD, Honolulu, HI (*Presenter*) Nothing to Disclose
 Ulises Barajas, MD, Juarez, Mexico (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography. 2) Define and discuss technical aspects, rationale, and pitfalls involved in musculoskeletal interventional sonographic care procedures. 3) Successfully perform basic portions of hands-on US-guided MSK procedures in a tissue simulation learning module, including core biopsy, small abscess drainage, cyst aspiration, soft tissue foreign body removal, and intraarticular steroid injection. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning opportunities.

ABSTRACT

Ultrasound Guided Foreign Body Removal: Simulation Training and Clinical implementation Outcomes Purpose: USFBR can be taught to radiologists to generate competency. Radiologists can apply the technique in the patient setting to remove foreign bodies. Materials and Methods: Proof of concept was performed by a radiologist and surgeon removing nine 1-cm foreign bodies using the USFBR method (P) and traditional surgery (S) with and without wire guidance (W) on the cadaver model. Next, USFBR was taught to 48 radiologists at 4 hospitals. Training included didactic and hands-on instruction covering 7 components: instrument alignment, hand/transducer position, forceps use, foreign body definition, forceps grasp, recognition of volume averaging, and oblique cross cut artifact. Pre-training testing assessed single toothpick removal from turkey breast in 15 minutes. Post-training evaluation consisted of 5 toothpick removals. Ongoing clinical implementation data of USFBR by trained radiologists are being collected. Parameters including age of patient, which radiologist, removal success, type and size of foreign body, incision size, foreign body retention time, reason for removal, symptoms, modalities used in detection, wound closure, and sedation are recorded. Data analyzed using chi-squared and Fisher's exact tests for categorical outcomes and analysis of variance for continuous outcomes. Results: USFBR technique shows a higher success rate and smaller incision size in comparison to surgical technique alone in the cadaver. Removal success: P 100%, S 78%, and W 89%. Radiologists' scores improved from 21-52% pre-training to 90-100% post-training ($p < 0.001$ for each component). In the clinical setting to date, USFBR has been 100% successful, ages 9-73 years, by four radiologists. Parameters included; length 4 to 30 mm, retention 2 to 864 days, incision, 2 to 8 mm. Conclusion: USFBR is superior to non-guided surgical technique. The approach taught in simulation improves radiologist technique and outcomes.

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

Dynamic Musculoskeletal US: Clicks and Clunks of the Upper Extremity (Hands-on)

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



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

Participants

Viviane Khoury, MD, Philadelphia, PA, (Viviane.khoury@uphs.upenn.edu) (*Presenter*) Nothing to Disclose
 Etienne Cardinal, MD, Montreal, QC (*Presenter*) Nothing to Disclose
 Jon A. Jacobson, MD, Ann Arbor, MI, (jjacobsn@umich.edu) (*Presenter*) Consultant, BioClinica, Inc; Royalties, Reed Elsevier; ; ;
 Joseph G. Craig, MD, Detroit, MI (*Presenter*) Nothing to Disclose
 David P. Fessell, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
 Ghyath Habra, MD, Detroit, MI (*Presenter*) Nothing to Disclose
 Joseph H. Introcaso, MD, Neenah, WI (*Presenter*) Nothing to Disclose
 Kenneth S. Lee, MD, Madison, WI (*Presenter*) Grant, General Electric Company; Research support, SuperSonic Imagine; Research support, Johnson & Johnson; Consultant, Echometrix, LLC; Royalties, Reed Elsevier
 Humberto G. Rosas, MD, Madison, WI (*Presenter*) Nothing to Disclose
 Marnix T. van Holsbeeck, MD, Detroit, MI, (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;
 Kambiz Motamedi, MD, Los Angeles, CA, (kmotamedi@mednet.ucla.edu) (*Presenter*) Nothing to Disclose
 Mark Cresswell, MBBCh, Vancouver, BC (*Presenter*) Research Consultant, RepliCel Life Sciences Inc; ; ; ;
 Robert R. Lopez, MD, Charlotte, NC (*Presenter*) Nothing to Disclose
 Colin D. Strickland, MD, Denver, CO (*Presenter*) Nothing to Disclose
 Georgina M. Allen, MBBCh, FRCR, Oxford, United Kingdom (*Presenter*) Nothing to Disclose
 Gandikota Girish, MBBS, FRCR, Ann Arbor, MI (*Presenter*) Nothing to Disclose
 Benjamin D. Levine, MD, Santa Monica, CA, (blevine@mednet.ucla.edu) (*Presenter*) Research Consultant, Merck & Co, Inc
 Carlo Martinoli, MD, Genova, Italy (*Presenter*) Nothing to Disclose
 J. Antonio Bouffard, MD, Bloomfield Hills, MI (*Presenter*) Nothing to Disclose
 Ximena L. Wortsman, MD, Santiago, Chile, (xworts@yahoo.com) (*Presenter*) Nothing to Disclose
 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
 David J. Wilson, MD, Oxford, United Kingdom, (davidwilson.stlukes@btconnect.com) (*Presenter*) Royalties, Reed Elsevier;
 Lodewijk J. van Holsbeeck, MD, Northville, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify anatomic structures which can impinge or move abnormally in the upper extremity causing pain during normal range of motion. 2) Describe the ultrasound anatomy and scanning technique for a dynamic examination of these lesions. 3) Position patients optimally for the dynamic evaluation of the upper extremity respecting ergonomics.

ABSTRACT

This course will demonstrate standardized techniques of performing the dynamic examination of upper extremity conditions that are only or best demonstrated dynamically. These include shoulder impingement syndrome, long head of biceps dislocation, medial elbow joint instability, ulnar nerve/medial triceps dislocation, extensor carpi ulnaris dislocation, skier's thumb, median nerve movement, and trigger finger. In the first portion of the course, probe positioning will be demonstrated on a model patient with overhead projection during live scanning. In the second portion of the course, an international group of expert radiologists will assist participants in learning positioning and scanning of the shoulder, elbow, and wrist/ finger lesions described. An emphasis on dynamic maneuvers and ergonomic documentation of tissue dynamics will be taught. Participants will be encouraged to directly scan model patients.

Honored Educators

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

Jon A. Jacobson, MD - 2012 Honored Educator

RC553

Tools and Use Cases for Text Information Extraction in Radiology

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

IN

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

Participants

Paras Lakhani, MD, Philadelphia, PA, (paras.lakhani@jefferson.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Place natural language processing (NLP) in context of the history of radiology reporting. 2) Review how NLP is used in disciplines outside of radiology. 3) Understand basic NLP methods. 4) Assess the applicability of NLP to radiology reports.

ABSTRACT

Natural Language Processing (NLP) refers to the automated extraction of meaningful information from narrative text. Some NLP systems use simple rules to categorize text according to whether a particular concept may be present. More sophisticated systems use part-of-speech tagging and grammatical parsing to extract concepts and relationships from text. Some NLP systems use statistical approaches that can learn to categorize text automatically based on a test set of positive and negative examples. When applied to radiology reports, NLP systems are most frequently used to identify and retrieve reports of interest, such as reports containing a critical result, an incidental finding, or a recommendation for follow up. NLP systems are simpler to construct and more accurate when the structure of the analyzed text is constrained in some manner. Several real-world examples of both simple and sophisticated NLP systems in radiology will illustrate the spectrum of applicable techniques and the potential benefit to radiology practice.

Sub-Events

RC553A Creation of Patient-Oriented Radiology Reports with Natural Language Processing

Participants

Paras Lakhani, MD, Philadelphia, PA, (paras.lakhani@jefferson.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Potential problems with current radiology reports from a patient's point of view. 2) NLP methods to create patient centric reports. 3) Examples of patient-oriented reports created by NLP approaches.

RC553B Navigating the Available Tools and Methods for Natural Language Processing

Participants

Scott Leroy Duvall, PhD, Salt Lake City, UT, (scott.duvall@utah.edu) (*Presenter*) Research Grant, Amgen Inc; Research Grant, AbbVie Inc.; Research Grant, Anolinx LLC; Research Grant, AstraZeneca Pharmaceuticals LP; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Genentech Inc.; Research Grant, Genomic Health, Inc.; Research Grant, Gilead Sciences Inc.; Research Grant, HITEKS Solutions Inc.; Research Grant, LexisNexis Risk Solutions; Research Grant, Merck & Co, Inc; Research Grant, Mylan Specialty LP; Research Grant, Novartis International AG; Research Grant, PAREXEL International Corporation; Research Grant, Shire plc

LEARNING OBJECTIVES

1) Present a survey of open-source tools for NLP and manual chart review and how these can be built upon. 2) Demonstrate the creation of manually created reference standards against which to measure NLP systems.

ABSTRACT

Natural language processing (NLP) shouldn't be a scary term. It's not magic, but there are some things these methods can do well that you can take advantage of today. This session will walk attendees through open source tools that can easily be built upon for customized needs. Partnering fully automated NLP with manual chart review will also be introduced as a way to get the best of both worlds.

RC553C NLP and Information Extraction from Multi-institutional Radiology Reports

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 machine-learning methods for natural language processing. 2) Learn a scalable method for extraction of information from radiology reports using a simple information model. 3) Review evaluation methods for multi-institutional natural language processing research.

RC553D Natural Language Processing for Extracting and Managing Oncological Measurements

Participants

Merlijn Sevenster, PhD, Cambridge, MA (*Presenter*) Employee, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Describe challenges in extracting measurements from free-text radiology reports. 2) Explain a use case of measurement extraction in oncology research. 3) Explain a use case of measurement extraction in workflow technology adoption.

ABSTRACT

Oncological treatment response is assessed by longitudinal comparison of radiological measurements. In the dominant speech-centric workflow model, oncological measurements are dictated in narrative radiology reports and then manually transcribed into dedicated Excel spreadsheets. This process is error prone and inefficient, and may benefit from machine assistance. We present natural language processing methods to extract measurements from radiology reports and correlate them automatically across reports.

RC554

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

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



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

Participants

Katherine P. Andriole, PhD, Dedham, MA, (kandriole@bwh.harvard.edu) (*Moderator*) Advisory Board, McKinsey & Company, Inc;

LEARNING OBJECTIVES

1) Understand what is meant by business analytics in the context of a radiology practice. 2) Be able to describe the basic steps involved in implementing a business analytics tool. 3) Learn how business analytics tools can be used for quality assurance in radiology, for maintenance of certification (MOC), and for practice quality improvement. 4) Be introduced to the capabilities of current and potential future business analytics technologies.

ABSTRACT

This course will provide an overview of the use of business analytics (BA) in radiology. How a practice manages information is becoming a differentiator in the competitive radiology market. Leveraging informatics tools such as business analytics can help a practice transform its service delivery to improve performance, productivity and quality. An introduction to the basic steps involved in implementing business analytics will be given, followed by example uses of BA tools for quality assurance, maintenance of certification (MOC) and practice quality improvement. The power of current business analytics technologies will be described, along with a look at potential future capabilities of business analytics tools.

Sub-Events

RC554A Introduction to Business Analytics Demonstrating Application to Radiology

Participants

Katherine P. Andriole, PhD, Dedham, MA, (kandriole@bwh.harvard.edu) (*Presenter*) Advisory Board, McKinsey & Company, Inc;

LEARNING OBJECTIVES

1) Gain an overview of business analytics tools and understand how they might be used in radiology. 2) Be able to describe the general steps involved in business analytics, including data extraction, transformation, analysis, and presentation or visualization of key performance indicators (KPI). 3) Review several example radiology use cases.

ABSTRACT

This session will provide a general overview of business analytics concepts and how they can be used in radiology. A walk through of the basic steps involved in implementation including identifying, collecting, transforming, and analyzing data, followed by dynamically presenting key performance indicators (KPI) will be demonstrated. Example use cases involving multiple database sources taken from a radiology practice will be shown.

RC554B Operational and Predictive Analytics in Radiology

Participants

Luciano M. Prevedello, MD, MPH, Dublin, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Explain the big data science and radiology. 2) Identify the role of informatics in capturing, extracting, analyzing, and communication quality projects. 3) Illustrate graphical dashboarding examples to support quality efforts.

ABSTRACT

RC554C Capabilities of Current and Future Business Analytics Technologies

Participants

Tessa S. Cook, MD, PhD, Philadelphia, PA, (tessa.cook@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To gain familiarity with currently available business technologies and their relevance to radiology practice. 2) To consider how existing business technologies can support quality assurance in radiology. 3) To learn about business analytics features that may be available/desirable in the future to augment and support both the practice of radiology.

ABSTRACT

RCB41

Hands-On Basic Dicom with Horos/Osirix (Hands-on)

Wednesday, Nov. 30 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.

RCC41

Structured Reporting and the RSNA Reporting Initiative

Wednesday, Nov. 30 8:30AM - 10:00AM Room: S501ABC



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

Participants

Charles E. Kahn JR, MD, MS, Philadelphia, PA, (charles.kahn@uphs.upenn.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how to implement structured reporting across your department to make radiology reports more consistent and improve quality. 2) Describe national and international efforts to share best-practice radiology report templates. 3) Explore how RSNA's reporting initiative adds value to the healthcare enterprise.

Sub-Events

RCC41A Herding the Cats: Successfully Implementing a Department-Wide Standardized Reporting Program

Participants

David B. Larson, MD, MBA, Los Altos, CA (*Presenter*) License agreement, Bayer AG; Potential royalties, Bayer AG

LEARNING OBJECTIVES

1) Understand critical interpersonal elements to consider in implementing and managing a department-wide standardized structured report program. 2) Understand the technical challenges associated with implementing and managing a department-wide standardized structured report program.

ABSTRACT

Modern voice recognition technology has made department-wide standardized structured reporting feasible. However, the most significant challenges often lie in the interpersonal and organizational aspects. The author will discuss his experience in implementing and maintaining department-wide standardized structured reporting programs at two academic institutions, highlighting critical steps, major pitfalls, and strategies for success. The session will focus on those who might wish to develop department-wide structured reporting programs at their own institutions.

Honored Educators

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David B. Larson, MD, MBA - 2014 Honored Educator

RCC41B Radiology Reporting in the Age of Precision Medicine

Participants

Charles E. Kahn JR, MD, MS, Philadelphia, PA, (charles.kahn@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the background and rationale for RSNA's reporting initiative. 2) Describe recent advances in the technologies for radiology reporting. 3) Explore how reporting can add augment radiology's value to the healthcare enterprise. 4) Envision the latest directions and opportunities for radiology reporting.

ABSTRACT

Since 2007, the RSNA has taken a leading role in developing tools and clinical content to help radiologists improve their reporting practices. RSNA's library of best-practice reporting templates (www.radreport.org) has seen more than 2 million views and downloads. The "Management of Radiology Report Templates" (MRRT) profile and a DICOM standard for transmitting template-based reports into the electronic health record (EHR) have been recently developed. These standards, and a set of tools that use them, provide new opportunities for information from radiology reports to be integrated into the clinical enterprise. The "Open Template Library" (open.radreport.org) allows any RSNA member to contribute report templates, and the open-source "T-Rex" template editor simplifies the editing process. Through partnerships with other organizations, RSNA is seeking to improve and extend these approaches. This presentation will highlight recent advances and new directions in radiology reporting.

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Charles E. Kahn JR, MD, MS - 2012 Honored Educator

RCC41C radreport.org: Facing Challenges and Moving Forward

Participants

Marta E. Heilbrun, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how to share templates on open.radreport.org Know how templates from open.radreport.org are promoted to radreport.org 2) Describe the active collaborations with the European Society of Radiology (ESR) and other societies with the RSNA structured reporting effort.

ABSTRACT

As a component of the RSNA structured reporting initiative a select template library was created and is available at www.radreport.org. In order to facilitate the exchange of templates and to identify best practices, a resource for hosting templates created by RSNA members and affiliated societies has been created at the www.open.radreport.org site. This presentation will walk the audience through the process for sharing templates on open.radeport.org and using the T-Rex editor to create MRRT templates. Additionally, the activities of the Template Library Advisory Panel (TLAP), a joint collaboration between the RSNA and the ESR will be described. The TLAP is responsible for promoting the crowd-sourced templates to the the select template library will be described.

ASRT@RSNA 2016: Size-specific Imaging: Removing Some of the Guesswork During Pediatric (and Adult) Imaging

Wednesday, Nov. 30 9:20AM - 10:20AM Room: N230B

PDAMA PRA Category 1 Credit™: 1.00
ARRT Category A+ Credit: 1.00**Participants**

Keith J. Strauss, FAAPM, FACR, Cincinnati, OH, (keith.strauss@cchmc.org) (*Presenter*) Research Consultant, Koninklijke Philips NV; Speakers Bureau, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Understand why the thickness of the patient irradiated during an x-ray exam is a better indicator of the required radiographic technique than the patient's age, weight, or BMI. 2) Better understand the growth patterns of children from newborns to adults. 3) Learn simple techniques to use to obtain the patient thickness either before or after the examination. 4) Understand basic dose indices of CT and how to use these to manage patient dose from newborns to adult sized patients. 5) Understand basic dose indices for radiographic/fluoroscopic exams and how to use these to manage patient dose from newborns to adult sized patients.

ABSTRACT

Purpose: To assist radiologic technologists in the process of obtaining the correct radiographic technique for CT, radiographic, or fluoroscopic exams of children regardless of their size or age. Organization of Content: Radiologic technologists need accurate knowledge of the thickness of the pediatric or adult patient to best select the proper radiographic technique for all exams using x-rays. The different rates of growth of the different body parts of the pediatric patient will be investigated. Simple tools and techniques to quickly determine the thickness of the body part imaged will be presented. Armed with the patient size of the body part to be imaged, the radiologic technologist can use available published data to adjust CT technique factors to obtain the desired Size Specific Dose Estimate (SSDE) regardless of the patient's size or age. The size of the patient also determines the proper radiologic techniques for radiographic/fluoroscopic dose management for direct radiography, computed radiography, general fluoroscopy, or interventional fluoroscopy. Dose indices of air kerma and kerma area product will be discussed along with methods to manage radiation dose to the patient during these exams.

MSCP42

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

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S406A

PD

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

Participants

Ricardo Restrepo, MD, Miami, FL (*Director*) Nothing to Disclose

Sub-Events

MSCP42A Pediatric Abdominal Disorders

Participants

Kate A. Feinstein, MD, Chicago, IL, (kfeinstein@radiology.bsd.uchicago.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recommend the most appropriate radiological exam for a pediatric patient with a suspected abdominal disorder. 2) Compare strategies for evaluating the acute abdomen in different age groups. 3) Assemble differential diagnoses to enhance clinical management strategies.

MSCP42B Pediatric Musculoskeletal Disorders

Participants

Robert Orth, MD, PhD, Houston, TX, (rcorth@texaschildrens.org) (*Presenter*) Research support, General Electric Company;

LEARNING OBJECTIVES

1) Identify various musculoskeletal disorders that occur in children. 2) Apply the most appropriate imaging modality for evaluating pediatric musculoskeletal disorders. 3) Describe characteristic imaging findings of various pediatric musculoskeletal disorders.

ABSTRACT

MSCP42C Pediatric Interventional Cases

Participants

Ricardo Restrepo, MD, Miami, FL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the differential diagnosis of some vascular anomalies in children and their treatment. 2) Recognize some arterial and venous pathologies in children and their treatment. 3) Recognize benign and malignant features of thyroid nodules in children and be familiar with the guidelines for thyroid nodule biopsy in pediatric patients. 4) Be familiar with complications associated with acute pancreatitis in pediatric patients including the proper terminology and indications for treatment.

ABSTRACT

MSES42

Essentials of GI Imaging

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S100AB



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

Participants

Sub-Events

MSES42A Hepatobiliary Agents: The Basics

Participants

Giuseppe Brancatelli, MD, Palermo, Italy, (gbranca@yahoo.com) (*Presenter*) Speaker, Bayer AG

LEARNING OBJECTIVES

1) Describe the mechanism of action of hepatobiliary agents. 2) Understand the added value of hepatobiliary agents in the characterization of focal liver lesions. 3) Identify the most common pitfalls and limitations of hepatobiliary agents.

ABSTRACT

MSES42B Sonography of Focal Liver Lesions

Participants

Mitchell E. Tublin, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand historical role of ultrasound in identifying and characterizing hypoechoic and echogenic liver lesions. 2) Describe features characteristic of classic and typical "atypical" hemangiomas. 3) Utilize a cost effective imaging algorithm for management of echogenic lesions identified at ultrasound based upon ultrasound features and clinical history. 4) Describe how ultrasound contrast (microbubble) enhancement patterns of differing liver lesions increase study specificity.

ABSTRACT

MSES42C Pancreatic Cancer: Detection and Staging

Participants

Nikolaos Kartalis, MD, PhD, Stockholm, Sweden, (nikolaos.kartalis@karolinska.se) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To explain the role of CT and MRI in the evaluation of patients with pancreatic cancer. 2) To describe important technical aspects of CT and MRI protocols in these patients. 3) To identify imaging features in regard to the stage and extent of pancreatic cancer, including features that indicate non-resectability.

MSES42D Imaging Rectal Carcinoma

Participants

Regina G. Beets-Tan, MD, PhD, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1. To understand the relevant role of Imaging in rectal cancer. 2. To know the clinical management of rectal cancer and how MR findings influence treatment choice 3. To know the accuracy and pitfalls in interpretation of staging and restaging MRI 4. To learn about new treatment options and the role of imaging

ABSTRACT

BOOST: Head and Neck-Science Session with Keynote

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S103CD

RO HN OIAMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**Participants**Sung Kim, MD, New Brunswick, NJ (*Moderator*) Nothing to Disclose
Timothy J. Kruser, MD, Chicago, IL (*Moderator*) Nothing to Disclose**Sub-Events****MSRO42-01 Invited Speaker:****Participants**Minh T. Truong, MD, Boston, MA (*Presenter*) Nothing to Disclose**MSRO42-03 Intravoxel Incoherent Motion Diffusion Weighted Imaging (IVIM-DWI) in Evaluating the Hypoxia and Radiosensitivity of Nasopharyngeal Carcinoma Xenografts**

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S103CD

ParticipantsYouping Xiao, Fuzhou, China (*Presenter*) Nothing to Disclose
Yunbin Chen, MD, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Ying N. Chen, PhD, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Dechun Zheng, MS, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Xiang Zheng, MS, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jianji Pan, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Li Peng, BS, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Xiangyi Liu, BS, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhuangzhen He, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jing Zhong, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Wang Ren, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose**PURPOSE**

To preliminary investigate intravoxel incoherent motion diffusion weighted imaging(IVIM-DWI) in assessing the hypoxia and radiosensitivity of nasopharyngeal carcinoma(NPC) xenografts.

METHOD AND MATERIALSTwo different radiosensitive NPC cell lines(CNE-1 and CNE-2) were transplanted on sixty nude mice(30 of each group) to raise xenografts, which received the fractional radiations(30Gy, each fraction of 10Gy) at the alternative days. Each group was then subcategorized into the following five groups: non-radiation group(G0), radiation group of 10Gy(G1), 20Gy(G2), 30Gy(G3), and 3 days after 30Gy radiation(G4). On a 3.0T MR system, IVIM-DWI with 14 b-factors(0~1000 s/mm²) were performed on G0 xenografts directly and G1~G4 xenografts after irradiations. IVIM-parameters of xenografts were calculated with IDL6.3 software. The cell density, necrosis proportion and HIF-1 α of xenografts were analyzed histopathologically. The general changes of IVIM-parameters and pathological features after irradiations were tested with One-way ANOVA, their difference were compared by Student t test and/or Mann-Whitney U test. The correlations between different variables were analyzed with Spearman test.**RESULTS**After fractional radiations, the general changes of D, f and D* values in CNE-2 xenografts were statistically significant than those of CNE-1 xenografts(P<0.01). D increased while D* and f decreased more significantly in CNE-2 xenografts(P<0.01). D and necrosis proportion of G3 and G4 in CNE-2 xenografts were higher than those of CNE-1 xenografts(P<0.05), while D* and f of G4 as well as cell density of G2, G3 and G4 in CNE-2 xenografts were lower than those in CNE-1 xenografts(P<0.005). However, the general change of HIF-1 α expression in CNE-1 xenografts was more significant than that of CNE-2 xenografts(P<0.005). On the other hand, D correlated negatively with cell density(rs=-0.861, P < 0.001) and HIF-1 α expression(rs=-0.814, P<0.001), while it behaved a positive correlation with necrosis proportion(rs=0.952, P<0.001). Furthermore, f correlated positively with cell density(rs=0.627, P<0.001) but negatively with necrosis proportion(rs=-0.649, P<0.001).**CONCLUSION**

High-radiosensitive CNE-2 xenografts behaved more significant changes in IVIM-parameters than low-radiosensitive CNE-1 xenografts after fractional radiations, which correlated significantly with microstructure features and hypoxia of xenografts. Thus, IVIM-DWI can be potentially valuable in predicting the radio-sensitivity of NPC xenografts.

CLINICAL RELEVANCE/APPLICATION

Animal studies of IVIM-DWI can help demonstrate the mechanism on hypoxia and radiosensitivity of NPC.

MSRO42-04 A Phase I Trial of Ketogenic Diet with Concurrent Chemoradiation (ChemoRT) in Head and Neck Squamous Cell Carcinoma (HNSCC)

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S103CD

Participants

Caryn Anderson, MD, Iowa City, IA (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Ketogenic diet (KD) combined with chemoRT reduced tumor growth and improved survival in pre-clinical models. We hypothesized stage III-IVb HNSCC patients would be able to remain compliant with KD because of PEG tube requirement during chemoRT. Research supported by NIH U54TR001356 and KetoCal® 4:1 provided by Nutricia Pharmaceuticals.
Materials/Methods: This phase I clinical trial enrolled stage III-IVb definitive and post-op HNSCC patients receiving concurrent platinum-based chemoRT. PEG placement was required, but subjects were encouraged to continue KD by mouth. KD recipes and KetoCal® shakes were provided for daily consumption for 5 weeks starting 2 days prior to chemoRT. Fingertick ketones (FK) were checked Mon-Fri, and serum beta-hydroxybutyrate (BHB), glucose, and uric acid were checked weekly. Lipid panel was checked at week 3. Serum oxidative stress parameters were assessed prior to, during, and after completing KD. Adverse events were graded utilizing CTCAE version 4.0.
Results: Median follow-up for all enrolled subjects (n=12) from completion of RT was 4.9 mo (range: 0-16.6). 4/12 subjects successfully completed 5 weeks of KD as prescribed. Successful subjects used scheduled anti-emetics, consumed shakes via PEG tube as opposed to orally and had strong social support. Median days on KD for those who discontinued was 5.5 (range: 2-8). Of the first 4 subjects treated, 2 completed, 1 withdrew due to fatigue (gr. 3), and 1 had a dose limiting toxicity (DLT) (hyperuricemia, grade 4; 12.7 nd/dL; nl ref 2.4-7.0). The protocol was amended to address diet-related hyperuricemia and allow for increased protein intake. Subsequently, 8 eligible subjects enrolled with 2 completing therapy and 2 experiencing DLTs (acute pancreatitis grade 3; hyperuricemia with complicating nausea and vomiting, grade 3). The remaining 4 subjects withdrew due to diet intolerance prior to beginning chemoRT (n=1), and nausea with vomiting (nausea grade 2, vomiting grade 1, n=3). Serious adverse events included hospitalizations for parotiditis (n=1), acute pancreatitis (n=1), neutropenic fever (n=1), and nausea with vomiting (n=1). Both the acute pancreatitis and nausea with vomiting SAEs were considered related to study diet and were deemed DLTs. In those who completed KD, the median days FK were elevated and weeks the BHB levels were above baseline were 24.5 days (range: 19-25) and 5 weeks (range: 4-6), respectively. Median uric acid levels were 4.9 nd/dL (range: 3.4-5.4). Lipids remained normal. Serum oxidative stress markers, as assessed by protein carbonyls, increased linearly with increasing days on KD.
Conclusion: While challenging despite PEG availability, KD compliance is possible when combined with concurrent chemoRT for HNSCC. Enrollment continues.

MSRO42-05 Unilateral versus Bilateral Intensity Modulated Radiation for Surgically-treated Squamous Cell Carcinoma of the Palatine Tonsil Staged with FDG-PET/CT

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S103CD

Awards

Student Travel Stipend Award

Participants

Re-I Chin, BA, Saint Louis, MO (*Presenter*) Nothing to Disclose

Yuan J. Rao, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Michael Y. Hwang, Newark, NJ (*Abstract Co-Author*) Nothing to Disclose

Christopher R. Spencer, MD, MS, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Todd DeWees, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Pranav Patel, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Parul Sinha, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Hiram A. Gay, MD, Greenville, NC (*Abstract Co-Author*) Nothing to Disclose

Brian Nussenbaum, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Douglas Adkins, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

James S. Lewis Jr, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Wade L. Thorstad, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Michael Pierro, BS, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We report long-term outcomes of unilateral (UL) vs. bilateral (BL) radiation therapy (RT) for tonsil cancer in the era of FDG-PET/CT (PET). We hypothesize that staging with PET aids in patient selection for ULRT, especially in patients with multiple ipsilateral lymph nodes (stage N2b), for which there is controversy on whether ULRT is appropriate.

METHOD AND MATERIALS

The population included 159 patients treated with IMRT for tonsil cancer from 1997-2013. The primary tumor was treated to a median dose of RT was 66 Gy. PET was used in 113 (71%) patients. Fifty-two patients received ULRT for lateralized (>1cm from midline) tonsil cancer. Twenty-nine patients with N2b disease received ULRT and 56 received BLRT. All patients received surgery to the tonsil primary and 154 (97%) received neck dissection. We evaluated acute toxicity and patient-reported quality of life (PROQOL). We also reviewed cases of contralateral failures (CLF) in N2b patients receiving ULRT on PubMed, and correlated these outcomes to utilization of PET staging.

RESULTS

Median follow-up was 6.1 years. The 5 and 10-year rates of local-regional control (LRC) among patients treated with unilateral RT vs bilateral RT were 98% and 98% vs 96% and 96% respectively (p=0.41). There were no CLF. P16+ was associated with improved LRC on univariate and multivariate analysis (HR 0.11, p=0.02). Unilateral RT reduced use of reactive gastrostomy tube, xerostomia, pharyngitis, and weight loss. Global and xerostomia PROQOL were superior for unilateral radiation. Publications without use of staging PET had significantly higher rates of CLF in unilaterally treated stage N2b patients compared to studies that used staging PET (9.9% vs 1.4% CLF rate).

CONCLUSION

Unilateral neck radiation reduces acute toxicity and improves quality of life compared to bilateral radiation, and results in high LRC. For properly selected patients with well lateralized tumors (>1cm from midline), there was no difference in LRC between unilateral and bilateral radiation. In this study with high utilization of PET, we observed no CLF. FDG-PET staging may be useful when considering unilateral radiation in patients with stage N2b disease.

CLINICAL RELEVANCE/APPLICATION

This study highlights the importance of staging FDG-PET in contributing to proper patient selection when considering unilateral radiation in patients with stage N2b tonsil cancer.

MSRO42-06 Patterns of Loco-Regional Failure Following Post-Operative IMRT to Oral Cavity Cancer: Quantitative Dose-Volume Analysis Using a Standardized Pattern-of-Failure Typology

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S103CD

Participants

Andrew Wong, BS, Houston, TX (*Presenter*) Nothing to Disclose
Abdallah S. Mohamed, MD, MSc, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Clifton D. Fuller, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
David I. Rosenthal, Houston, TX (*Abstract Co-Author*) Advisory Board, Bristol-Myers Squibb Company Advisory Board, Merck KGaA Research support, Merck KGaA
Brandon Gunn, MD, Galveston, TX (*Abstract Co-Author*) Nothing to Disclose
Adam S. Garden, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Loco-regional failure is traditionally coded as a binary variable. For oral cavity cancer patients receiving post-operative intensity modulated radiotherapy (PO-IMRT), we seek to localize and identify volumetric/dosimetric patterns of failure with quantitative dose maps, using a standardized typology.

METHOD AND MATERIALS

Oral cavity cancer patients receiving PO-IMRT at our institution between 2001-2011 were identified. Diagnostic CT documenting recurrence (rCT) was co-registered with the original planning CT (pCT) with previously validated deformable image registration method. Manually segmented recurrent gross disease (rGTV) on the rCT was deformed to co-registered pCTs. Dose to 95% failure volume (fD95%) was compared to 95% dose to target volume the failure centroid originated from (pD95). Failures were classified into five types: A (fD95 higher than pD95, centroid within CTV1), B (fD95 higher, centroid in CTV2 or CTV3), C (fD95 lower, in CTV1), D (fD95 lower, in CTV2 or CTV3), E (centroid outside all target volumes), and F (centroid from matching low-neck supraclavicular field).

RESULTS

289 patients were reviewed. Local and loco-regional control at 5-years was 83% and 76%, respectively. Of 62 patients with documented local/regional failure, 51 had available rCT and pCT for analysis. 1-, 2- and 4-year overall survival was 74%, 30%, and 4%, respectively. Mean time to recurrence diagnosis post-radiation treatment was 6.4 months. Primary tumor sites were: 22 oral tongue, 10 alveolar ridge, 6 buccal mucosa, 6 retromolar trigone, 4 hard palate, and 3 floor of mouth. 83 rGTVs were identified (primary = 45, nodal = 38). Only 35 of 83 (42%) of failures were classified as Type A. Non-Type A failures were distributed as follows: 21 (25%) type B, 6 (7%) type C, 5 (6%) type D, 13 (16%) type E, and 3 (4%) type F.

CONCLUSION

Over half of failures following PO-IMRT in oral cavity cancer were not those that had originated from high-dose target volumes and that had received adequate dosimetric coverage. A standardized typology incorporating volumetric and dosimetric metrics adds value to failure characterization over simplistic binary "loco-regional failure" categories.

CLINICAL RELEVANCE/APPLICATION

A standardized typology for failure classification incorporating volumetric and dosimetric metrics can be utilized to infer mechanisms of failure and to identify interventions to reduce failure rates.

MSRO42-07 PET/CT in CT Simulation: Significance of a Standardized Positioning Protocol for Head and Neck Radiotherapy Planning

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S103CD

Participants

George Tolekidis, Chicago, IL (*Presenter*) Nothing to Disclose
Miranda L. Thoma, ARRT, BS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Mehee Choi, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Aidnag Z. Diaz, MD, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Diagnostic imaging scans are a valuable tool for head and neck (H&N) cancer radiotherapy treatment planning (RTP). Information from diagnostic scans can be incorporated into the RTP process by performing a dedicated diagnostic scan in the treatment position or by co-registering an existing scan with the simulation scan. The purpose of this study was to use the clival incline to quantify differences in H&N positioning between patients undergoing diagnostic PET/CTs positioned with vs. without the RTP immobilization mask.

METHOD AND MATERIALS

Twenty patients receiving radiotherapy for H&N cancer from 2011-2015 at our institution were selected for this retrospective review. Ten patients underwent diagnostic PET/CT using the mask created during simulation (Group A) while ten patients underwent PET/CT without the mask (Group B). Clival incline was measured three times for each simulation and PET/CT group and used to obtain a mean clival incline value.

RESULTS

Mean clival incline measured on the CT from the PET/CT images in Group B was 61.44° (standard deviation (SD), 8.30°; standard error mean (SEM), 2.62°), while clival incline for Group A was 72.25° (SD, 7.78°; SEM, 2.46°). Comparing the simulation CT to the PET/CT, mean clival incline difference was 12.61° in Group B (SD, 5.62°; SEM, 1.78°), and 1.48° (SD, 1.03°; SEM, 0.32°) in Group A. These differences between the groups were statistically significant, $p=0.008$ and $p=0.001$, respectively, using T-test analysis for the equality of means.

CONCLUSION

Based on these results we reach two conclusions. 1) When no mask is used for PET/CT, there is a different approach to positioning: PET/CT technologists favor a neutral to flexion position, while we favor a neutral to extended position. 2) Using the simulation mask for PET/CT greatly reduces the difference in head position when compared to its respective simulation scan. This allows for more robust registration. When possible, patients should have PET/CT performed using the immobilization mask created for simulation. However, as this is not always feasible, a standardized neck positioning protocol for both H&N simulation and PET/CT scans should be explored.

CLINICAL RELEVANCE/APPLICATION

We hypothesize that simulating patients with their RTP mask will 1) increase patient comfort 2) allow for a superior registration and 3) not significantly affect plan quality.

MSRO42-09 Inter-Scan Positional Variability of Head and Neck Soft Tissue on a Dedicated 1.5T MR Simulator with Open-Face Immobilization

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S103CD

Participants

Oi Lei Wong, PhD, Happy Valley, Hong Kong (*Presenter*) Nothing to Disclose
Gladys G. Lo, MD, Happy Valley, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Jing Yuan, PhD, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

With the advancement in radiotherapy treatment delivery techniques, quality of soft-tissue delineation for RT planning becomes increasingly important. Owing to the superior soft tissue contrast in MR images, MR-sim is superior to CT-sim. In this study, the inter-scan positional repeatability on MR-sim is quantitatively evaluated based on the concordance index (CI) and centroid position.

METHOD AND MATERIALS

Four healthy volunteers were scanned (4 scans for each on different days) using a T2w CUBE sequence with identical coverage, voxel-size(0.8x0.8x1.0mm³) and receiver-bandwidth(62.5kHz) on a 1.5T MR-sim with open-face thermoplastic cast for immobilization. Image distortion was minimized using the system provided geometric correction function. VOIs of the parotid gland(PGs), intervertebral discs(C23,C67), brainstem(BS), pituitary gland(PIT) and eyeballs(EBs) were carefully drawn. For each volunteer, volume and centroid position of each VOI were calculated. CI and centroid shift of the delineated VOIs, all referencing to the first scan, were subsequently calculated.

RESULTS

The calculated CI (mean±SD) of C23, C67, PIT, EBL, EBR, PGL, PGR and BS were 0.13±0.04, 0.10±0.07, 0.25±0.13, 0.66±0.04, 0.68±0.03, 0.62±0.07, 0.66±0.06 and 0.72±0.08, respectively. For PGs, our CI was similar to the published CI for an interobserver study using CT-sim. The observed low CI in C23, C67 and PIT corresponded to the small intersection between the delineated VOI of different scan sessions. The mean 3D shift of C23, C67, PIT, EBL, EBR, PGL, PGR and BS were 3.73±1.41, 9.11±10.45, 3.20±1.17, 3.69±0.71, 3.46±0.65, 3.55±1.11, 3.50±2.61, 4.30±4.18mm. Small CI and large 3D shift indicated a large positional variability in C67 since C67 was located at the posterior end of the cast. For BS, the large CI and large 3D shift were noted. Large CI corresponded to a large VOI intersection, which was affected by multiple factors such as positional variability, shape and size of the delineated VOI.

CONCLUSION

Except for C67, acceptable 3D shift was obtained for all VOIs (3.2-4.3mm) using MR-sim.

CLINICAL RELEVANCE/APPLICATION

Measurement of the inter-scan positional variability of MR-sim is important as it is related to the normal tissue sparing and hence the treatment outcome.

MSSR42

RSNA/ESR Hybrid Imaging Symposium: Hybrid Imaging in the Female (An Interactive Session)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S402AB



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

Participants

Alexander Drzezga, MD, Cologne, Germany (*Moderator*) 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
Katrine Riklund, MD, PhD, Umea, Sweden, (katrine.ahlstrom.riklund@umu.se) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

Sub-Events

MSSR42A Pelvic Tumors

Participants

Farrokh Dehdashti, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn about different tracers. 2) Understand how to interpret hybrid imaging examinations of the pelvis. 3) Learn about the role of hybrid imaging in staging, treatment evaluation and follow-up.

MSSR42B Breast Cancer

Participants

Osman Ratib, MD, PhD, Geneva, Switzerland (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn about pathophysiology and relation to different tracers. 2) Understand how to interpret hybrid imaging examinations of the breast. 3) Learn about the role of hybrid imaging in staging, treatment evaluation and follow-up.

ABSTRACT

MSSR42C Interactive Case Discussion

Participants

Farrokh Dehdashti, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Osman Ratib, MD, PhD, Geneva, Switzerland (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how to interpret hybrid imaging in female pelvic tumours. 2) Understand how to interpret hybrid imaging in breast cancer. 3) Learn how to avoid common pitfalls.

3D Printing (Mimics) (Hands-on)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S401AB

INAMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**Participants**

Adnan M. Sheikh, MD, Ottawa, ON, (asheikh@toh.on.ca) (*Moderator*) Nothing to Disclose
 Adnan M. Sheikh, MD, Ottawa, ON, (asheikh@toh.on.ca) (*Presenter*) Nothing to Disclose
 Frank J. Rybicki III, MD, PhD, Ottawa, ON, (frybicki@toh.ca) (*Presenter*) Nothing to Disclose
 Dimitris Mitsouras, PhD, Boston, MA, (dmitsouras@alum.mit.edu) (*Presenter*) Research Grant, Toshiba Corporation;
 Leonid Chepelev, MD, PhD, Ottawa, ON (*Presenter*) Nothing to Disclose
 Taryn Hodgdon, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
 Carlos H. Torres, MD, FRCPC, Ottawa, ON, (catorres@toh.ca) (*Presenter*) Nothing to Disclose
 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 (*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

RCB42

Intro to Statistics with R (Hands-on)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S401CD



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

Joe C. Wildenberg, MD, PhD, Philadelphia, PA, (joe.wildenberg@gmail.com) (*Presenter*) Nothing to Disclose

James E. Schmitt, MD, PhD, Philadelphia, PA, (james.schmitt@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Install and launch the R software package. Understand how to search for and download external packages to extend R's functionality. 2) Load data from external files such as txt, csv, and xls. 3) Perform basic mathematical operations and utilize data structures to manipulate data. 4) Use loops to perform more complex operations over the data, including true/false logic. 5) Understand the basics of creating plots and histograms. 6) Perform common statistical tests including correlation, Chi-square, and ANOVA.

ABSTRACT

RCC42

Will MACRA and MIPS Kill Your Practice?

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S501ABC



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

Participants

David C. Levin, MD, Philadelphia, PA, (david.levin@jefferson.edu) (*Moderator*) Consultant, HealthHelp, LLC; Board of Directors, Outpatient Imaging Affiliates, LLC
Ezequiel Silva III, MD, San Antonio, TX (*Presenter*) Nothing to Disclose
J. Raymond Geis, MD, Fort Collins, CO (*Presenter*) Shareholder, Montage Healthcare Solutions, Inc; Advisor, Nuance Communications, Inc;

LEARNING OBJECTIVES

1) Understand what ramifications the Medicare Access and CHIP Reauthorization Act (MACRA) have for a radiology practice. 2) Understand what we know so far about how the Merit-Based Incentive Payment System (MIPS) will affect a radiology practice. 3) Be aware of the aspects of MIPS that are still being formulated.

ABSTRACT

SSK01

Breast Imaging (Intervention Path Correlation)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: E450A



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

Participants

Michael A. Cohen, MD, Atlanta, GA (*Moderator*) Nothing to Disclose
Michael N. Linver, MD, Albuquerque, NM (*Moderator*) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc
Paul R. Fisher, MD, East Setauket, NY (*Moderator*) Research Grant, Siemens AG;

Sub-Events

SSK01-01 Unwise Conventional Wisdom: Real Truths About Atypical and Malignant Solitary Papillomas of the Breast

Participants

Sheryl G. Jordan, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose
Niyati Mukherjee, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Christine E. Bookhout, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Zane S. Jordan, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Lawton, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Radiologists continue to be taught breast atypical and malignant papillomas present with nipple discharge or palpable lump, are peripheral rather than central in locale, that symptomatic patients are at more risk for atypia/malignancy than asymptomatic patients hence require surgical excision, and that peripheral papillomas have predilection to be mammographically occult. Our clinical experience defies each of these; we hence studied characteristics of our institution's ten year experience with these diagnoses.

METHOD AND MATERIALS

IRB-approved, study retrospectively identified all patients with histologic confirmed diagnosis of solitary atypical or malignant papilloma from January 1, 2004 through September 3, 2014 in our CoPath and RadPathConf databases. Diagnoses of papillomatosis and nonsynchronous multiple intraductal papillomas excluded. Remaining cases (N=53) were reviewed multivariate manner. Then study cohort was analyzed against a comparison cohort (N=57) of all institution patients with solitary benign papillomas on core needle biopsy same time frame.

RESULTS

Study cohort solitary papilloma w/ atypia or malignancy on 53 CNB pts: median age 60, range 35-85. 39/53 screening mammo detected 11/53 palpable lump or nipple discharge 3/53 screening MRI. 0/53 solitary papilloma patients presented w/ bloody nipple discharge. 16/53 central in breast, 37/53 peripheral. Based on CNB results, malignancy was more common central (31%) vs peripheral (19%) papillomas. Both central and peripheral most commonly presented as mammo new mass or asymmetry. 14/47 cases were upstaged to malignancy on surgical excision path. 4/16 central and 10/37 peripheral, with all invasive carcinomas favorable prognosis and luminal molecular subtypes. Comparison cohort solitary benign papilloma 57 CNB pts: median age 48, range 15-78, 30/57 nipple discharge or palpable lump, 10 bloody and 6 nonbloody. 27 screen-detected. 25/57 central and 32/57 peripheral.

CONCLUSION

Study debunks conventional wisdom on patient presentation and imaging findings for at-risk papillomas. Atypia and malignancy were detected more frequently in asymptomatic patients on screening exams, and malignancy in central papillomas. Erroneous physician bias should not hamper care.

CLINICAL RELEVANCE/APPLICATION

In an era of desired turnkey patient care, this study assists radiologists in refining pre- and post-biopsy assessment and management recommendations of breast patients with solitary papillomas.

SSK01-02 Cryoablation as a Primary Treatment of Low Risk Breast Cancers in Women 65 and Older: Imaging Findings and Interim Update of the Ice 3 Trial

Wednesday, Nov. 30 10:40AM - 10:50AM Room: E450A

Participants

Kenneth R. Tomkovich, MD, Freehold, NJ (*Presenter*) Consultant, Scion Medical Technologies, LLC; Scientific Advisory Board, IceCure Medical, Inc; Speaker, Becton, Dickinson and Company; Consultant, Becton, Dickinson and Company
Alexander B. Sevrakov, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Randy D. Hicks, MD, Flint, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The Ice3 trial is the first of its kind large scale multi-center trial to assess cryoablation as a primary treatment for breast cancer without surgical resection. We report interim results and imaging findings of this novel approach.

METHOD AND MATERIALS

The goal of this HIPAA compliant IRB approved multi-center trial is cryoablation of approximately 150 patients with low risk invasive

The goal of this NCI/AA-compliant and approved multi-center trial is cryoablation of approximately 100 patients with low-risk invasive carcinoma of the breast. The study is limited to females age 65 and older with primary, unifocal, biopsy-proven cancer measuring 1.5 cm or less. Tumors must be ER+/PR+ or ER+/PR-, HER2-, and Nottingham grade 1 or 2 with an ultrasound-visible target following core needle biopsy. All patients underwent ultrasound-guided cryoablation using the IceSense 3 system (IceCure Medical, Ltd.) using local anesthesia. The goal was to create a 1cm visible margin of ice around the tumor during the freeze, thaw, freeze cycles. Patients have the option of post-procedure hormone therapy, chemotherapy, and radiation therapy as clinically indicated. Patients do not undergo surgical lumpectomy post-cryoablation. Patients will be followed by mammography at 6 months then annually for 5 years following ablation.

RESULTS

The trial began enrollment in October 2014. To date, 69 patients have been treated with cryoablation at 11 institutions throughout the United States. Tumor sizes ranged from 3 to 14 mm. Ages ranged from 65-90. There have been no serious adverse events. There has been 100% procedural success to date. 30 patients have reached the 6-month follow-up mark and 4 patients have had 12-month follow-up imaging. There have been no imaging or clinical findings suggestive of residual or recurrent tumor following treatment. Most common mammographic findings post-cryoablation include fat necrosis and "cryo-halo". The fat necrosis is comparable to that seen post-lumpectomy.

CONCLUSION

Cryoablation is safe, well-tolerated, and easily monitored. To date, there has been 100% initial procedural success. There has been no evidence of residual or recurrent tumor in patients with at least 6-month follow-up imaging. Most common imaging findings include fat necrosis and the "cryo-halo" effect. This trial is ongoing.

CLINICAL RELEVANCE/APPLICATION

Interim results suggest that cryoablation is a safe and effective primary treatment for women with low-risk invasive breast cancer and a potential image-guided alternative to surgical lumpectomy.

SSK01-03 Canceled MRI-Guided Breast Biopsies: Is Follow-Up Necessary?

Wednesday, Nov. 30 10:50AM - 11:00AM Room: E450A

Awards

Student Travel Stipend Award

Participants

Niveditha Pinnamaneni, MD, New York, NY (*Presenter*) Nothing to Disclose
Samantha L. Heller, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ana Paula D. Leite, MD, MS, Recife, Brazil (*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

PURPOSE

The purpose of this study was to evaluate the frequency of ipsilateral breast malignancy in patients after a canceled MRI-guided breast biopsy due to nonvisualization of the original lesion.

METHOD AND MATERIALS

This retrospective study is Institutional Review Board approved. Electronic medical records from 1/2007-12/2013 were searched for patients with canceled MRI-guided breast biopsy due to lesion nonvisualization. Imaging studies and medical records were reviewed for patient demographics, MRI lesion characteristics, and follow-up imaging. Patients without follow-up data were excluded.

RESULTS

We identified 1403 lesions detected at MRI and scheduled for MR biopsy. 89 (6.3%) were canceled due to nonvisualization of the lesion at biopsy. Follow-up imaging was available for 85/89 patients (95.5%). Mean patient age was 47.1 years (range: 23.9-75.9 years). Average follow-up interval was 29.5 months (range: 2.8-80.2 months). In 71/85 patients (83.5%), the abnormality was not seen on follow-up exams. In 14/85 patients (16.5%), the lesion was seen on subsequent studies. For 6/14 patients (42.8%), upon reassessment, the MRI finding was felt to be secondary to background parenchymal enhancement. In 8/14 (57.1%) patients, the original MRI finding was re-identified and underwent biopsy. Six of 8 lesions (75%) were benign, 1/8 (12.5%) lesions was high risk (ADH on pathology and ADH and ALH on surgical resection), and 1/8 lesions yielded DCIS with microinvasion.

CONCLUSION

Cancer detection rate was 1/85 (1.2%). The incidence of subsequent malignancy is low in patients who have had a canceled MRI biopsy due to nonvisualization, but continued follow-up imaging is warranted.

CLINICAL RELEVANCE/APPLICATION

Although cancer detection rate is low in patients with canceled MRI-guided breast biopsies due to nonvisualization, short-term follow-up MRI within 6-12 months is recommended.

SSK01-04 Management of Breast Papillomas by US-Guided Vacuum-Assisted Removal, Sonographic Follow-up and US-Guided Vacuum-Assisted Reexcision of Residual or Recurrent Lesions. Long-term Outcomes

Wednesday, Nov. 30 11:00AM - 11:10AM Room: E450A

Participants

Jose Maria Oliver-Goldaracena, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Carolina Martinez Gamarra, MD, Madrid, Spain (*Presenter*) Nothing to Disclose
Agustin Andres Mateo, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Vicenta Cordoba Chicote, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Ana Veron Sancrez, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Roca Navarro, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To review the long-term outcome of percutaneous management of breast papillomas by US-Guided Vacuum-Assisted Removal (US-VA), Sonographic follow-up and US-VA reexcision of residual or recurrent lesions.

METHOD AND MATERIALS

Between April 2010 and June 2015, 133 lesions (mean size 11mm, range 3-43mm) were removed with US-VA: 90 probably intraductal papillomas (benign intraductal mass within a dilated duct or cyst with Color-Doppler signal or correlation on ductography) and 43 benign papillomas (BP) diagnosed at US-CNB in a consecutive series of 112 patients (mean age 64, range 22-85). Pathological discharge was present in 70 patients while 42 patients were asymptomatic. Patients underwent US follow-up at 1-2 months, 6-8 months and 12-14 months after US-VA and later annual US follow-up. When a residual or recurrent suspicious papilloma (sP) was detected at US follow-up, reexcision by US-VA was performed. Clinical, US follow-up and pathologic outcomes were recorded.

RESULTS

At histology, there were 119 benign papillomas (BP), 7 atypical papillomas (AP), 1 papilloma with DCIS, 1 DCIS and 5 cases with no histologic lesions. US follow-up (range 10-72 months, mean 41) was performed in 99 patients with 119 BP and 6 patients with 7 AP. US showed 14 residual sP (range 1-6 months, mean 2) and 9 recurrent sP (range 8-24 months, mean 14) in 21 patients with 23 BP. Reexcision US-VA was performed in 20 sP in 18 patients. In 17 of them histology showed BP and in 3 fibrosis. In 3 sP (3 patients) reexcision US-VA was not performed: 1 patient with 1 recurrent sP grew inside the nipple and underwent surgical excision that confirmed the diagnosis of BP and 2 sP (2 patients) developed many recurrent papillomas in different locations at 14 and 24 months. Nipple discharge disappeared in all but one of the symptomatic patients (68/69). In this series of 126 papillomas (105 patients), percutaneous management by US-VA removal, US follow-up and reexcision US-VA has been effective in 123 papillomas (102 patients). None were upgraded to DCIS at long term US follow-up or in the setting of residual or recurrent lesions.

CONCLUSION

US-VA removal, US follow-up and US-VA reexcision of residual or recurrent lesions allow percutaneous long-term management in most of patients with papillomas.

CLINICAL RELEVANCE/APPLICATION

US-VA removal, US follow-up and US-VA reexcision of residual or recurrence lesions is appropriate for the percutaneous management of patients with papillomas at long term.

SSK01-05 Does Mammographic Calcification Determine Surgical Outcome in HER 2 Positive Breast Cancers rather than the response to Neo-Adjuvant Chemotherapy Itself?

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E450A

Participants

Fayyaz A. Mazari, MSc, PhD, Sheffield, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nisha Sharma, MBChB, Leeds, United Kingdom (*Presenter*) Nothing to Disclose
Kieran Horgan, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
David Dodwell, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Neo-adjuvant chemotherapy (NAC) is frequently used in treatment of HER2+ breast cancer to downstage the disease and for breast conservation. Mammographic calcification usually represents DCIS and does not resolve after NAC. We wanted to investigate whether HER2+ cancers with mammographic calcification behave differently in their response to NAC.

METHOD AND MATERIALS

This was a retrospective review of HER2+ breast cancer patients who underwent NAC from 2007-2015. Data recording included demographics, mammographic appearance, radiological response, surgery & pathological response. Subgroup analysis was performed for presence of mammographic calcification & cancer subtype.

RESULTS

89 patients were included. Median age was 49 years (IQR 41-58). 60.7% (N=54) had mammographic calcification. 62.9% (N=56) were luminal B and 37.1% (N=33) were non-luminal HER2+ cancers. Significant radiological response was observed in 53.9% (N=48). 95.5% (N=85) had surgery with 29.5% (N=25) undergoing breast conservation. Pathological complete response (pCR) was observed in 27.1% (N=23) of these patients. 17.6% (N=15) showed residual DCIS only, and 54.1% (N=46) had residual invasive cancer. **a) Subgroup analysis for mammographic calcification:** A significantly low (P=0.033, X2) pCR rate was observed in patients with mammographic calcification (19.2%, N=10) compared to those without it (40.6%, N=13). **b) Subgroup analysis for cancer subtype:** pCR rates in non-luminal HER2+ cancers (46.7%, N=14) were significantly higher (P=0.003, X2) compared to luminal B cancers (16.7%, N=9). Presence of mammographic calcifications significantly reduced the pCR rates in luminal B (9.4% vs 27.3%) and non-luminal (35.0% vs 70.0%) cancers. Likewise, residual DCIS was three times more likely after NAC in luminal B (31.3% vs 9.1%) and non-luminal HER2+ (33.3% vs 10.0%) cancers with mammographic calcification.

CONCLUSION

HER2+ cancers with mammographic calcification behave differently to NAC. It is argued that all HER2+ breast cancers should be offered breast conserving surgery at the outset given its response to anti-HER2 & chemotherapy. Our study shows mammographic calcifications should drive the type of surgery rather than the response to chemotherapy.

CLINICAL RELEVANCE/APPLICATION

This paper explores the significance of mammographic calcification in treatment planning of HER2+ breast cancer. This can provide the basis for developing breast conservation algorithms in this patient group.

SSK01-06 Digital Breast Tomosynthesis Vacuum Assisted Biopsy for Tomosynthesis-Detected Sonographically Occult Lesions

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E450A

Participants

Nikki S. Ariaratnam, MD, Voorhees, NJ (*Presenter*) Nothing to Disclose
Sherrill T. Little, MD, Glen Mills, PA (*Abstract Co-Author*) Nothing to Disclose
Markus Whitley, MD, Voorhees, NJ (*Abstract Co-Author*) Nothing to Disclose
Kristy Ferguson, Voorhees, NJ (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the utility of Digital Breast Tomosynthesis Vacuum-Assisted Biopsy (DBT VAB) and pathological results of DBT-detected abnormalities that are occult on 2D mammography and breast ultrasound (US).

METHOD AND MATERIALS

This is a HIPAA compliant retrospective review of a prospectively-maintained database of 1116 consecutive stereotactic biopsies performed over 27 months (12/1/13-2/29/16). Two breast radiologists independently assessed each case for the technical feasibility of sampling under DBT VAB versus standard stereotactic (prone or upright) biopsy. DBT VAB was performed in 38 consecutive patients (age range 38-76; mean age 55 years) for 38 non-calcified lesions which were solely detected using DBT and not observed on US. Imaging findings and pathology results were reviewed.

RESULTS

Technical success was achieved in 38 of 38 (100%) lesions using DBT VAB. The densities of the patients' breast tissues were: fatty (5), scattered fibroglandular densities (15), heterogeneously dense (12), and extremely dense (6). The lesion types were: masses (16), architectural distortion (16), and asymmetry (6). Pathologic findings were malignant in 8 of 38 lesions (21%; 95% confidence interval: 8.1%, 33.9%), including 6 invasive malignancies. The malignant lesions appeared on tomosynthesis as masses (5) and distortion (3). High-risk findings (radial scars, ADH, LCIS and papillomas) were found in 14 of 38 lesions, in which 3 were masses and 11 presented as distortion.

CONCLUSION

DBT VAB may be easily and successfully performed for the primary evaluation of tomosynthesis-detected lesions that are not readily visible on US or conventional 2D mammography. Furthermore, the majority of DBT VAB cases yield actionable pathologies including high-risk lesions, DCIS, or invasive carcinomas. Therefore, it is paramount to perform DBT VAB primarily when available, or proceed to breast MRI or needle localization to further pursue these tomosynthesis-detected lesions.

CLINICAL RELEVANCE/APPLICATION

Digital breast tomosynthesis vacuum-assisted biopsy reliably samples lesions seen only on tomosynthesis and occult on ultrasound and 2D mammography, with the majority of these lesions yielding malignant or high risk pathologies.

SSK01-07 Clinical, Imaging, and Intervention Factors Associated with Atypia Upgrade in the Setting of Vacuum Assisted Core Needle Biopsy

Wednesday, Nov. 30 11:30AM - 11:40AM Room: E450A

Awards

Student Travel Stipend Award

Participants

Erin Alencherry, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Rakhee H. Goel, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Sarah Gore, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Cheryl L. Thompson, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Christina Dubchuk, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Abstract Co-Author*) Research Grant, Hologic, Inc;

PURPOSE

To determine the upgrade rate following breast excision for atypia, including flat epithelial atypia (FEA), atypical lobular hyperplasia (ALH) and atypical ductal hyperplasia (ADH), in the setting of vacuum assisted biopsy (VAB) performed with either a 9 or 12 gauge needle.

METHOD AND MATERIALS

Between 2012-2015, 363 patients had atypia on VAB, including ultrasound, MRI and stereotactic guided. Patients were excluded if surgical excision was not completed, mastectomy was performed, or if the surgical specimen included the biopsy site for a simultaneously diagnosed malignancy on a separate VAB. An upgrade was defined as obtaining ductal carcinoma in situ (DCIS) or invasive cancer on excision. Demographic, imaging, biopsy and pathology characteristics were analyzed for association with upgrade among the 254 cases included in the final review.

RESULTS

Of the 254 atypia lesions, 34 (12%) were upgraded at resection. Upgrade rates for each atypia are: 8% (14/160) for FEA, 10% (9 of 80) for ALH, and 17% (25/123) for ADH. The 34 upgraded patients included 25 DCIS, 3 invasive cancers, and 1 mucocystic cancer. 8 patients upgraded had a simultaneously diagnosed cancer in either the same or opposite breast. 11 upgraded patients had core biopsy pathology known to be associated with upgrade, including papilloma and severe ADH. After exclusion of these 19 high-risk patients, only 4 FEA upgrades remain (3%, 4/151). Imaging findings associated with upgrade included segmental distribution of calcifications (45% vs 6%, $p < 0.0001$) and the presence of a mass (38.3% vs 17.8%, $p=0.006$). For stereotactic biopsy of calcifications, having only 0-24% of calcifications removed during biopsy was associated with upgrade (42% vs 9.8%, $p=0.0008$). Patients with a personal history of breast cancer were more likely to be upgraded (20.6%), compared to those without a cancer history (11%, $p=0.018$).

CONCLUSION

In the absence of personal history of breast cancer, segmental calcifications, mass lesion, concurrent cancer or papilloma there is a

low FEA upgrade rate, which may allow follow-up without excision. ADH and ALH should be excised because of higher upgrade rates.

CLINICAL RELEVANCE/APPLICATION

The upgrade rate following vacuum assisted biopsy of Flat Epithelial Atypia is low. Clinical, imaging, and intervention characteristics are useful for determining which cases should be excised.

SSK01-08 What Happens After a Diagnosis of High Risk Lesion at Stereotactic Biopsy? - A Look At Breast Imaging Compliance and Outcomes

Wednesday, Nov. 30 11:40AM - 11:50AM Room: E450A

Awards

Student Travel Stipend Award

Participants

Marissa L. Albert, MD, MSc, 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
Alana A. Lewin, MD, 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
Samantha L. Heller, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess compliance for subsequent annual screening mammography following diagnosis of high risk lesions at stereotactic biopsy with or without surgical excision.

METHOD AND MATERIALS

This IRB-approved HIPAA compliant study included 208 patients (mean age 53, range 31-81) who underwent a stereotactic biopsy between 1/2012-12/2014, yielding high risk lesions. Subjects with upgrade to cancer at surgical excision who had mastectomies (n=5) were excluded. Post diagnosis compliance to annual mammography (defined as within 9-18 months of biopsy) was compared to date-matched baseline annual mammographic screening compliance acquired from a dataset of 34,339 studies performed during 1/2012-12/2014 at the same institution. Post biopsy clinical notes were reviewed to identify patient care by a breast surgeon. Statistical analysis was performed.

RESULTS

Of 34,339 screening mammograms, 831/34339 (2.42%) were recommended for stereotactic biopsy. 208/831 (25%) were high risk lesions at stereotactic biopsy (Table.1), 140 (67.3%) lesions underwent surgical excision with 11.4% (16/140) upgrade to cancer (12 DCIS, 4 IDC). Excluding five mastectomy patients, 135/203 (66.5%) underwent surgery and 68/203 (33.5%) did not. The overall post-high-risk-diagnosis compliance to annual mammography of 57.1% (116/203) is similar to 56.3% among control patients who had a normal screening mammogram. Of note, compliance is significantly higher (94/135; 69.6%) in the surgical group as compared to the non-surgical group (22/68; 32.4%)(p<0.001). Among non-surgical patients, those compliant with 1 year mammogram (17/22; 77.3%) are significantly more likely to have seen a breast surgeon than the non-compliant (10/29; 34.1%) (p=0.004).

CONCLUSION

Diagnosis of a high risk lesion at stereotactic biopsy did not compromise subsequent annual mammographic screening overall. Patients without surgical excision who did not undergo a surgical consultation had significantly lower subsequent imaging compliance as compared to their counterparts who underwent surgery, suggesting specialist care may be important in ensuring adherence to imaging recommendations.

CLINICAL RELEVANCE/APPLICATION

Patients with high risk lesions are at increased risk for breast cancer. Educating patients and physicians is important to ensure adherence to annual mammography in those who do not undergo surgery.

SSK01-09 Non-Palpable Breast Lesion Localization and Excision Utilizing SAVI SCOUT: A Single Institution Analysis of Patient Outcomes

Wednesday, Nov. 30 11:50AM - 12:00PM Room: E450A

Participants

Victoria Mango, MD, New York, NY (*Presenter*) Nothing to Disclose
Ralph T. Wynn, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Lauren C. Friedlander, MD, White Plains, NY (*Abstract Co-Author*) Nothing to Disclose
Ameer Gomberawalla, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sheldon Feldman, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Richard S. Ha, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate outcomes of SAVI SCOUT guided localization and excision of non-palpable breast lesions.

METHOD AND MATERIALS

An IRB approved HIPAA compliant retrospective review of 77 SAVI SCOUT (® Cianna Medical) cases was performed. A non-radioactive, infrared-activated, electromagnetic wave reflector was percutaneously inserted adjacent to/within 77 non-palpable breast targets in 68 patients utilizing image guidance 0-8 days preoperatively. Target/reflector were surgically localized utilizing an electromagnetic wave/infrared light emitting handpiece. Target/reflector removal was verified with handpiece specimen

interrogation, specimen radiography and pathology. Distance between target and reflector on mammogram and specimen radiograph was recorded in addition to reflector distance from the skin. Final specimen pathology including margins was reviewed. Re-excision rates and complications were recorded.

RESULTS

77 reflectors were placed using sonographic (22/77) or mammographic (55/77) guidance. Mean target-reflector distance on mammography was 0.3 cm. 77/77 (100%) targets/reflectors were excised. Final pathology yielded 42 malignancies (avg 0.9 cm; 25 IDC, 1 ILC, 15 DCIS, 1 papillary ca), 20 high risk lesions and 15 benign results. 67/77 (87%) specimen radiographs demonstrated a target-reflector distance compared with post-procedure mammogram within 0.5 cm. 3/77 (4%) specimens demonstrated a >1.2 cm increased target-reflector distance on specimen radiograph compared with post-procedure mammogram. Average reflector depth on post-procedure mammogram was 2.6 cm (range 0.3-6.3 cm) and 1.3 cm (range 0.5-2.8 cm) on ultrasound. No procedural complications were identified. 3 patients required re-excision for positive margins. 7 patients had 2 reflectors placed in one breast, 1 patient had 3 reflectors placed in one breast. Reflectors were placed at minimum 2.6 cm apart.

CONCLUSION

The SAVI SCOUT surgical guidance system is an accurate method to localize and excise non-palpable breast lesions with acceptable margin positivity and re-excision rates. Bracketing is possible with reflectors as close together as 2.6 cm. Reflector migration is observed in a small percentage of cases; however targets were still successfully excised.

CLINICAL RELEVANCE/APPLICATION

Wire guided excision of non-palpable breast lesions has disadvantages overcome with I-125 seed localization. SAVI SCOUT provides a non-radioactive alternative with comparable patient outcomes.

SSK02

Science Session with Keynote: Breast Imaging (Ultrasound Screening)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: E451A

BR **US**

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

FDA Discussions may include off-label uses.

Participants

Regina J. Hooley, MD, New Haven, CT (*Moderator*) Consultant, FUJIFILM Holdings Corporation; Consultant, Siemens AG
Paula B. Gordon, MD, Vancouver, BC (*Moderator*) Stockholder, OncoGenex Pharmaceuticals, Inc ; Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd
Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

SSK02-01 Breast Imaging Keynote Speaker: Update on Screening Ultrasound

Participants

Regina J. Hooley, MD, New Haven, CT (*Presenter*) Consultant, FUJIFILM Holdings Corporation; Consultant, Siemens AG

SSK02-02 Should the Axilla Be Included in Screening Ultrasound?

Wednesday, Nov. 30 10:40AM - 10:50AM Room: E451A

Participants

Su Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ann Yi, 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
Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Kyung Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the outcome of routine bilateral axillary scanning while performing supplemental screening ultrasound (US).

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board and the requirement for written informed consent was waived. Between January 2012 and December 2014, 20327 supplemental screening US examinations were performed in 13056 women with negative mammograms at a single health screening center. Bilateral whole breast US examinations were performed with a handheld device by experienced radiologists and bilateral axillary regions were routinely scanned and representative images were documented. The abnormal interpretation rates, cancer detection rates, and positive predictive values (PPVs) of supplemental screening US for the breasts only and both breasts and axillae were calculated, respectively.

RESULTS

Of 13056 women, 12624 (97%) were at low risk and 432 (3%) were at intermediate-to-high risk for breast cancer. Bilateral whole breast US showed positive results in 1715 exams (abnormal interpretation rate, 8.4% [1715/20327]) and detected 27 breast cancers (cancer detection rate, 1.3 per 1000 exams) with PPV1 (abnormal interpretation) of 1.6% (27/1715) and PPV3 (biopsy performed) of 7.8% (23/295). Bilateral axillary US showed positive results in 46 exams (with negative results on bilateral whole breast US in 34 exams; positive results on bilateral whole breast US in 12 exams) which yielded no malignancy by follow-up (n=33), core needle biopsy (n=12), or fine needle aspiration (n=1). The abnormal interpretation rate of supplemental screening US for the both breasts and axillae minimally increased to 8.6% [1749/20327]. The PPVs slightly decreased (PPV1, 1.5% [27/1749]; PPV3, 7.5% [23/307]) without changes in the cancer detection rate.

CONCLUSION

Routine bilateral axillary scanning had no effects on the cancer detection rates of supplemental screening US, however increased false-positive findings.

CLINICAL RELEVANCE/APPLICATION

Routine bilateral axillary scanning is unnecessary for supplemental screening US. Automated breast volume scanner, which cannot cover axillary regions, could be used for supplemental breast screening.

SSK02-03 Decreasing Short-term Interval Follow-up and Biopsies by Following BI-RADS Category 3 Lesions at 1 Year, A Prospective Study: Preliminary Results

Wednesday, Nov. 30 10:50AM - 11:00AM Room: E451A

Participants

Richard G. Barr, MD, PhD, Youngstown, OH (*Presenter*) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Toshiba Corporation; Research Grant, Esaote SpA; Research Grant, B and K Ultrasound; Research Grant, Hitachi Aloka Ultrasound
Federica Manzoni, PhD, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose
Annalisa DeSilvestri, PhD, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose
Carmine Tinelli, MD, MSC, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Supplemental breast US in dense breasts can detect cancers not identified on mammography. However the large number of short-term interval follow-ups and low PPV3 are not cost effective. The majority of these are due to BI-RADS 3 (B3) lesions with an incidence of cancer of less than 1%. This prospective study evaluates the effect of following B3 lesions detected on supplemental ultrasound at 1 year.

METHOD AND MATERIALS

Patients with BI-RADS 1 or 2 screening mammogram with density 3 or 4 of any risk were asked to receive a free automated volume whole breast supplemental ultrasound (AVBS) in this HIPAA compliant IRB approved study. The AVBS was performed on a Siemens S2000 using a 15cm L14-5 transducer. AVBS was read by a radiologist with 2 years experience with AVBUS and 20 years of breast US experience. AVBS scans were read as BIRADS 1, 2, 3, or 0. Category 0 patients were scheduled for a hand held breast US (HH) of the abnormality. Patients were followed for 2 years.

RESULTS

Of 19,417 patients receiving a screening mammogram 5833(30%) had density 3 or 4 breasts and asked to participate in the study. 1412 (24.2%) agreed to participate in the study (50 yo mean, range 31 to 90), (93.1% average risk (1314/1412), 6.9% (98/1412) high risk). The AVBS was interpreted as BIRADS 1 (B1) in 748 (53%), BIRADS 2 (B2) in 345 (24.4%), BIRADS 3 (B3) in 265 (18.8%) and BIRADS 0 (B0) in 54 (3.8%). Of the 265 B3 patients, 176 had 1-year follow-up and were cancer free 0% (95% CI: 0-2.1%), 85 had 2-year follow-up and were cancer free 0% (95% CI: 0-4.2%). Of the 54 B0 patients, (recall rate 3.8%; 95% CI: 2.9-5.0%) on HH 9 (16.7%) were B1 (artifacts), 39 (72.2%) were B2, 0 (0%) were B3, 4 (7.4%) were B4, and 2(3.7%) were B5. The B4 and 5 lesions were biopsied and 2 B4A lesions were fibroadenomas, 2 B4C lesions were IDC, and 2 B5 lesions were IDC. The biopsy rate was 0.4% (6/1412) (95% CI: 0.2-0.9%) with a positive biopsy rate (PPV3) of 66.7% (4/6). The supplemental ultrasound detected 2.8/1000 additional cancers (4/1412) (95%CI: 0.7-7.2/1000).

CONCLUSION

Following B3 lesions at 1 year substantially decreases the recall rate (8.8% (233/2637) ACRIN 6666 to 3.8% (54/1412)) ($p < 0.001$) and increases the PPV3 (8.9% (21/235) ACRIN 6666 to 66.7% (4/6)) ($p = 0.001$) without substantial cancer misses.

CLINICAL RELEVANCE/APPLICATION

Following B3 lesions at 1 year interval substantially decreases the recall rate and increases the PPV without cancer misses.

SSK02-04 Faster Evaluation of Automated 3D Breast Ultrasound using Computer Aided Detection without Compromising Accuracy

Wednesday, Nov. 30 11:00AM - 11:10AM Room: E451A

Participants

Jan Van Zelst, MD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Tao Tan, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, QView Medical, Inc
Paola Clauser, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Michael Golatta, MD, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthieu Rutten, MD, Hertogenbosch, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mathijn D. De Jong, MD, 's-Hertogenbosch, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Angels Domingo, MD, TARRAGONA, Spain (*Abstract Co-Author*) Nothing to Disclose
Ruud Pijnappel, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Monique D. Dorrius, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Shareholder, Matakina Technology Limited Consultant, QView Medical, Inc Shareholder, QView Medical, Inc Director, ScreenPoint Medical BV Shareholder, ScreenPoint Medical BV
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Presenter*) Research agreement; Siemens AG; Research agreement, Seno Medical Instruments, Inc

PURPOSE

Automated 3D breast ultrasound (ABUS) has been shown to increase cancer detection as a supplement to mammography. Nevertheless, ABUS consists of multiple views per breast and therefore reading ABUS may be relatively time-consuming and cancers may be overlooked. We investigated whether dedicated computer aided detection software improves reading performance and reduces reading time (RT) of breast radiologists reading ABUS.

METHOD AND MATERIALS

The need for informed consent was waived by the IRB. 120 unilateral ABUS exams (378 views) (SIEMENS, Erlangen, Germany) of women with heterogeneously or extremely dense breasts were randomly selected from a large imaging archive. We included 30 malignant cases (two-third mammography negative), 30 benign cases and 60 normal exams. All cases had histological verification or >2 years of negative follow up. Eight dedicated breast radiologists, with 0-7 years of experience with ABUS, were asked to read all cases once conventionally and once using a CAD-based (Qview, Medical, Los Altos, Ca, USA) step-by-step screening workflow in a dedicated workstation developed for this study. Readers underwent a short training in using the CAD-software. Reading sessions were at least 8 weeks apart and the reading modes and order of the cases were randomized for each reader. Suspicious findings were scored using the BI-RADS scoring system and a likelihood scale from 0-100. Multi-case-multi-reader AFROC analysis was used to evaluate reader performance. T-tests were used to compare RT. McNemar test was used to compare sensitivity and specificity.

RESULTS

The mean AUC for conventional ABUS reading was 0.82 and this remained unchanged at 0.83 using CAD ($p = 0.29$). Specificity improved in 7/8 readers ($p < 0.0001$) while sensitivity decreased minimally in 2/8 readers. Mean RT decreased from 153.8s (SD 78.6) to 133.4 (SD 61.9) ($p < 0.001$).

CONCLUSION

Evaluating ABUS examinations using a CAD-based reading workflow is significantly faster than conventional ABUS reading, while the accuracy is maintained.

CLINICAL RELEVANCE/APPLICATION

Using dedicated CAD-software for automated 3D breast ultrasound may improve the efficiency of supplemental ABUS screening in women with dense breasts.

SSK02-05 Large 1000 Case Reader Study of Radiologists' Performance in Reading Automated Breast Ultrasound (ABVS) Images with the Aid of a Computer Aided Detection (CADe) System

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E451A

Participants

Lingyun Bao, MD, Hangzhou, China (*Presenter*) Nothing to Disclose
Xiaojing Xu, MD, MMed, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yanjuan Tan, MD, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Luoxi Zhu, MD, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Qingqing Zhu, MD, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Fanlei Kong, MD, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Wei Wang, MD, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We investigated the effectiveness of using a CADe system as an aid for radiologists in reading ABVS images (Siemens).

METHOD AND MATERIALS

The study was conducted as a retrospective observer study. A total of 1000 cases were selected from ABVS exams acquired in our institution in 2012. Among those cases were 206 cancer, 486 benign, and 308 normal cases. The cancer cases were consecutive, the benign and normal cases were randomly selected. All cancer and benign cases were confirmed by biopsy or surgery and normal cases were confirmed by 2-year follow-up.

9 radiologists from our institution participated in the study. Among those, 3 had more than 8 years ultrasound and more than 4 years ABVS experience (A), 3 had more than 5 years ultrasound experience (B), and 3 had more than 1 year ultrasound experience (C).

The CADe system used was the QVCAD System from QView Medical, Inc, Los Altos, California, USA. It is designed to aid radiologists in searching for suspicious areas in the ABVS images. The QVCAD results are presented to the reader simultaneously with the ABVS images, i.e. the radiologist read the ABVS images concurrently with the QVCAD results.

The cases were randomly assigned for each reader into 2 equal size groups, 1 and 2. Initially the readers read their group 1 cases with the aid of QVCAD and their group 2 cases without the aid of QVCAD. After a 1-month washout period, they reread their group 1 cases without the aid of QVCAD and their group 2 cases with the aid of QVCAD.

ROC analysis was used to compare the area under the ROC curve (AUC) of the QVCAD aided readings to those of the un-aided readings. Additionally, the reading time per case for each reader was recorded.

RESULTS

The AUC of all readers were 0.784 for reading with QVCAD and 0.747 without QVCAD. AUCs with and without QVCAD are 0.833 and 0.829 for A, 0.757 and 0.696 for B, 0.759 and 0.718 for C. All the differences in AUCs are statistically significant ($p < 0.05$), except for A. The average reading time was 10% faster with the aid of QVCAD for all readers.

CONCLUSION

QVCAD improves radiologist performance in both accuracy and reading time for the detection of breast cancer using ABVS, especially for those inexperienced with ABVS.

CLINICAL RELEVANCE/APPLICATION

QVCAD can potentially improve breast cancer detection using ABVS.

SSK02-06 Patient Risk Analysis of Malignancy Initially Identified at Screening Breast Ultrasound

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E451A

Participants

Wade C. Hedegard, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Andrea L. Arieno, BS, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Renee Morgan, RT, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether screening breast ultrasound is predominantly finding malignancy in high or average risk women.

METHOD AND MATERIALS

A retrospective chart review was conducted from 6/1/2013 to 3/10/2016 of malignant lesions identified on a screening ultrasound examination. Women with dense breast tissue were notified of their density and made aware that additional screening with breast ultrasound was available. All women who were found to have sonographically detected malignancies were further analyzed by determining their lifetime risk of breast cancer calculated at the time of diagnosis using the Tyrer-Cuzick risk calculator version 7.02. Lifetime risk of breast cancer was also calculated for a random sample of 50 age-matched screening mammography detected malignancies, normal screening breast ultrasound patients and normal screening mammogram patients. The risk factors were evaluated to determine if a correlation could be found between US only cancers and patients at increased risk of breast cancer.

RESULTS

6,706 screening ultrasound procedures were performed from 6/1/2013 to 3/10/2016. 29 sonographically detected cancers were found in 27 women with an average patient age of 62. Our cancer detection rate was 4.3 / 1000 with 29 of 141 biopsies (20.6%) revealing malignancy. Cancer diagnoses included 20 invasive ductal carcinoma, 5 invasive lobular carcinoma, 1 ductal carcinoma in situ, and 3 metastatic axillary lymph nodes. 37.5% of the malignancies were found in women with a 20% or higher lifetime breast cancer risk on the Tyrer Cuzick model. An additional 6 malignancies occurred in women with a personal history of breast cancer.

Comparison with age-matched patients showed 17.7% of patients undergoing screening mammography and 18.4% of patients electing to undergo screening ultrasound at our facility had a 20% or higher lifetime risk of breast cancer. Additionally, 33.3% of screening mammography detected malignancies were found in women at an elevated lifetime risk greater than 20% and another 7 women had a personal history of malignancy.

CONCLUSION

Screening breast ultrasound finds malignancy in average and high risk patients in a similar fashion to screening mammography, with 37.5% and 33.3% of cancers occurring in high risk patients, respectively.

CLINICAL RELEVANCE/APPLICATION

Screening breast ultrasound performed for dense breast tissue finds mammographically occult cancer in both high risk and average risk women.

SSK02-07 Can Acoustic Radiation Force Impulse Imaging Aid in the Differentiation of Benign from Malignant Breast Lesions?

Wednesday, Nov. 30 11:30AM - 11:40AM Room: E451A

Participants

Panagiotis Kapetas, Vienna, Austria (*Presenter*) Nothing to Disclose
Ramona Woitek, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Paola Clauser, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Maria Adele Marino, MD, Messina, Italy (*Abstract Co-Author*) Nothing to Disclose
Sara Vigano, MD, San Donato Milanese, Italy (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker-Domenig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Maria Bernathova, Wien, Austria (*Abstract Co-Author*) Nothing to Disclose
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medicor, Inc Research Grant, Siemens AG Research Grant, C. R. Bard, Inc
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the added value of Acoustic Radiation Force Impulse (ARFI) imaging with Virtual Touch IQ (VTIQ) compared to B-mode breast ultrasound as well as to identify "rule-in" and "rule-out" thresholds for the probability of malignancy.

METHOD AND MATERIALS

189 patients with 196 sonographically evident lesions were included in this retrospective, IRB-approved study. B-mode and quantitative ARFI images with VTIQ of each lesion were obtained. 4 radiologists independently reviewed all B-mode images and assigned a BI-RADS score. Subsequently the VTIQ images were reviewed and a new BI-RADS score for each lesion was assigned. ROC-curve analysis was used to calculate the diagnostic performance of B-mode and ARFI imaging as well as to specify "rule-in" and "rule-out" thresholds for the probability of malignancy. The standard of reference was either histopathology or follow-up stability for >18 months.

RESULTS

84 lesions were malignant and 112 benign. The combined B-mode and ARFI imaging reading showed a tendency towards better accuracy for most of the readers (AUC 0.873-0.914 vs. 0.851-0.900 respectively), a finding that didn't reach statistical significance. All readers reported a higher diagnostic confidence through the combined reading. The application of a "rule-out" Shear Wave Velocity (SWV) cutoff value of 1.9m/s led to a sensitivity of 98%, whereas a "rule-in" SWV cutoff value of 6.5m/s suggested a probability of malignancy of >95%.

CONCLUSION

ARFI imaging with VTIQ can aid in the differentiation of malignant from benign breast lesions and raise the diagnostic confidence of the examiner. The application of "rule-in" and "rule-out" thresholds is feasible.

CLINICAL RELEVANCE/APPLICATION

ARFI imaging with VTIQ, a novel sonographic elastography technique, provides data, valid for the differentiation of benign and malignant breast lesions. Application of "rule-in" and "rule-out" cutoff values has the potential to reduce unnecessary breast biopsies.

SSK02-08 Outcomes of Screening US-detected Breast Cancers

Wednesday, Nov. 30 11:40AM - 11:50AM Room: E451A

Participants

Sooyeon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Eun-Kyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Boo-Kyung Han, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Kyung Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate outcomes of mammography-negative and ultrasound (US)-detected breast cancers in asymptomatic women.

METHOD AND MATERIALS

Among women who received surgery for breast cancers from Jan 2004 to Mar 2011 at three institutions, asymptomatic women who had mammography-negative and US-detected breast cancers were identified. Women with personal history of breast or other organ cancer or women with <5 years of follow-up period after surgery were excluded. Finally, a total of 438 women (mean age, 48.0 years; range, 27-74) were included. Three hundred and sixty six (83.6%) had invasive cancers and 72 (16.4%) had ductal carcinoma in situ (DCIS). Three hundred and eighty five (87.9%) received breast conserving, 53 (12.1%) received total

mastectomy and 362 (82.6%) received adjuvant endocrine therapy. Of 366 invasive cancers, 51 (13.9%) had lymph node metastases and 176 (48.1%) received chemotherapy. Of 366 invasive cancers, 291 (79.5%) were TNM stage I, 65 (17.8%) were stage II, and 10 (2.7%) were stage III. Invasive cancers were classified as 291 (79.5%) hormone receptor (HR)-positive/HER2-negative, 22 (6.0%) HR-positive/HER2-positive, 17 (4.6%) HR-negative/HER2-positive, and 36 (9.8%) triple negative. Kaplan-Meier analysis was performed to calculate recurrence-free survival (RFS). Cox proportional hazard analysis was performed to determine the patient and disease characteristics associated with recurrence.

RESULTS

At a median follow-up of 7 years (range, 5-12 years), there were 13 recurrences. The 5-year RFS was 98.2% and 10-year RFS was 97.0%. Among 13 recurrences, 10 were invasive cancers (6 in contralateral breast, 2 in remnant breast and 2 distant metastasis in lung), and 3 were DCIS (2 in contralateral breast and 1 in remnant breast). There were no deaths. In women with invasive cancers, triple negative (Hazard ratio, 4.742; 95% confidence interval, 1.215-18.515, P=0.025) was independently associated with recurrence in multivariate analysis adjusting for TNM stage and histologic grade.

CONCLUSION

Clinical outcome of mammography-negative and US-detected breast cancers was favorable. Triple negative subtype was independently associated with recurrence in women with invasive breast cancers.

CLINICAL RELEVANCE/APPLICATION

Most women with US-detected breast cancers have an excellent outcome. Tumor subtype may identify patients with high risk for recurrence.

SSK02-09 Utility of Whole Breast Screening Ultrasound in Women Undergoing Digital Breast Tomosynthesis

Wednesday, Nov. 30 11:50AM - 12:00PM Room: E451A

Participants

Janice S. Sung, MD, New York, NY (*Presenter*) Nothing to Disclose

Carol H. Lee, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Christopher E. Comstock, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively evaluate the clinical utility of whole breast screening ultrasound (WBUS) in women undergoing digital breast tomosynthesis (DBT.)

METHOD AND MATERIALS

This is a prospective IRB approved trial recruiting asymptomatic women scheduled for a screening DBT and WBUS within 30 days of one another. Between July 2014 – March, 2016, 560 women enrolled. The DBT and WBUS were performed at the same visit and interpreted independently by 2 radiologists blinded to the other modality. Once final recommendations for each modality were recorded, the patient was managed per standard institutional practice after integrating findings of both studies. The cancer detection rate, PPV3 of biopsy, and risk factors (breast density, family history (FH), personal history (PH), BRCA status, prior high risk lesion) were recorded.

RESULTS

Mean patient age was 56 years (range: 30-84). 417/560 (74%) of women had dense breasts. 184 (33%) had no additional risk factors, 127 (23%) a PH of breast cancer, and 96 (17%) a FH in a 1st degree relative. 75 (13%) women had >1 additional risk factor. 3 cancers (2 IDC, 1 DCIS) were detected for a cancer detection rate of 5/1000. The two node negative IDCs (mean size: 0.7 cm) were seen on the 2D images, tomosynthesis images, and WBUS. 1 case of DCIS was detected only on the tomosynthesis images and WBUS. The PPV3 was 19% for DBT and 27% for WBUS. The addition of tomosynthesis views reduced the number of recalls from the 2D mammographic views by 15%.

CONCLUSION

Both DBT and WBUS increase the cancer detection rate compared to a 2D mammogram. However, no additional cancers were detected on WBUS compared to DBT. The addition of tomosynthesis images had the added benefit of reducing the recall rate by 15%.

CLINICAL RELEVANCE/APPLICATION

The clinical value of WBUS may be reduced in women undergoing DBT compared to a 2D mammogram.

SSK03

Science Session with Keynote: Cardiac (Congenital Cardiovascular Disease)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S502AB

CA MR

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

FDA Discussions may include off-label uses.

Participants

Frاندics P. Chan, MD, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose
Jay S. Leb, MD, Baltimore, MD (*Moderator*) Nothing to Disclose

Sub-Events

SSK03-01 Cardiac Keynote Speaker: Imaging for Tetralogy of Fallot-Current Practice and Future Directions

Participants

Frاندics P. Chan, MD, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

PURPOSE

Tetralogy of Fallot (TOF) is the most common cyanotic heart disease, representing 10% of all cases of congenital heart disease. Today, total surgical repair at early childhood greatly enhances survival and quality of life of these patients. In most cases of simple TOF, the imaging needs for initial diagnosis and surgical planning are met by echocardiography. More complicated cases, where there are additional intracardiac or coronary anomalies, abnormal pulmonary artery anatomy, malformation of the airways and lungs, may require catheterization, CT, or MRI to guide surgical planning. The most frequent and important clinical indication for cardiac MRI in patients with TOF is the evaluation of impending right heart failure after total surgical repair. A total repair of TOF calls for closure of the ventricular septal defect and relief of the pulmonary stenosis, usually accomplished by transannular patch augmentation. This leaves a variable degree of pulmonary regurgitation. In some patients, this chronic volume loading to the RV leads to ventricular dilation and heart failure. Cardiac MRI is the most accurate and least invasive way of detecting early evidence of heart failure, which triggers timely replacement of the pulmonary valve. Cardiac MRI and CT are powerful tools for investigating pathophysiology and for evaluating experimental treatments for TOF. Both MRI and CT provide patient-specific, detailed 3D or 4D structural information of the heart and the pulmonary vasculatures required for computational fluid dynamic (CFD) simulations. MRI enables multi-dimensional phase-contrast technique (4D-flow) that characterizes blood flow in the TOF heart. Finally, cardiac MRI has unique capabilities for myocardial tissue characterizations. These capabilities include myocardial tagging for strain mapping, T1-mapping and delay-enhancement for scar imaging, first-pass contrast enhancement for perfusion imaging, and diffusion imaging for myocardial fiber tracking.

SSK03-03 Abdominal Blood Flow Assessment with Phase Contrast MRI in Children with Fontan Circulation

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S502AB

Participants

Pablo Caro-Dominguez, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Shi-Joon Yoo, MD, Toronto, ON (*Abstract Co-Author*) Owner, 3D HOPE Medical; CEO, IMIB-CHD;
Govind B. Chavhan, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To establish normal ranges of blood flow in the major thoracic and abdominal vessels in children with fenestrated and completed Fontan and to identify flow differences in children with signs of hepatic damage or clinical evidence of protein-losing enteropathy

METHOD AND MATERIALS

Cardiovascular MRI including PCMR and abdominal sequences were performed in 25 children with fenestrated Fontan circulation, 30 children with completed Fontan and compared with a control group of 19 healthy children.

RESULTS

Children with fenestrated Fontan have higher cardiac output, SVC flow (reflecting cerebral blood flow) and aorto-pulmonary collaterals with reduced flow to all abdominal vessels as compared to control and completed Fontans. Children with completed Fontan have lower cardiac output, flow in the SVC, descending aorta, IVC, celiac axis, splenic and renal veins as compared to controls, with no difference in superior mesenteric artery blood flow. The mesenteric venous blood flow is reduced in all Fontan patients, markedly in those with clinical criteria of protein-losing enteropathy. The portal venous flow is reduced in all Fontan children, especially in children with signs of cirrhosis.

CONCLUSION

This study showed abnormal blood flow patterns on PCMR that helps to understand better the physiology in children with fenestrated and completed Fontan circulation. We have established normal ranges of blood flow in the thoracic and abdominal vessels with PCMR that can be used in the daily practice. Finally, a significant difference between SMA and SMV blood flow can be used as a warning sign of developing protein-losing enteropathy

CLINICAL RELEVANCE/APPLICATION

Phase contrast MRI can potentially be used to quantify protein-losing enteropathy and give valuable blood flow information in children with signs of failed Fontan circulation

SSK03-04 Visualization and Quantification of Shunt Fraction with 4D Flow MRI in Patients with Atrial Septal

Defects - A Multicenter Pilot Study

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S502AB

Participants

Raluca G. Chelu, MD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose
Shreyas S. Vasanawala, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research collaboration, General Electric Company; Consultant, Arterys Inc; Research Grant, Bayer AG;
Adriaan Coenen, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Consultant, Bracco Group; Scientific Advisor, Zebra Medical Vision Ltd; Advisory Board, Quantib BV
Koen Nieman, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Albert Hsiao, MD, PhD, San Diego, CA (*Abstract Co-Author*) Founder, Arterys, Inc Consultant, Arterys, Inc Research Grant, General Electric Company

PURPOSE

Cardiac MRI is valuable for quantification of shunt fraction (Qp/Qs) in patients with atrial septal defects (ASD). However, ASD can be challenging to visualize with conventional cardiac MRI, especially when they are relatively small. We hypothesized that 4D Flow MRI may improve the visualization of small ASD, while providing comparable quantification of Qp/Qs.

METHOD AND MATERIALS

With IRB-approval and HIPAA-compliance, we retrospectively identified patients referred for cardiac MRI including 4D flow for further evaluation of known ASD in 3 academic centers, as well as control subjects with matched body habitus and scanning parameters. Images were analyzed by a radiologist with 2 years of experience with cardiac 4D Flow. Three rendering techniques were compared, including (a) color speed overlay, (b) vector velocity overlay and (c) streamline rendering from the superior (SVC) and inferior vena cava (IVC), right (RUPV) and left upper pulmonary vein (LUPV). Streamline rendering was considered 'positive' when multiple streamlines were seen crossing into the contralateral ventricle during multiple diastolic phases. Shunt volumes and fractions were statistically compared between conventional phase-contrast and 4D Flow with Pearson correlation, Bland-Altman analysis and t-test.

RESULTS

We identified 18 patients known with ASD (4 males, mean age 45 yo) and 7 controls (6 males, mean age 34 yo) between May of 2014 and February of 2016. With color overlay, we visualized 14 of the 18 ASDs. With vector overlay, we visualized 15 of 18 ASDs, two of which showed bidirectionality. Streamline rendering was 'positive' from the SVC in 8 patients and all controls, from IVC in 7 patients and 4 controls, from RUPV in 9 patients and 2 controls and from LUPV in 11 patients and 1 control. Shunt fractions ranged from [1.1-2.25 mL/min] and correlated well with conventional phase-contrast MRI ($r=0.9$).

CONCLUSION

Multiple visualization strategies are possible with 4D Flow MRI for visualization of ASDs. Vector velocity overlay may help convey directionality that may not be readily apparent on color overlay visualization. Streamline rendering was more effective at differentiating interatrial left-to-right flow than right-to-left flow.

CLINICAL RELEVANCE/APPLICATION

Cardiac 4D Flow MRI may complement conventional cardiac MRI for visualization and quantification of interatrial flow in patients with ASD.

SSK03-05 Potential Role for FFRct in Guidance of Therapy of Malignant Right Coronary Anomalies: Proof of Concept

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S502AB

Participants

Kristof De Smet, MD, MSc, Brussels, Belgium (*Presenter*) Nothing to Disclose
Jeroen Sonck, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Dries Belsack, MD, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Kaoru Tanaka, MD, PhD, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Nico Buls, DSc, PhD, Jette, Belgium (*Abstract Co-Author*) Nothing to Disclose
Johan De Mey, Jette, Belgium (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Anomalous right coronary artery arising from the left sinus of Valsalva and coursing between the aortic root and pulmonary trunk is seen in 0,2-0,5% of the population and is associated with increased risk of sudden cardiac death. The ACC/AHA 2008 guidelines for adults with congenital heart disease suggest surgical coronary revascularization for those patients with evidence of ischemia. FFRCT is a novel computational technique which shows very good correlation with FFR in the haemodynamic assessment of coronary arteries. We want to investigate the potential usefulness of FFRCT in evaluating ischemia in malignant right coronary artery anomalies.

METHOD AND MATERIALS

Retrospective, blinded FFRct analysis was carried out in 7 patients with CTA-reported malignant right coronary artery anomaly. Evaluation of the potential impact of clinical adoption of FFRct to guide surgical intervention was based on the ACC/AHA 2008 guidelines for adults with CHD.

RESULTS

FFRct analysis demonstrated ischemia in 1 of the seven cases with an FFRct-value of 0,73 in the distal RCA. This was a 45-year old female patient in excellent general condition who presented with a history of "exercise-induced chest pain". CTA examination showed a typical high-take-off origin of the RCA from the left sinus of Valsalva. Surgical revascularization was performed with good result. The other 6 cases had no clinical symptoms, did not show a high take-off of the RCA and medical management had been set

up. No major cardiac events upon today were reported for the 7 patients.

CONCLUSION

Utilization of FFRct analysis in the evaluation of patients with malignant right coronary anomalies is feasible and offers a one-stop-shop assessment of the anatomical and physiological aspects of this clinical entity. This technique could play an important role in clinical decision making and guidance of therapy (surgical revascularization or medical management) in patients with this congenital coronary anomaly.

CLINICAL RELEVANCE/APPLICATION

Utilization of FFRct analysis in the evaluation of patients with malignant right coronary anomalies is feasible and offers a one-stop-shop assessment of the anatomical and physiological aspects of this clinical entity, thereby potentially playing an important role in clinical decision making and guidance of therapy (surgical revascularization or medical management) in patients with this congenital coronary anomaly.

SSK03-06 Combined Anatomic and Functional CT Evaluation in Adult Congenital Heart Disease using High-Pitch Helical CTA/Low-Dose Function Protocol--An Approach for Dose Reduction While Maintaining Image Quality

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S502AB

Participants

Tust Techasith, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Dominik Fleischmann, MD, Palo Alto, CA (*Abstract Co-Author*) Research support, Siemens AG;
Beverley M. Newman, MD, MBBCh, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Frاندیس P. Chan, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Many congenital heart disease (CHD) patients have absolute contraindications to cardiac MR. Cardiac CT has good correlation with cardiac MR for ventricular function assessment and the ability to provide robust anatomic delineation of the complex CHD anatomy; however, its use has been limited by radiation dose. We evaluated a combined high-pitch helical (FLASH) CTA/low-dose function protocol for the evaluation of cardiac anatomy and function in adult CHD patients, in comparison to traditional ECG-modulated retrospective acquisition.

METHOD AND MATERIALS

A retrospective review of all adult CHD patients who underwent a CTA between May 1, 2014 and January 31, 2016 was performed, for the identification of patients who received anatomic and functional evaluation via a combined FLASH CTA/low-dose function (lowered reference mAs to 20% throughout) protocol. Demographics and technical parameters were recorded. Comparison of radiation dose and objective image quality (SNR & CNR) between the combined protocol and matched simulated controls (for traditional ECG-modulated retrospective acquisition) was performed.

RESULTS

Seventeen adult CHD patients underwent the combined FLASH CTA/low-dose function protocol. The radiation dose using the combined protocol was significantly less than the matched simulated controls for ECG-modulated retrospective acquisition, with effective dose of 4.74 vs. 6.66 mSv ($p < 0.05$). Image quality (SNR and CNR) of the combined protocol compared to the matched simulated controls at three locations (RV, LV, and IV septum) demonstrated no significant difference (all p -values > 0.05).

CONCLUSION

The combined FLASH CTA/low-dose function protocol is a clinically advantageous method compared to traditional ECG-modulated retrospective acquisition for the evaluation of anatomy and function in adult CHD patient who cannot undergo cardiac MR. The combined protocol is able to provide similar diagnostic image quality, while significantly reducing the effective radiation dose.

CLINICAL RELEVANCE/APPLICATION

Adult CHD is a growing patient population with a large portion of patients with implanted medical devices, making cardiac MR contraindicated. CTA is an alternative for the evaluation of cardiac anatomy and function in these patients. The combined FLASH CTA/low-dose function protocol provides diagnostic images at a reduced radiation dose compared to the traditional ECG-modulated retrospective protocol.

SSK03-07 Right Ventricle Function and Volumes Assessment in Congenital Heart Disease using CMR Compressed Sensing Real-time Cine Imaging

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S502AB

Participants

Julien Pagniez, MD, Lille, France (*Presenter*) Nothing to Disclose
Hedi Farah, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Benjamin Longere, MD, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Mathilde Vermersch, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Michaela Schmidt, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Christoph Forman, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Alain Duhamel, PhD, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Francois Pontana, MD, PhD, Lille, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the reliability of real-time cine imaging using the compressed sensing (CS) technique (Sparse 2D cine, Siemens Healthcare) for quantification of right ventricular (RV) function and volumes in congenital heart disease (CHD).

METHOD AND MATERIALS

32 consecutive patients (15 males, 17 females; mean age = 21 ± 7.5 years) were evaluated with cardiac magnetic resonance

32 consecutive patients (19 males, 17 females, mean age = 21 ± 7.9 years), were evaluated with cardiac magnetic resonance (CMR) in the clinical context of CHD for either initial work-up or following repair (tetralogy of Fallot: n=17, pulmonary atresia with ventricular septal defect: n=6, cardiac shunt: n=3, others: n=6). Single ventricle anatomy was excluded. For each patient, two series of cine images were systematically acquired: (a) a standard segmented multi-breath-hold steady-state free precession (bSSFP) sequence including short-axis stack, one four-chamber slice, one long-axis slice (Group 1) and (b) an additional real-time CS single-breath-hold prototype sequence (Group 2) providing the same slice number, position and thickness as the reference technique. Two radiologists independently assessed image quality and measured RV ejection fraction (RVEF) and RV volumes for both acquisition techniques.

RESULTS

The mean acquisition time for the CS single-breath-hold sequence was 19.2 ± 3.5 seconds. The image quality of Group 2 was diagnostic in all examinations, mostly rated as good (n= 25/32). There was a high correlation between Group 1 and Group 2 images regarding (a) the RVEF measured 49.6 ± 7.4% vs 47.9 ± 7.8% respectively (r=0.92); and (b) the RV end-diastolic volume indexed to body surface area measured 122.0 ± 30.9 ml/m² vs 124.9 ± 33.6 ml/m² respectively (r=0.97).

CONCLUSION

Compressed sensing real-time cine imaging enables, in one breath-hold, a reliable assessment of RV function and volumes in patients with CHD in comparison with standard SSFP cine imaging.

CLINICAL RELEVANCE/APPLICATION

As complex anatomy in CHD often requires extensive CMR examinations, use of CS cine can significantly reduce acquisition time without compromising RV assessment accuracy.

SSK03-08 Cardiac Magnetic Resonance Quantification of Ventricular Volumes in Patients with Congenital Heart Disease: Three-dimensional Threshold-based Segmentation Versus Simplified Contouring

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S502AB

Participants

Hyun Woo Goo, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To compare three-dimensional (3D) threshold-based segmentation using 3D whole heart MR angiography with simplified contouring using two-dimensional (2D) cardiac cine MRI in measuring ventricular volumes with flow volumes of the great arteries using phase contrast imaging as reference standard.

METHOD AND MATERIALS

In 110 patients with congenital heart disease (median age 18 years, age range 4 months–35 years; M:F=74:36), navigator-gated, contrast-enhanced, 3D whole heart MR angiography was acquired during end-systole (ES) and end-diastole (ED) as well as conventional cardiac cine imaging and phase contrast imaging of the great arteries. Cases showing mitral or tricuspid regurgitation greater than grade 1 (1 and 30 datasets, respectively) were excluded. ES and ED volumes were measured by using 3D threshold-based segmentation for 3D whole heart MR angiography and by using simplified contouring for 2D cardiac cine MRI. Stroke volumes calculated from ventricular volumes were correlated with flow volumes of the great arteries.

RESULTS

Higher correlations with flow volumes of the great arteries were observed in stroke volumes from simplified contouring than in those from 3D threshold-based segmentation for the left ventricle (LV) (r = 0.90 vs. 0.85) and the right ventricle (RV) (r = 0.90 vs. 0.77). Flow volumes of the ascending aorta showed no significant difference (mean difference = 0.02 ml, p = 0.98) with LV stroke volumes from 3D threshold-based segmentation but significant difference (mean difference = -8.7 ml, p < 0.001) with those from simplified contouring. In contrast, flow volumes of the pulmonary artery showed no significant difference (mean difference = 0.4 ml, p = 0.83) with RV stroke volumes from simplified contouring but significant difference (mean difference = 22.7 ml, p < 0.001) with those from 3D threshold-based segmentation.

CONCLUSION

Stroke volumes calculated from ventricular volumes correlate well with flow volumes of the great arteries, slightly higher for 3D threshold-based segmentation. Simplified contouring may overestimate LV stroke volumes and 3D threshold-based segmentation may underestimate RV stroke volume.

CLINICAL RELEVANCE/APPLICATION

For ventricular volume quantification, 3D threshold-based segmentation using 3D whole heart MR angiography needs to be technically improved particularly in acquiring ED RV volume correctly.

SSK03-09 Left Ventricle Function Quantified with CMR 4D Flow

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S502AB

Participants

Raluca G. Chelu, MD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

Piotr A. Wielopolski, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Consultant, Bracco Group; Scientific Advisor, Zebra Medical Vision Ltd; Advisory Board, Quantib BV

Albert Hsiao, MD, PhD, San Diego, CA (*Abstract Co-Author*) Founder, Arterys, Inc Consultant, Arterys, Inc Research Grant, General Electric Company

Shreyas S. Vasanawala, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research collaboration, General Electric Company; Consultant, Arterys Inc; Research Grant, Bayer AG;

Koen Nieman, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Quantification of stroke volume is an integrative part of the work-up of patients with structural heart disease. Cardiac magnetic resonance is a robust and validated method for this quantification, but requires cooperation from the patient and special skills from the technician. The purpose of our study was to use the imaging technique "CMR 4D flow" to quantify the stroke volume of left ventricle and used the standard CMR technique as reference.

METHOD AND MATERIALS

Between 2014-2016 we have prospectively included 24 patients that had a clinical CMR and an extra 4D flow scan. The acquisition was performed using a 1.5T whole body scanner. Images for the standard CMR were reviewed by two radiologists with two and ten years of experience in CMR and the 4D flow images were reviewed by a radiologist with five years of CMR experience.

RESULTS

The mean age of the population was 31 years old and 5 were females. The mean stroke volume measured with 4D flow was 86 (+/- 14) ml/beat. The mean enddiastolic and endsystolic volumes were 161 (+/- 39) ml and 75 (+/- 36) ml. When measured with standard CMR, the mean EDV was 171 (+/- 40) ml, the mean ESV 79 (+/- 33) ml and the mean stroke volume 91 (+/- 18) ml. The Pearson correlations were 0.93, 0.97 and 0.7 for end-diastolic, endsystolic and stroke volume respectively.

CONCLUSION

4D flow may be feasible for evaluating left ventricle function.

CLINICAL RELEVANCE/APPLICATION

CMR 4D flow may replace the standard CMR examinations in congenital patients

SSK04

Cardiac (General Topics I)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S504AB

CA **CT** **MR**

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

FDA Discussions may include off-label uses.

Participants

Carole J. Dennie, MD, Ottawa, ON (*Moderator*) Nothing to Disclose
Phillip M. Young, MD, Rochester, MN (*Moderator*) Nothing to Disclose
Lisa Diethelm, MD, New Orleans, LA (*Moderator*) Nothing to Disclose

Sub-Events

SSK04-01 High Incidence of Renal Artery Stenosis in Post TAVI Acute Kidney Injury: Should Renal Artery Evaluation Become a Part of Pre TAVI Workup?

Participants

Orly Goitein, MD, Ramat Gan, Israel (*Presenter*) Research Grant, Koninklijke Philips NV
Orna Komisar, MD, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Israel Barbash, Ramat gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Victor Guetta, Tel Hashomer, Israel (*Abstract Co-Author*) Nothing to Disclose
Amit Segev, Tel Hashomer, Israel (*Abstract Co-Author*) Proctor, Edwards Lifesciences Corporation
Paul Fefer, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Elad Asher, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Sagit Benzekry, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Anat Berkovich, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Ashraf Hamdan, MD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Elio Di Segni, MD, Tel Hashomer, Israel (*Abstract Co-Author*) Nothing to Disclose
Boris Orlov, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Eli Konen, MD, Ramat Gan, Israel (*Abstract Co-Author*) Research Consultant, RadLogics Inc
Yafim Brodov, MD, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Acute kidney injury (AKI) is a frequent complication after transcatheter aortic valve implantation (TAVI) affecting outcome and survival. The presence of atherosclerotic disease in the renal arteries might be related to post TAVI AKI, not previously addressed in this context. Objective: To quantify and correlate the presence and extent of RAS to post TAVI AKI.

METHOD AND MATERIALS

AKI was defined as Valve Academic Research Consortium -2 (VARC-2) score ≥ 1 . Patients with AKI were matched to patients with baseline creatinine > 1.4 mg/dl (non AKI group). The presence and severity of RAS was measured using MDCT curved multiplanar reformats and graded as $< 50\%$ or $\geq 50\%$ and $> 75\%$ in the renal artery ostium and proximal third (4 renal segments per patient).

RESULTS

AKI group (N=69; mean age 82 ± 6 ; 60% female, renal segments N=276). Non-AKI group (N=36; mean age 82 ± 7 ; 49% female, renal segments N=144). AKI group: RAS $\geq 50\%$ and $> 75\%$ was seen in 27 and 15 segments, respectively. Non AKI group: RAS $\geq 50\%$ and $> 75\%$ was seen in 3 and 2 segments, respectively (P=0.003, P=0.04).

CONCLUSION

There is a statistically significant higher rate of RAS in AKI as compared with non- AKI patients. This suggests that the presence and severity of RAS may be a risk factor for post TAVI AKI. Thus, we propose that renal artery evaluation should be an integral part in pre-TAVI workup. Further studies are needed in order to elucidate the role of RAS in AKI.

CLINICAL RELEVANCE/APPLICATION

Post TAVI AKI is a dreaded complication. RAS may play a role in its occurrence. Dedicated MDCT renal artery evaluation may identify patients predisposed for AKI.

SSK04-02 CT Predictors of the Clinically Significant Moderate Coronary Stenosis

Wednesday, Nov. 30 10:40AM - 10:50AM Room: S504AB

Participants

Irina Timofeeva, MD, PhD, Saint-Denis, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Louis Sablayrolles, Saint Denis, France (*Presenter*) Nothing to Disclose
Laurent Macron, Saint Denis, France (*Abstract Co-Author*) Nothing to Disclose
Philippe Guyon, MD, PhD, Saint-Denis, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study CT predictors for the clinical significance of moderate coronary stenosis by coronary CT angiography (CCTA) in comparison with fractional flow reserve (FFR) studying by quantitative coronary angiography (QCA).

METHOD AND MATERIALS

A total of 87 patients underwent CCTA were retrospectively analyzed. 43 patients (61 lesions, group 1) with FFR assessment were studied by 256-MDCT one-beat axial acquisition, three-phase injection protocol by using smart shot dual injector. 44 patients (group 2) were examined by 64 MDCT only to compare dose and contrast volume changes. Moderate stenosis (50-69%) with FFR $\leq 0,80$ were considered as clinically significant.

RESULTS

The average age was $67,9 \pm 10,1$, BMI $27,3 \pm 4,4$ kg/m² and 75% were males. No difference between coronary stenosis degree and length measured by CCTA and QCA ($p > 0,10$ and $p > 0,94$ respectively) were observed. There was a substantial significant difference demonstrated the prevalence of new acquisition mode of 256 MDCT in dose and contrast volume reduction. Thus, total exam dose reduction in 1st group was -73% (220 ± 82 mGy-cm vs 815 ± 493 mGy-cm, $p < 0,000$) and the reduction of contrast volume of -38,6% ($67,5 \pm 2,3$ ml vs 110 ± 0 ml, $p < 0,000$). 29% (18 arteries) from the 1st group have clinically significant moderate stenoses with FFR $\leq 0,8$; 23% (n=14) have moderate but not clinically significant stenoses (FFR $> 0,80$) and 48% (n=29) were presented by stenoses $< 50\%$. All of stenosis $< 50\%$ were clinically insignificant with FFR $> 0,8$ ($p < 0,05$, 100% negative predictive value (NPV)). Moderate stenosis are more likely clinically significant with FFR $\leq 0,8$ if their length ≥ 16 mm (sensitivity (ss) 78%, specificity (sp) 79%, PPV 82%, NPV 73%, $p = 0,004$); if they are presenting multiple stenosis in calcified arteries with the stenosis's length ≥ 16 mm (sp 86%, PPV 85%, $p = 0,012$).

CONCLUSION

The CT predictors for clinical significance of moderate stenosis were the stenosis length more than 16 mm with multiple stenosis in calcified arteries.

CLINICAL RELEVANCE/APPLICATION

High reliability of CT predictors of clinical significance of moderate stenosis with a drastic radiation dose reduction, time and cost saving efficiency consider CTA as a new gold standard for the patient management.

SSK04-04 Associations between Renal Function, Urinary Albumin Excretion and Left Ventricular Mass and Function: A Population-based MR Imaging Study

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S504AB

Awards

Trainee Research Prize - Resident

Participants

Iлона A. Dekkers, MD, MSc, Leiden, Netherlands (*Presenter*) Nothing to Disclose

Renee De Mutsert, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Ton J. Rabelink, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Wouter J. Jukema, MD, Leiden, Netherlands (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, AstraZeneca PLC; Research Grant, BIOTRONIK GmbH & Co KG; Research Grant, Boston Scientific Corporation; Research Grant, DAIICHI SANKYO Group; Research Grant, Eli Lilly and Company; Research Grant, sanofi-aventis Group; Research Grant, Medtronic plc; Research Grant, Merck & Co, Inc; Research Grant, Pfizer Inc; Research Grant, OrbusNeich; Research Grant, Novartis AG; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, SERVIER; Research Grant, The Medicine Company; Speaker, Astellas Group; Speaker, AstraZeneca PLC; Speaker, BIOTRONIK GmbH & Co KG; Speaker, Boston Scientific Corporation; Speaker, DAIICHI SANKYO Group; Speaker, Eli Lilly and Company; Speaker, sanofi-aventis Group; Speaker, Medtronic plc; Speaker, Merck & Co, Inc; Speaker, Pfizer Inc; Speaker, OrbusNeich; Speaker, Novartis AG; Speaker, F. Hoffmann-La Roche Ltd; Speaker, SERVIER; Speaker, The Medicines Company;

Albert De Roos, MD, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Frits R. Rosendaal, MD, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Aiko P. de Vries, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Hildo J. Lamb, MD, PhD, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Left ventricular (LV) hypertrophy and dysfunction is highly prevalent in advanced kidney disease and is an important predictor of cardiovascular morbidity and mortality. Our aim was to investigate associations between renal function (eGFR-EPI), urinary albumin excretion (UAE), urinary albumin creatinine ratio (UACR), and LV mass, LV systolic and LV diastolic function in the general population.

METHOD AND MATERIALS

This study was approved by the institutional review board, and all participants gave informed consent. In this cross-sectional analysis of the Netherlands Epidemiology of Obesity Study a subset of 1,139 healthy participants (51% male, 97% Caucasians) underwent cardiac MR imaging to assess LV geometry, LV systolic and diastolic function. Linear regression analysis was performed while adjusting for age, sex, smoking, mean arterial pressure, total body fat and visceral adipose tissue.

RESULTS

Mean (SD) age was 56 (6) years, eGFR 85.9 (13) ml/min/1.73 m², median UAE (ICR) 3.57 mg/L (1.77), median UACR (ICR) 0.42 (0.39) mg/mmol. Per SD of eGFR, LVMI increased with 0.115 g [95% ci: 0.02 to 0.21] and LVCI with 0.165 L/min/m² [0.07 to 0.26]. After adjustment for potential confounders these associations attenuated to 0.115 g [-0.00 to 0.23] for LVMI and 0.149 L/min/m² [0.06-0.24] for LVCI. eGFR was not associated with LVEF and E/A ratio. Per SD of log transformed UAE, LVMI increased with 0.155 g [0.09 to 0.22] and for UACR with 0.003 g [-0.09 to 0.09]). After adjustment UAE and UACR were both associated with LVMI; 0.160 g [0.07-0.25] for UAE and 0.160 g [0.05-0.27] for UACR. UAE and UACR were not associated with LVCI, LVEF and E/A ratio.

CONCLUSION

Even within a normal range, renal function and urinary albumin excretion are associated with LV mass and systolic function in the general population and may influence LV mass and function above and beyond known cardiovascular risk factors such as age, sex, blood pressure, smoking and BMI. These findings support the hypothesis that renal function influences cardiac remodelling in the general population.

CLINICAL RELEVANCE/APPLICATION

The study results shed light on the relation between renal function, urinary albumin excretion and LV geometry and function in the general population.

SSK04-05 A Preliminary Study of Coronary CT Angiography within Single Cardiac Cycle in Patients with Atrial Fibrillation Using 256-Row Detector CT

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S504AB

Participants

Bo Wen, MD, PhD, Beijing, China (*Presenter*) Nothing to Disclose
Zhanming Fan, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Lei Xu, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Junfu Liang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the image quality and radiation dose of CCTA in single cardiac cycle using a 256-row detector CT in patients with atrial fibrillation (AF).

METHOD AND MATERIALS

Fifty-nine patients with persistent or paroxysmal AF during scan (33 men and 26 women; 62.2 ± 10.6 years; BMI, 25.8 ± 3.5 kg/m²) were enrolled. All the examinations were performed on a 256-row detector CT (Revolution CT, GE healthcare) in single cardiac cycle with 100 kV or 120 kV and 100-450 mA using kV Assist and Smart mA techniques. The patients were separated into group A (HR ≥ 75 bpm, n=31) or B (HR < 75 bpm, n=28) according to the HR during acquisition and group I (≥ 50 , n=23) or II (< 50, n=36) according to HR variability. Each dataset was reconstructed at best phase. If necessary, snapshot freeze (SSF) reconstruction was used to reduce motion artifact. Two experienced radiologists, blinded to the ECG and reconstruction information, independently graded the images (1 = excellent, 2 = good, 3 = poor, 4 = insufficient). Subjective image quality scores and effective dose (ED) were calculated and compared.

RESULTS

The mean HR of 59 patients ranged between 28 and 222 bpm (86 ± 26.9). On the patient-basis, the image qualities of 57 CT angiograms (96.6%) were high enough for diagnosis, 2 (3.4%) were considered nonevaluable. On the segment-basis, 748 of 761 coronary artery segments were diagnostically evaluable (98.3%). In 24 of 57 evaluable patients (42%), the SSF technique was applied and thus showed improved image quality ($t=7.459$, $P<0.001$). There was no statistical difference in image quality between group A and B ($t=1.217$, $P>0.05$), nor was there a difference with respect to the HR variability ($t=0.486$, $P>0.05$). The ED (mSv) was 3.06 ± 2.38 for general and 3.84 ± 2.46 , 2.26 ± 2.18 , 3.83 ± 2.47 , and 2.50 ± 2.45 for group A, B, I and II, respectively. A statistically significant difference was revealed between group A and B ($t=2.54$, $P<0.05$), but there was no significant difference between group I and II ($t=1.876$, $P>0.05$).

CONCLUSION

The image quality of CCTA within single cardiac cycle at a considerably low radiation dose was satisfactory in most patients with AF.

CLINICAL RELEVANCE/APPLICATION

It has good feasibility in patients with AF for that single cardiac cycle scan and SSF technique can improve image quality and scan success rate at a considerably low radiation dose.

SSK04-06 Magnetic Resonance Evaluation of Cardiac Thrombi and Masses by T1 and T2 Mapping

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S504AB

Participants

Thibault Caspar, MD, MSc, Strasbourg, France (*Presenter*) Nothing to Disclose
Soraya El Ghannudi-Abdo, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Mickael Ohana, MD, MSc, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Patrick Ohlmann, MD, PhD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Anthony Schultz, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Aissam Labani, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Michel De Mathelin, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Catherine Roy, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Afshin Gangi, MD, PhD, Strasbourg, France (*Abstract Co-Author*) Proctor, Galil Medical Ltd
Philippe Germain, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate CMR T1 and T2 mapping sequences in patients with intracardiac thrombi and masses in order to assess T1 and T2 relaxometry usefulness and to allow better etiological diagnosis.

METHOD AND MATERIALS

This observational study of patients scheduled for routine cardiac MRI was performed from September 2014 to August 2015. All patients referred to our department for a 1.5T CMR were screened to participate. The native T1 (MOLLI) and T2 mapping images were obtained by the Siemens Tx-mapping WIP780 package before injection of Gadolinium.

RESULTS

41 patients were included. 22 presented with cardiac thrombi and 19 with cardiac masses. The native T1 of thrombi was 1037 ± 152 ms (vs 1032 ± 39 ms for myocardium, $p=0.88$; vs 1565 ± 88 ms for blood pool, $p<0.0001$). The post-gadolinium T1 relaxation time of thrombi was significantly higher than T1 of myocardium (731 ± 208 vs 339 ± 67 ms, $p<0.0001$) and as compared with blood pool T1 (222 ± 52 ms, $p<0.0001$). Post contrast T1 decrease were respectively 29.5% (thrombus), 67.2% (myocardium) and 85.8% (blood pool). T2 were 74 ± 13 ms (vs 51 ± 3 ms for myocardium, $p<0.0001$; vs 170 ± 32 ms for blood pool, $p<0.0001$). Recent thrombi

had a native T1 shorter than old thrombi (911 ± 177 vs 1169 ± 107 ms, $p=0.01$). The types of masses were as follow: 2 myxomas, 2 papillary fibroelastomas, one hemangioma, one rhabdomyoma, 4 lipomas, 5 calcified masses, one lymphoma, and 3 metastases. The masses having a shorter T1 than the myocardium were lipomas (278 ± 29 ms), calcifications (621 ± 218 ms), and melanoma (736ms). These masses with a short T1 could be distinguished by : (i) the post-gadolinium T1, which did not decrease significantly for lipomas and calcifications (-1.5%) as compared to the melanoma (-59%) (ii) the value of T2 : low for calcifications (42 ± 7 ms), intermediate for the melanoma (58 ms) and very high for lipomas (111 ± 12 ms). All other masses showed T1 values higher than myocardial T1, with T2 consistently increased over 70 ms. The high values of both T1 (1800ms) and T2 (180ms) of fibroelastomas should be emphasized.

CONCLUSION

T1 and T2 mapping CMR sequences can be useful and represent a new approach for the evaluation of cardiac thrombi and masses.

CLINICAL RELEVANCE/APPLICATION

To be able to quantify T1 and T2 values of cardiac masses seems to be very interesting in the seek for incremental discriminative diagnostic performance of CMR.

SSK04-07 Multiyear Follow-up of Patients with Bicuspid or Tricuspid Aortic Valve, Assessing Aortic size and Hemodynamic Stress Using 4D Flow MRI

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S504AB

Participants

Ozair A. Rahman, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Emilie Bollache, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Michael Rose, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Kenichiro Suwa, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Alex Barker, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Michael Markl, PhD, Chicago, IL (*Abstract Co-Author*) Institutional research support, Siemens AG; Consultant, Circle Cardiovascular Imaging Inc;
Patrick L. McCarthy, MD, Lisle, IL (*Abstract Co-Author*) Nothing to Disclose
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

Monitoring the progression of aortopathy is crucial in patients with congenital aortic valve disease. Nonetheless, it is difficult to predict which patients may be at risk for aneurysm or dissection. Abnormal transvalvular blood flow, such as high velocity jets and eccentric hemodynamic wall shear stress (WSS) may detect those at risk of environmentally mediated aortopathy development. Accordingly, we studied the multiyear evolution of the transvalvular hemodynamics and regional aorta size in patients with either a bicuspid (BAV) or tricuspid (TAV) aortic valve using 4D flow MRI.

METHOD AND MATERIALS

A retrospective IRB approved and HIPAA compliant study was conducted on patients with BAV ($n=20$, age: 44 ± 12 years) or TAV with dilation of the thoracic aorta ($n=20$, age: 69 ± 5 years), and healthy controls ($n=5$, age: 60 ± 10 years), who underwent two aortic 4D flow MRI exams (follow-up duration: 2.72 ± 0.63 years for BAV; 1.65 ± 0.83 years for TAV; 1.38 ± 0.47 years for controls). Images were subsequently analyzed using custom software (Matlab, The Mathworks, USA), resulting in ascending aortic maximal velocity, WSS quantification and Contrast-Enhanced MRA was used to measure diameter. Furthermore, a regional WSS analysis was performed in 4 ascending aortic segments (Figure 1A). Two sided t-test was calculated for between group differences.

RESULTS

A significant increase in maximal velocity was found between baseline and follow-up exams in BAV patients ($P=0.012$) (Figure 1B, Figure 1C), but no significant change was observed in TAV patients ($P=0.17$) or controls ($P=0.40$). In addition, BAV patients had a significant decrease in aortic WSS at follow-up, while no change was obtained in TAV patients and controls (Figure-E). Finally, the mid-ascending aorta significantly grew over time in BAV ($p<0.009$), as well as TAV patients ($p<0.02$), but remained insignificant in controls ($p<0.23$) (Figure-E).

CONCLUSION

We found a significant increase over time in aortic maximal velocity in both BAV and TAV patients. In addition, the aortic dilation in BAV patients was accompanied by a decrease in WSS, potentially illustrating a BAV-specific sensitivity to remodel in the presence of high velocity transvalvular jets and high WSS.

CLINICAL RELEVANCE/APPLICATION

The identification of factors associated with aortopathy in bicuspid aortic valve patients, including hemodynamics, is crucial to improve the ability to identify high-risk features associated with progression of aortopathy.

SSK04-08 Apical Late Gadolinium Enhancement in Predicting Adverse Cardiac Events in Patients with Mid-Ventricular Hypertrophic Obstructive Cardiomyopathy

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S504AB

Participants

Lu Li, BA, Beijing, China (*Presenter*) Nothing to Disclose
Shihua Zhao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Apical aneurysm has been considered an independent risk factor in hypertrophic cardiomyopathy (HCM). This subgroup also behaves differently in apical late gadolinium enhancement (LGE). The purpose of our study is to investigate the role of apical LGE in predicting adverse cardiac events in midventricular hypertrophic obstructive cardiomyopathy (MVHOCM) patients.

METHOD AND MATERIALS

A prospective study of 28 patients from Jan,2008 to Mar,2015 with MVHOCM who underwent MRI were followed up for 28.46±3.31 (range from 4 to 63) months, and were divided into apical LGE(+) group(14) and apical LGE(-) group(14). LGE scores were assessed according to the AHA 17-segment model,apical LGE was analyzed on the horizontal or vertical long axis of the left ventricle. There are 4 modes of adverse cardiac events (1)sudden cardiac death (SCD) (2) end-stage or burnt out HCM (meaning an ejection fraction <50% and dilated phenotype) or died due to HF;(3)stroke-related death; (4) potentially lethal arrhythmic incidents such as ventricular tachycardia or fibrillation, resuscitated cardiac arrest and appropriate implantable defibrillator (ICD) discharge

RESULTS

The incidence of adverse cardiac events is higher in apical(+)group (57.14[8/14]) compared with apical (-) group(7.14%[1/14] ,P=0.037).Significances between apical(+)and apical (-) group are found in LGE scores (11.71±1.22 vs 7.21±1.15, p=0.013), Left Ventricular End diastolic Volume Index(LVEDVI) (121.82±9.74 vs 90.60±7.50,p=0.017), Left Ventricular End systolic Volume Index(LVESVI) (52.04±6.28 vs 32.31±2.95,p=0.011). In logistic regression analysis, apical LGE is an independent determinant of adverse cardiac events (p=0.03) ,while LGE score is not an independent determinant (p=0.35).

CONCLUSION

Apical LGE shows unfavorable outcomes in MVHOCM patients,which is notable for attention in clinical practice.

CLINICAL RELEVANCE/APPLICATION

(Dealing with LGE) "Apical LGE can demonstrate unfavorable outcomes in MVHOCM patients thus is worthy to be considered in clinical strategy"

SSK04-09 Role of Surface Coils in the Evaluation of Myocardial Edema in Patients affected by Acute Myocardial Infarction (AMI) and Acute Myocarditis (AM)

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S504AB

Participants

Federica Ciolina, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Cristian Borrazzo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Rosa Maria Ammendola, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Nicola Galea, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Francone, MD, Rome, Italy (*Abstract Co-Author*) Speakers Bureau, Bracco Group
Iacopo Carbone, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate myocardial edema in patients affected by AMI and in patients with suspicious AM in terms of signal intensity (SI), signal to noise ratio (SNR) and contrast to noise ratio (CNR) using T2w-short-tau inversion recovery (STIR) sequences acquired with body coils and with both body coils and surface coils.

METHOD AND MATERIALS

37 patients with diagnosis of AMI or with clinical suspicious of AM (average age 51±14,1) underwent a cardiac magnetic resonance (CMR) using a 1.5 T scanner (Magnetom Avanto; Siemens) equipped with high gradient system (32 channels body coil and surface coils).T2-STIR sequences were acquired in short axis planes using body coil and both body and surface coils. Quality and quantity analysis were done comparing T2-STIR values, CNR and SNR obtained using body coils and both body and surface coils. All values were compared with native T1.Statistical analysis was done using t test and p values were considered significant with p<0.005.

RESULTS

21(57%) patients with AMI (group A) and 16(43%) patients with suspicious of AM (group B) were evaluated.T2-STIR values of SI obtained using body coil and using both body and surface coils resulted in group A of 244,28±28,74 vs 191,65±17,12, in group B of 201,4±65,13 vs 176,14±59,31 (p<0,0001).SNR and CNR were in group A of 107 vs 8,7 and 48,7vs 3; in group B of 66,7 vs 7,8 and 26,7 vs 1,5 (p<0,0001). Native T1 mapping values measure in both groups confirmed the presence of edema (group A of 1101,38 ± 72,14; group B of 1087,2 ± 70,82 (p<0,0001).

CONCLUSION

Surface coils coupled with body coils enable a better detection of myocardial edema in AMI and in suspicious myocarditis.

CLINICAL RELEVANCE/APPLICATION

The use of surface coils coupled with body coils allow to obtain images with high SNR and CNR compared to images obtained using only body coil. In this way it is possible a better detection and quantification of myocardial edema in patients affected by AMI and in cases with suspicious myocarditis.

SSK05

Chest (Vascular/Interventional)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S404CD

CH **VA** **CT** **IR** **MR**

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

Participants

Jonathan H. Chung, MD, Chicago, IL (*Moderator*) Royalties, Reed Elsevier; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Boehringer Ingelheim GmbH; Consultant, Veracyte, Inc
David F. Yankelevitz, MD, New York, NY (*Moderator*) Royalties, General Electric Company

Sub-Events

SSK05-01 Prospective Randomized Comparison of High-Pitch CT under Free Breathing with Standard-Pitch CT under Breath Hold for Detection of Pulmonary Embolism

Participants

Katharina Martini, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Andreas A. Meier, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Kai Higashigaito, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Natalia Saltybaeva, PhD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Hatem Alkadhi, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Thomas Frauenfelder, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively compare high pitch computed tomography (HPCT) under free breathing (FB) with standard pitch CT (SPCT) under breath-hold (BH) for the detection of pulmonary embolism (PE).

METHOD AND MATERIALS

In this IRB-approved prospective study, 100 consecutive patients (47 females, 53 males; mean age 58.7±16.6) randomly underwent HPCT under FB (n=50) or SPCT under BH (n=50). Radiation doses were documented for all scans. One reader measured mean pulmonary artery attenuation, noise; mean signal to noise ratio (SNR) was calculated. Two independent readers assessed overall image quality (5-point Likert scale), diagnostic confidence for detection or exclusion of PE, motion artifacts, assessability of anatomical structures, and presence of transient interruption of contrast as sign of Valsalva maneuver. Inter-reader agreement was calculated.

RESULTS

Radiation dose was significantly lower in HPCT as compared to SPCT (6.01±2.26 mGy vs. 2.68±0.60; p<0.001). Mean pulmonary artery attenuation and image noise were significantly higher in HPCT (attenuation: 479HU vs. 343, p<0.001; noise: 16HU vs. 10HU, p<0.001) whereas SNR was similar between groups (34HU vs. 38HU; p=0.258). Images of both groups were of diagnostic quality. HPCT showed to have significantly higher diagnostic confidence for detection of PE (p=0.048), less cardiac and breathing artifacts (p<0.001) and better assessability of anatomical structures (p<0,001) compared to the SPCT group. Additionally, there were significantly less cases showing Valsalva maneuver/transient interruption of contrast in the HPCT group compared to the SPCT group (p<0.001).

CONCLUSION

HPCT under free breathing allows for a significant reduction of breathing and cardiac motion artifacts compared to SPCT under breath hold. Diagnostic confidence and assessability of vascular and bronchial structures as well as SNR were maintained.

CLINICAL RELEVANCE/APPLICATION

HPCT allows for significant reduction of motion artifacts, transient interruption of contrast and provides high diagnostic confidence despite patients do not need to follow breathing instructions

SSK05-02 C-Arm Computed Tomography Adds Diagnostic Information in Patients with Chronic Thromboembolic Pulmonary Hypertension and a Positive V/Q SPECT

Wednesday, Nov. 30 10:40AM - 10:50AM Room: S404CD

Participants

Jan Hinrichs, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Werncke, MD, Dipl Phys, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Till F. Kaireit, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Marius Hoeper, Hannover, Germany (*Abstract Co-Author*) Consultant, Actelion Ltd; Consultant, Bayer AG; Consultant, GlaxoSmithKline plc; Consultant, Pfizer Inc
Karen Olsson, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank K. Wacker, MD, Hannover, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Pro Medicus Limited; Research Grant, Delcath Systems, Inc;
Frank M. Bengel, MD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Lantheus Medical Imaging, Inc; Research Grant, General Electric Company; Research Grant, Bracco Group; Consultant, Lantheus Medical Imaging, Inc; Advisory Board, General Electric Company; Speaker, General Electric Company; Speaker, Siemens AG ; Speaker, Bayer AG
Christian Von Falck, MD, Hannover, Germany (*Abstract Co-Author*) Research Grant, Pro Medicus Limited Research Grant, Siemens AG
Imke Schatka, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernhard C. Meyer, Hannover, Germany (*Presenter*) Research Consultant, Pro Medicus Limited

PURPOSE

To determine if C-Arm computed tomography (CACT) has added diagnostic value in patients suffering from chronic thromboembolic pulmonary hypertension (CTEPH) with a positive mismatch pattern in V/Q single photon emission computed tomography (SPECT).

METHOD AND MATERIALS

Twenty-eight patients (23 men, 62±18y) with CTEPH who had undergone SPECT, followed by CACT and right heart catheterization (RHC) were included. Patients with combined V/Q defects were excluded. Two independent readers reviewed SPECT and CACT. CTEPH-indicating findings and their location (segmental or sub-segmental) were identified (V/Q mismatch in SPECT and vascular pathologies in CACT). Inter-modality agreement was calculated (Cohen's Kappa). Findings were scored on a 3-point-scale. The sum of the score (pulmonary artery CTEPH severity score (PACSS)) was calculated for each patient and imaging modality, correlated to RHC (spearman rho) and compared to the final therapeutic decision of the CTEPH board (including the consensus of SPECT, selective pulmonary DSA and CACT).

RESULTS

Overall, 504 pulmonary artery segments were assessed in SPECT and CACT. SPECT had identified 266/504 (53%) arterial segments without and 238/504 (47%) with pathologic V/Q mismatch. CACT detected 131/504 (26%) segments without pathologic findings and 373/504 (74%) with pathologic findings. Inter-modality agreement for V/Q mismatch in SPECT vs. pathology on CACT was fair ($\kappa=0.38$). Median PACSS based on SPECT V/Q mismatch was 10 [7.75/13.5; 25/75 quartile], compared to a median PACSS of 15 [13.75/17] in CACT ($p=0.01$). PACSS of CACT correlated mildly significant with mean pulmonary artery pressure ($R=0.47$, $p=0.01$), whereas SPECT missed significance ($R=0.3$, $p=0.12$). Discrepant findings were mostly attributed to a higher frequency of sub-segmental pulmonary arterial pathologies on CACT (145 sub-segmental pathologic findings) rated as normal on SPECT.

CONCLUSION

In patients with CTEPH, contrast-enhanced CACT is of additional value for a more precise morphological assessment of distal pulmonary arteries. CACT indicates abnormalities even in segments without V/Q abnormalities.

CLINICAL RELEVANCE/APPLICATION

SPECT perfusion scanning underestimates the extent of pulmonary vascular lesions and thus disease severity in comparison to CACT with potentially high clinical impact in case of missed diagnosis of CTEPH.

SSK05-03 Noncontrast Lung Perfusion Imaging with Arterial Spin Labeling MRI

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S404CD

Awards

Student Travel Stipend Award

Participants

Christopher Maroules, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Josh Greer, BS, Rowlett, TX (*Abstract Co-Author*) Nothing to Disclose
Ananth J. Madhuranthakam, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Ivan Pedrosa, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Kelly Chin, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Fernando Torres, MD, 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
Ronald M. Peshock, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Few studies have evaluated lung perfusion imaging with noncontrast arterial spin labeling (ASL) magnetic resonance imaging (MRI). We sought to evaluate the feasibility of ASL MRI at 3 Tesla in healthy volunteers and patients with pulmonary vascular disease.

METHOD AND MATERIALS

The study consisted of 10 healthy volunteers and 10 patients with pulmonary arterial hypertension (PAH), mean age 42 years. All subjects underwent lung perfusion MRI at 3 Tesla, including 2-dimensional (2D) flow alternating inversion recovery with an extra radiofrequency pulse (2D ASL-FAIRER). 2D phase contrast imaging of the pulmonary arteries was performed to measure pulmonary artery flow. A subgroup ($n=10$) underwent repeat 2D ASL-FAIRER on the same day for evaluation of test-retest reproducibility. Regional perfusion was quantified using an established perfusion equation. Relative dispersion (standard deviation of image intensity divided by the mean) was measured to assess heterogeneity in pulmonary perfusion. Inter-observer and test-retest reproducibility were evaluated using the Bland-Altman method. Spearman correlation was used to evaluate associations between regional perfusion and pulmonary artery flow. The Wilcoxon signed-rank test was used to compare relative dispersion between healthy volunteers and patients with PAH.

RESULTS

2D ASL-FAIRER regional lung perfusion in all subjects was within the normal range of 400-600 mL/100g/min. Regional perfusion by 2D ASL-FAIRER demonstrated high inter-observer reproducibility (-45 ± 120 mL/100g/min) and moderate test-retest reproducibility (62 ± 252 mL/100g/min). There was good correlation between perfusion in the right lower lobe and pulmonary artery flow ($r=0.72$, $p=0.02$), and weaker correlation between perfusion in the right upper lobe and pulmonary artery flow ($r=0.49$, $p=0.03$). The relative dispersion of lung perfusion was higher in patients with PAH compared to healthy volunteers (1.25 ± 0.41 vs 0.93 ± 0.32 , $p=0.06$), but this difference did not reach statistical significance.

CONCLUSION

Noncontrast 2D ASL-FAIRER measurement of regional lung perfusion at 3 Tesla is feasible and demonstrates good reproducibility. ASL-derived regional lung perfusion correlates with phase contrast pulmonary artery flow.

CLINICAL RELEVANCE/APPLICATION

Regional lung perfusion imaging with noncontrast ASL at 3 Tesla is a feasible technique and may provide new quantitative

biomarkers for evaluating pulmonary vascular 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/>

Suhny Abbara, MD - 2014 Honored Educator

SSK05-04 Comparison of Unenhanced and Contrast Enhanced MRI of the Pulmonary Vasculature in the Detection of Pulmonary AV-Malformations (PAVM) in Patients with Hereditary Hemorrhagic Telangiectasia (HHT / Osler's Disease)

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S404CD

Participants

Philippe Jagoda, MD, Homburg/Saar, Germany (*Presenter*) Nothing to Disclose
Jonas Stroeder, MD, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander Massmann, MD, Homburg/Saar, Germany (*Abstract Co-Author*) Nothing to Disclose
Arno Buecker, MD, Homburg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Consultant, Bracco Group; Speaker, Bracco Group; Consultant, Medtronic plc; Speaker, Medtronic plc; Research Grant, Novartis AG; Research Grant, GlaxoSmithKline plc; Research Grant, Biotest AG; Research Grant, OncoGenex Pharmaceuticals, Inc; Research Grant, Bristol-Myers Squibb Company; Research Grant, Eli Lilly & Company ; Research Grant, Pfizer Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, sanofi-aventis Group; Research Grant, Merrimack Pharmaceuticals, Inc; Research Grant, Sirtex Medical Ltd; Research Grant, Concordia Healthcare Corp; Research Grant, AbbVie Inc; Research Grant, Takeda Pharmaceutical Company Limited ; Research Grant, Merck & Co, Inc; Research Grant, Affimed NV; Research Grant, Bayer AG; Research Grant, Johnson & Johnson; Research Grant, Seattle Genetics, Inc; Research Grant, Onyx Pharmaceuticals, Inc; Research Grant, Synta Pharmaceuticals Corp; Research Grant, Siemens AG; Research Grant, iSYMED GmbH; Research Grant, St. Jude Medical, Inc; Co-founder, Aachen Resonance GmbH; Guenther K. Schneider, MD, PhD, Homburg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group;

PURPOSE

Since PAVMs are a common finding in HHT patients and paradoxical thromboembolism may result in significant morbidity and mortality due to cerebral strokes or abscess formations, a safe and reliable method to detect these AV malformations is needed to allow for early minimal invasive treatment by catheter embolization. MRI of the pulmonary vessels can be considered a preferable method for this purpose, since no x-ray or iodinated contrast agents are needed. The aim of our study was to compare Gd-enhanced MRA with unenhanced MR imaging technique of the pulmonary vasculature in detection of PAVMs.

METHOD AND MATERIALS

62 patients with HHT underwent 100 MR examinations between 2011 and 2015. During each examination a non contrast enhanced SPACE (3D TSE-sequence/ TR 4.733 ms/ TE 101 ms/ FLIP 150°) and a contrast enhanced 3D GRE MRI sequence (TR 2,87ms/ TE 1,07 ms/ FLIP 25°, 0.1 mmol/kg BW MultiHance) were acquired. Both examinations were read by two experienced radiologists and the number of detected AV-Malformations was reported in mutual agreement for each examination. The contrast enhanced images were read first and after a blanking interval of 6 weeks, the SPACE was read by the same radiologists; blinded to the results of the first reading. In those patients that underwent interventional treatment, catheter angiography and in all other patients CE-MRA served as the gold standard. A paired t-test was utilized for statistical evaluation.

RESULTS

1 Examination was excluded due to respiratory artifacts in both sequences. 18 AV-malformations requiring therapy were reported in 16 patients. Using contrast enhanced images, an overall significantly higher number of AV-malformations was detected (60 vs. 41, $p < 0.001$) but none of the AV-malformations requiring therapy were missed using the unenhanced SPACE sequence.

CONCLUSION

Clinical relevant PAVMs in HHT patients can be identified using a non-contrast enhanced SPACE sequence, thus allowing for imaging especially in pediatric patients or pregnant patients without the need of contrast injection. However, small PAVMs are missed and thus to rule out even small PAVMs in adult patients, CE-MRA should be performed.

CLINICAL RELEVANCE/APPLICATION

The detection of clinical relevant pulmonary AV-malformations can be safely performed in patients with contraindications for i.v. contrast medium (e.g. pregnancy) by using a SPACE sequence.

SSK05-05 Preoperative CT-guided Microcoil Localization Facilitates Lung Parenchymal Spring Surgery in Patients at High Risk for Development of New Primary Lung Cancers with Local Recurrence Rates Comparable to Lobectomy

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S404CD

Awards

Student Travel Stipend Award

Participants

Carol Donagh, MBBCh, Vancouver, BC (*Presenter*) Nothing to Disclose
Richard Finley, MD, West Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Joanne Clifton, MS, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
John English, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Stephen Lam, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
John R. Mayo, MD, Vancouver, BC (*Abstract Co-Author*) Speaker, Siemens AG

PURPOSE

Lung cancer screening programs increase the detection of early T1 non-small cell lung cancers in high risk patients. After resection, these patients often develop new primary lung cancers requiring further surgery. Historically, unguided wedge resections of T1 non-small cell lung cancers recur locally in up to 30% of patients. We hypothesized that pre-operative localization of these nodules using percutaneous CT guided microcoil localization (CTML) followed by fluoroscopic guided VATS wedge resection would provide clean resection margins with low local recurrence rates while preserving lung parenchyma facilitating future localized resections of new primary tumours

METHOD AND MATERIALS

CTML and VATS wedge resection of NSLC was performed in 106 patients (59 women){median 64 (34-81) years}. Serial chest CTs (6-12 month postoperative intervals) and were reviewed by 2 chest radiologists for local, local/regional and distant cancer recurrences and new primaries. Median follow-up was 82 (32-136) months.

RESULTS

Resections after CTML were 53 diagnostic/therapeutic wedge (D/TW) alone or 53 diagnostic wedges followed by therapeutic lobectomy (DW/TL). The groups were matched for histopathology and stage at surgery. There was no significant 90-day morbidity or mortality. The overall recurrence rate was 13.2%. 3% developed recurrence at the resection margin, 2% locoregional disease in the ipsilateral lung or mediastinum and 8.4% metastatic disease. There were no statistical differences in recurrence rate or type between the coil group and lobectomy group. 17 patients (16%) patients developed new primary lung tumors in the follow up period.

CONCLUSION

CTML of small primary lung cancers followed by fluoroscopic guided VATS wedge resection preserves lung parenchyma and has a low recurrence rate, comparable to diagnostic wedge and lobectomy. This spares lung parenchyma in a patient group with high risk of new lung primary malignancy.

CLINICAL RELEVANCE/APPLICATION

CTML should be considered for surgical management of T1 lung cancer to preserve lung parenchyma and facilitate future surgical treatment of new primary lung cancer.

SSK05-06 Experience with a Tract Sealant System for Percutaneous CT-Guided Lung Nodule Biopsies in an Oncology Population

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S404CD

Participants

Patricia M. de Groot, MD, Houston, TX (*Presenter*) Nothing to Disclose
Girish S. Shroff, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Judy U. Ahrar, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Bradley S. Sabloff, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Cesar Moran, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jeremy J. Erasmus, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Sanjay Gupta, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Garrett M. Gladish, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Gregory W. Gladish, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Joe Y. Chang, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tract sealants are being used more frequently to reduce pneumothoraces and chest tube placement in patients undergoing lung biopsy. These tracts can be visible on follow-up imaging and can mimic the appearance of malignant tract seeding. The purpose of our study was to characterize these tracts and determine the likelihood of malignant seeding.

METHOD AND MATERIALS

Over a 15 month period 407 lung biopsies were performed using a BioSentry Tract Sealant System; 321 cases had follow up CT studies. 4 chest radiologists retrospectively analyzed imaging to determine the incidence, appearance, temporal relationship and evolution of biopsy tracts. Tracts that decreased or did not change on follow-up were considered benign. 10 surgically resected cases were retrospectively examined by a pathologist for malignant tract seeding.

RESULTS

321 cases were analyzed. 237 (74%) had a visible biopsy tract on CT (95%CI 0.69, 0.78) (primary lung cancer n=90, metastases n=81, benign nodule n=66). All tracts were identified on 1st follow-up imaging at 1-3 months post-biopsy. Tracts were typically serpiginous and smooth or lobulated with a thickness of 2-5 mm. 218/237 (92%) tracts were unchanged over time (mean follow up, 12 months). 15/237 (6.3%) decreased in thickness. Unchanged or decreasing tracts were considered negative for malignant seeding. Increase in tract thickness or nodularity occurred in 4/237 (1.7%), suspicious for malignant tract seeding. 0/90 (0%) biopsy tracts in primary lung cancer showed progressive increase. 4/81 (4.9%) tracts in patients with metastases showed increase (mean, 99 days post-biopsy). 10 resected nodules/tracts (5 primary NSCLCs, 5 metastases) had no malignant seeding at histology.

CONCLUSION

A biopsy tract on CT is common after lung biopsy using the BioSentry device. Malignant seeding of the biopsy tract occurred only after biopsy of metastases from extrathoracic primary malignancies and manifested as a progressive increase in tract thickness. Further studies are needed to assess whether the use of this new device increases the frequency of tract seeding in this patient group.

CLINICAL RELEVANCE/APPLICATION

Tracts from biopsy of primary lung cancers using the BioSentry device had no malignant seeding and they should have no impact

These non-invasive, or primary, lung cancers using the procedure, device had no malignant seeding and they should have no impact on surgical resection or localized radiation therapy. Patients undergoing lung biopsy for metastasis had a higher than expected rate of tract increase suspicious for seeding, requiring further investigation.

Honored Educators

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Jeremy J. Erasmus, MD - 2015 Honored Educator

SSK05-07 Utility of 3.0 T MRI for Dynamical and Long-term Observation in the Ablated Zone of Lung Nodule Postcryotherapy-A Pilot Study

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S404CD

Participants

Jing Li, Zhengzhou, China (*Presenter*) Nothing to Disclose

Hailiang Li, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess Magnetic Resonance Imaging (MRI) features after percutaneous cryotherapy for malignant lung nodules.

METHOD AND MATERIALS

A prospective IRB-approved analysis of 26 patients who underwent percutaneous cryoablation treatment for malignant lung nodule was included in this study. All procedures were performed using general anesthesia and CT guidance. Unenhanced and dynamic contrast-enhanced MRI scans were obtained at precryoablation and 1-day, 1-week, 1-, 3-, 6- and 12-month postcryoablation. Two radiologists independently and double-blindly reviewed MRI images, signal intensity of the ablated zone on both T1WI and T2WI were evaluated by a 5-point grading scale. The changing characters of nodule volume, signal intensity on T1WI and T2WI over time were summarized. Tumor volume and time-signal intensity curves of the nodule at each time point was also recorded.

RESULTS

(1) Scores of signal intensity on T1WI and T2WI by two observers showed good consistency, Kappa coefficient was 0.872, 0.856. (2) The mean volume at each time point were 15.15, 99.64, 72.50, 32.19, 11.49, 7.81 and 5.86 cm³. (3) The ablated zone showed heterogeneous signal intensity on T1WI and T2WI at 1-day postcryoablation, signal intensity increased at 1-week on T1WI and 1-month on T2WI postcryoablation, then decreased at 3-month and remain the same at 6- and 12-month postcryoablation. (4) The ablation zone showed no definite enhancement at 1-day, 1-week and 1-month and mild delayed enhancement at 3-, 6- and 12-month postcryoablation. (5) Cavitations occurred in 34.6% (9/26) cases and gradually resolved. (6) Four patients (17.4%, 4/23) had progression in the ablation zone, none of the patients had needle tract metastasis.

CONCLUSION

Patients who underwent cryotherapy for lung nodules treatment had characteristic changes on follow-up MRI, including: the volume of the nodule increased at 1-day, 1-week and 1-month, then gradually decreased. The signal intensity on T1WI and T2WI increased heterogeneously from 1-day to 1-month and continually decreased to homogeneous muscle-like level. Absence of a complete hypo-intense rim at 1-week and 1-month and cavitations at 1-month postcryoablation were suggestive of tumor progression. One week to 3-month postcryoablation was an important time period to observe significant change of the ablated zone.

CLINICAL RELEVANCE/APPLICATION

MRI is valuable in identifying the ablated zone and can reflect its evolution with time.

SSK05-08 Incidence and Risk Factors of Delayed Pneumothorax after Percutaneous Transthoracic Needle Biopsy (PTNB) under Cone-Beam CT (CBCT) Guidance in 4308 Patients

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S404CD

Awards

Student Travel Stipend Award

Participants

Woo Hyeon Lim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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

Hyun-Ju Lim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Jong Hyuk Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the incidence, risk factors and clinical significance of delayed pneumothorax after cone-beam CT (CBCT)-guided percutaneous transthoracic needle biopsy (PTNB) in 4308 consecutive patients.

METHOD AND MATERIALS

From January 2009 to November 2015, 4308 consecutive patients (2575 men and 1733 women; mean age 63.4 ± 12.3 years-old) underwent 4692 CBCT-guided PTNBs for lung lesions (mean target size, 3.2 ± 2.0 cm). Delayed pneumothorax was defined as pneumothorax that was not detected on immediate post-procedural CT scan, but found on follow-up chest radiographs. The incidence and risk factors of delayed pneumothorax after PTNBs and those of chest drainage tube insertion due to delayed pneumothorax were investigated.

RESULTS

Among 4692 PTNBs, delayed pneumothorax occurred in 284 procedures (6.1%). Target location, size, emphysema, pleura to target distance, pleural passage number, needle indwelling time, and biopsy-needle size were significantly associated with the occurrence of delayed pneumothorax according to univariate analysis. Subsequent multivariate analysis revealed that upper/middle lobe location (odds ratio [OR]=1.342; C.I, 1.032 - 1.746), smaller target size (OR=0.840 ; C.I, 0.772 - 0.913), presence of emphysema (OR=2.324; C.I, 1.554 - 3.475), deeply located target (OR=1.175; C.I, 1.100 - 1.255), longer needle indwelling time (OR=1.047; C.I, 1.016 - 1.078), and use of smaller biopsy-needles (20-22G) (OR=0.524; C.I, 0.361 - 0.761) were significant risk factors for delayed pneumothorax. Sex, age, and pleural passage number were not significantly associated with the occurrence of delayed pneumothorax. In addition, among the 284 patients with delayed pneumothorax, 27 patients underwent chest tube insertion due to delayed pneumothorax (9.5%). Only emphysema was found to be a significant risk factor for the placement of a chest drainage tube (OR=4.089; C.I, 1.677 - 9.970).

CONCLUSION

The incidence of delayed pneumothorax was 6.1% (284 of 4692) among all PTNBs of which 9.5% (27 of 284) underwent chest tube drainage procedures. Significant risk factors for delayed pneumothorax include emphysema, smaller target size, deeper location and longer needle indwelling time.

CLINICAL RELEVANCE/APPLICATION

Awareness of the significant risk factors for the occurrence of delayed pneumothorax and subsequent chest tube insertions can help in the screening and management of patients at high risk.

SSK05-09 Image Guided Percutaneous Pleural Biopsy Diagnostic Yield and Accuracy for Benign and Malignant Pleural Lesions

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S404CD

Participants

Joao R. Inacio, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Bann Saffar, MBChB,FRANZCR, Perth, Australia (*Abstract Co-Author*) Nothing to Disclose
Chantale Belanger, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Ashish Gupta, MD, Ottawa, ON (*Abstract Co-Author*) Grant, Medtronic plc
Carolina A. Souza, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Jean M. Seely, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Carole J. Dennie, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Primary goal was to determine the diagnostic yield, accuracy and complications of imaging-guided percutaneous biopsy of pleural lesions. Secondary goal was to assess technique and pleural lesion variables that correlate with accurate final diagnosis.

METHOD AND MATERIALS

A retrospective study was conducted between 2002 and 2013, and among 548 pleural biopsies performed at a single academic centre, 108/548 (19.7%) biopsies were performed under image guidance. A total of 108 biopsies were performed in 86 patients under computed tomography (CT) (n=53), ultrasound (US)(n=38) or fluoroscopy (n=17) guidance. Clinical data, pleural lesion imaging features, biopsy technique, complications and final diagnosis were reviewed. Yield and accuracy were calculated per modality and benign and malignant pleural lesions.

RESULTS

Pleural biopsies (fine needle aspirate and/or core) were adequate for final diagnosis in 74/86 (86%). Rate of repeat biopsy was 20% (17/86). Thoracoscopy or thoracotomy was required for final diagnosis in 12/86 (14%). Final diagnoses included malignancy (n=72) or suspected malignancy (n=3) in 87% and benign lesions (n=9) or negative for malignancy (n=1) in 12%. Of the 108 biopsies, 4% had complications (2 pneumothorax, 1 hydropneumothorax and 1 needle-tract seeding). Pleural lesion size was lower ($p < 0.05$) for CT guided group (17 ± 13 mm), compared to US (31 ± 21 mm) or fluoroscopy (35 ± 18 mm), and diffuse linear or nodular pleural thickening was more frequent in the CT 41/53 (79%) and fluoroscopy 11/17(65%) compared to US 10/38 (26%) group ($p < 0.05$). For diagnosing benign pleural disease, pleural biopsy sensitivity was 100%, specificity 94.7 and accuracy 95.3%. For malignant pleural disease, sensitivity was 91.9, specificity 90.9% and accuracy 91.8%. Overall, imaging-guided pleural biopsy had 92.9% sensitivity, 94.2% specificity and 93.5% accuracy.

CONCLUSION

Image-guided pleural biopsy has high diagnostic yield and accuracy for both malignant and benign lesions, with low complication rates.

CLINICAL RELEVANCE/APPLICATION

Image guided pleural biopsy is a safe procedure with high diagnostic yield and accuracy. In a selected population with confident pleural lesion imaging identification, image guided percutaneous pleural biopsy should be considered for pleural pathology diagnosis in alternative to thoracoscopy or surgical pleural biopsy.

SSK06

Gastrointestinal (Quantitative Imaging)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: E353A



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

FDA Discussions may include off-label uses.

Participants

Dushyant V. Sahani, MD, Boston, MA (*Moderator*) Research support, General Electric Company; Medical Advisory Board, Allena Pharmaceuticals, Inc
Alvin C. Silva, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose

Sub-Events

SSK06-01 Hepatic Perfusion CT Yields Early Imaging Biomarkers for Treatment Response of Sorafenib on Hepatocellular Carcinoma

Participants

Yuko Nakamura, MD, Bethesda, MD (*Presenter*) Nothing to Disclose
Toru Higaki, PhD, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Wataru Fukumoto, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Chikako Fujioka, RT, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Masao Kiguchi, RT, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, Eisai Co, Ltd; Medical Advisor, General Electric Company; ; ; ;
Akira Taniguchi, RT, Tokyo, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Makoto Iida, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Sorafenib inhibits excessive angiogenesis of abnormal arteries seen in advanced hepatocellular carcinoma (HCC). Hepatic perfusion CT facilitates the quantitative evaluation of hepatic arterial- and portal venous perfusion. We investigated whether perfusion CT performed before- and 1 week after sorafenib administration yields imaging biomarkers for the survival of HCC patients.

METHOD AND MATERIALS

We evaluated 51 HCC patients (11 women, 40 men, mean age 68.9 years, mean survival 250 days) who underwent perfusion CT before- and 1 week after sorafenib therapy. Serum alpha-fetoprotein (sAFP) and des-γ-carboxyprothrombin were recorded before sorafenib administration. We measured arterial and portal perfusion in their hepatic tumor and liver parenchyma [(AP)(PP)tumor], [(AP)(PP)liver] before and after sorafenib administration. The perfusion ratio was calculated by dividing the post- by the pre-sorafenib value. The effect of each value on the overall survival rate was analyzed with the Cox proportional hazards model; statistically significant parameters were subjected to receiver operating characteristic (ROC) analysis based on 250-day survival after sorafenib administration to determine the overall survival rate with the Kaplan-Meier method.

RESULTS

By univariate Cox regression analysis, sAFP and pre-sorafenib A_Ptumor were significantly associated with the overall survival rate (p=0.04 and 0.03, respectively). The A_Ptumor ratio tended to be associated with the overall survival rate (p=0.06). The optimal cut-off value for sAFP, pre-sorafenib A_Ptumor, and the A_Ptumor ratio was 133ng/mL, 82.1 mL/min/100 mL, and 1.1 by ROC analysis, respectively. By the Kaplan-Meier method the overall survival rate was higher in patients with sAFP≤133 ng/mL, with pre-sorafenib A_Ptumor >82.1 mL/min/100 mL, and with A_Ptumor ratio≤1.1 (log rank, p=0.01, 0.03, and 0.03, respectively).

CONCLUSION

Not only sAFP, but also pre-sorafenib A_Ptumor, and the A_Ptumor ratio were significantly associated with the overall survival rate, suggesting that early evaluation by hepatic perfusion CT yields imaging biomarkers for predicting overall survival in HCC patients treated with sorafenib.

CLINICAL RELEVANCE/APPLICATION

On hepatic perfusion CT scans, pre-sorafenib A_Ptumor and the A_Ptumor ratio are promising imaging biomarkers for predicting the overall survival rate in sorafenib-treated HCC patients.

SSK06-02 Early Treatment Response Evaluation after Yttrium-90 Radioembolization of Hepatocellular Carcinoma with Quantitative CT Analysis

Wednesday, Nov. 30 10:40AM - 10:50AM Room: E353A

Participants

Sungwon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jin-Young Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Do-Young Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Yun Won, MD, 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 evaluate quantitative computed tomography (CT) perfusion analysis for assessment of early treatment response after Yttrium-

90 transarterial radioembolization (TARE) in patients with hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

Dynamic contrast-enhanced CT was performed before and 4 weeks after transarterial radioembolization in 45 patients (35 men and 10 women; mean age, 61 years) with HCC. Enhancement maps of the liver were made by subtracting precontrast images from delayed phase images before and after the TARE. The portion of the liver which enhances less than the mean enhancement plus one standard deviation of the normal liver parenchyma was segmented out. The difference between remaining over-threshold areas of the tumoral and peritumoral enhancement before and after TARE was divided by the initial tumor area (the increased area of delayed enhancement per tumor size; IDEPT). The difference between nonenhancing areas within tumors (INPT) before and after TARE per tumor size was also computed. All processes were performed in a quantitative method by in-house programming written by Matlab. Kaplan-Meier curves were plotted to illustrate tumor recurrence rates.

RESULTS

Post-treated HCCs with IDEPT over 25% showed significantly longer recurrence-free periods than those with IDEPT less than 25% ($P = .0184$). The hazard ratio of the tumor recurrence was 8.42 ($P = .045$) for IDEPT <25% group versus IDEPT >25% group. HCCs with high INPT had a tendency to have longer recurrence-free periods but, did not reach statistically significant difference.

CONCLUSION

Quantitative analysis of the tumor and peritumoral delayed enhancement difference before and 4 weeks after TARE seems to predict tumor recurrence-free periods in patients with HCCs. In early follow up, the increased necrotic area may not predict the potential for recurrence.

CLINICAL RELEVANCE/APPLICATION

Early treatment response evaluation after Yttrium-90 radioembolization can help physicians to determine whether the patients need an early additional treatment or not.

SSK06-03 The Role of Volume Perfusion Computed Tomography (VPCT) for Evaluation of HCC Response to Sorafenib

Wednesday, Nov. 30 10:50AM - 11:00AM Room: E353A

Participants

Wolfgang M. Thaiss, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Sascha Kaufmann, Tuebingen, Germany (*Presenter*) Nothing to Disclose

Christopher Kloth, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Sven Schneeweiss, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Michael Bitzer, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Ulrich Lauer, 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

PURPOSE

To investigate the impact of sorafenib on perfusion parameters of tumors and uninvolved liver parenchyma by volume perfusion computed tomography (VPCT) and to assess interim therapy response in patients with advanced Hepatocellular Carcinoma (HCC).

METHOD AND MATERIALS

VPCT was performed in 29 HCC patients (70.6y, SD 10) before initiation of sorafenib therapy and after therapy. Changes in tumor and liver parenchyma perfusion measurements were assessed between baseline (BL) and follow-up (FU, mean 3 months, range 2-4) and compared to mRECIST response criteria. Response to sorafenib was classified by FU as response (R, time to progression >6 months) or non-response (nonR, time to progression <6 months). VPCT was performed for 40-sec using 80 kV, 100/120 mAs, 64x0.6 mm collimation, 26 consecutive measurements, i.v. injection (50 ml iodinated contrast), flow rate (5 ml/s). Blood flow (BF), blood volume (BV), arterial liver perfusion (ALP), portal-venous perfusion (PVP) and the hepatic perfusion index (HPI) were registered both in tumor and non-involved liver parenchyma. Permeability was additionally assessed for HCCs. Paired t-test was used for FU and unpaired t-test for group comparisons, p-values were adjusted for multiple testing.

RESULTS

One patient was lost in FU. 14 were R and 14 were nonR according to mRECIST. Time to progression was 114.1d (SD 40.2) in the nonR group and 295.4d (SD 108, $p < 0.0001$) for the R group (one complete remission). Perfusion parameters did not vary between groups at BL. Significant differences existed for all perfusion parameters between nonR and R at FU (e.g. BF mean nonR: 44.6 mL/100mL/min (SD 10.3), FU 48.7 (SD 17.8); BF mean R: 47.6 mL/100mL/min (SD 25.8), FU 29.4 (13.6); n.s. at BL, $p = 0.00013$ at FU) and for R between BL and FU ($p = 0.0035$ for BF). Permeability decreased in R (36.4 mL/min (SD 28), FU 26.6 (SD 12.6), $p = 0.011$) and varied significantly to nonR ($p = 0.00013$). No significant differences existed for normal liver parenchyma neither for time or group factor.

CONCLUSION

Perfusion parameters were significantly different in HCC patients that responded (mRECIST) to sorafenib treatment both between baseline and follow-up as well as compared to non-responders at follow-up.

CLINICAL RELEVANCE/APPLICATION

VPCT perfusion parameters accurately assess the impact of sorafenib therapy on HCCs and may predict progression after initial follow-up after 3 months. Larger studies are needed for confirmation.

SSK06-04 CT Perfusion of Colorectal Cancer: Impact of 4D Volume Coverage on Quantitative Analysis

Wednesday, Nov. 30 11:00AM - 11:10AM Room: E353A

Awards

Student Travel Stipend Award

Participants

Hongliang Sun, MD, Beijing, China (*Presenter*) Nothing to Disclose
Yanyan Xu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wu Wang, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
ying hou, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the feasibility of CT perfusion imaging in adaptive 4-dimensional(4D)-volume mode in patients with colorectal cancer (CRC), and to compare quantitative measurements between 2-dimensional regions of interest (2D-ROI) and 3-dimensional volumes of interest (3D-VOI).

METHOD AND MATERIALS

Sixty patients with biopsy-proven CRCs were enrolled in this study. They underwent CT perfusion imaging in a 4D-volume mode with 320-slice CT. Quantitative perfusion analysis (artery flow [AF], blood volume [BV], flow extraction product [Ktrans]) were performed by using modified Patlak mode in 2D-ROI and 3D-VOI, respectively. The differences of perfusion quantitative parameters in 2D-ROIs and 3D-VOIs were analyzed by using paired samples t test or Wilcoxon signed ranks test. Intra- and inter-observer agreement for 2D-ROIs and 3D-VOIs analysis was evaluated using the intraclass correlation coefficient (ICC) and Bland-Altman analysis.

RESULTS

No significant differences were found between the values of perfusion quantitative parameters based on 2D-ROIs and 3D-VOIs analysis. Intra- and inter-observer reproducibility in 2D-ROIs and 3D-VOIs were relatively good to excellent, respectively. The intra-observer 95% limits of consistency of perfusion parameters(AF, BV, Ktrans) were (-33.9~13.5)%、(-62.8~77)%、(-87.1~73.3)% with 2D-ROIs, respectively; (-33.5~11.8)%、(-44.7~50.6)%、(-64.5~48.5)% with 3D-VOIs, respectively; The inter-observer 95% limits of consistency of perfusion parameters(AF, BV, Ktrans) were (-49.2~13.9)%、(-57.6~48.4)%、(-71.9~72.3)% with 2D-ROIs, respectively; (-39.6~11.3)%、(-42.6~37.1)%、(-64.7~61.9)% with 3D-VOIs, respectively.

CONCLUSION

There were no statistically differences between 2D-ROI and 3D-VOI analysis of colorectal cancer CT perfusion parameters. However, the 3D-VOI analysis appropriately improves intra- and inter-observer consistency, reflecting perfusion parameters more accurately and repeatedly.

CLINICAL RELEVANCE/APPLICATION

Considerable colorectal cancer heterogeneity was found in both qualitative and quantitative analysis with the use of 4D volume perfusion techniques for both imaging and perfusion parameters analysis.

SSK06-05 Study of Intra-Patient Variability and Reproducibility of Quantitative Tumor Perfusion Parameters Evaluated with Dynamic Contrast-enhanced Ultrasonography

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E353A

Participants

Nathalie B. Lassau, MD, PhD, Villejuif, France (*Presenter*) Speaker, Toshiba Corporation; Speaker, Bracco Group
Benedicte Coiffier, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Laura Faivre, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Bernard Asselain, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Stephanie Pitre-Champagnat, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Serge Koscielny, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Dynamic Contrast Enhanced Ultrasonography (DCE-US) is a functional imaging technique enabling quantitative assessment of solid tumor perfusion in metastatic patients treated with antiangiogenic therapies. A multicentric study including 539 patients validated the area under the curve parameter (AUC) as correlated to freedom from progression and overall survival. The objective of this prospective monocentric study was to evaluate the intra-patient variability and reproducibility of DCE-US criteria by comparing the two perfusion curves obtained for a same patient on the same metastasis during 2 visits performed the same day, before and after lunch.

METHOD AND MATERIALS

For each patient, two DCE-US examinations were performed at baseline, day 15 and day 30, one before and one after lunch. A 3-minute perfusion curve was recorded just after injection of Sonovue to determine seven perfusion criteria. DCE-US examinations were analyzed by pairs: pre and post prandial. Log transformed values were used to determine the variability of the two measures (coefficient of variation CV) and their reproducibility (Spearman correlation coefficient).

RESULTS

Sixty patients with cancer (23 colon, 36 kidney and 1 breast), treated by Axitinib (26), Sunitinib (27) and other anti-angiogenic treatments (7) were included. Thirty had hepatic and 30 extra-hepatic metastatic target lesions. A total of 312 DCE-US were performed. Data with a quality from 1 to 5 were available for 128 pairs of DCE-US examinations: 45 at baseline, 45 at day 15 and 38 at day 30. Pre and post prandial values were not significantly different. Three parameters were associated with a correlation coefficient above 0.8 ($p < 0.0001$): AUC ($r = 0.88$), area under the wash-out AUWO ($r = 0.88$) and area under the wash-in AUWI ($r = 0.82$). For AUC and AUWO, the range of individual variations (value after/value before lunch) was less than 2 log with parameter

values ranging over about 4 logs (CV=61% and 64% respectively). Variability was independent of the site of metastases.

CONCLUSION

This study showed that AUC and AUWO are the two most reproducible and reliable DCE-US parameters.

CLINICAL RELEVANCE/APPLICATION

AUC and AUWO are two reliable and reproducible DCE-US parameters, and relevant for the evaluation of the response to TKI treatments.

SSK06-06 Reproducibility of mRECIST in Measurement and Response Assessment for Hepatocellular Carcinoma with Transarterial Chemoembolization: Intraobserver and Interobserver Reproducibility among Multiple Readers

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E353A

Participants

Ga-Eun Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ga Ram Kang, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Joon-Il Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Moon Hyung Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Eun Rha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soon Nam Oh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Michael Y. Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Eun Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Young Byun, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this retrospective study was to evaluate the reproducibility of Modified Response Evaluation Criteria in Solid Tumors (mRECIST) for hepatocellular carcinoma (HCC) in patients who underwent transarterial chemoembolization (TACE) as a first-line treatment.

METHOD AND MATERIALS

97 patients who underwent TACE (60 conventional TACE and 37 drug-eluting beads embolization) as a first-line treatment for HCC from January 2010 to December 2014 were enrolled. Four readers (two experts in mRECIST and two non-experts) with varying degree of experience underwent the education for mRECIST first, and then evaluated the pair of contrast enhanced dynamic CT of the liver scanned within one or two months before and after TACE. They independently measured the longest diameter of target lesions (up to three hepatic lesions), and categorized the responses of target lesion by comparing sum of longest diameters (SLD) on pre- and post-TACE. They also categorized the response of non-target lesions, assessed the presence of new lesions and decided overall responses according to mRECIST. Repeated image review and size measurement were performed two or more weeks later after first review by all four readers. To assess the intra- and interobserver reproducibility of SLD, Lin's concordance correlation coefficients (ρ_c) were used. The kappa statistics (κ) were used to compare the agreement of response categorization of target lesions and overall responses.

RESULTS

Results For concordance correlation coefficient of SLD, intraobserver reproducibilities were very good ($\rho_c > 0.9$) and interobserver reproducibilities were acceptable to very good ($\rho_c = 0.8756 - 0.9756$) in all four readers. In kappa statistics, intraobserver agreements of response categorization were moderate to very good ($\kappa = 0.564-0.656$) for non-experts and very good ($\kappa = 0.853 - 0.989$) for experts for both target lesions and overall responses. Most of interobserver agreements for response categorization between any two readers were within good range ($\kappa = 0.6-0.8$).

CONCLUSION

mRECIST demonstrates acceptable intra- and interobserver reproducibilities for HCC patients treated with TACE. Intraobserver reproducibilities were better for experts in mRECIST than non-experts, even though satisfactory level in both cases.

CLINICAL RELEVANCE/APPLICATION

Response evaluation for HCC after TACE by mRECIST is robust and can be used in daily practice and multicenter studies involved by multiple radiologists..

SSK06-07 Differentiation of Malignant Thrombus from Bland Thrombus of the Portal Vein in Patient with Cirrhosis: Application of Intravoxel Incoherent Motion Diffusion-Weighted MR Imaging

Wednesday, Nov. 30 11:30AM - 11:40AM Room: E353A

Participants

Jeong Min Choi, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Eun-Suk Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Junyoung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yun Jung Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Malignant thrombus of the portal vein (PV) shows internal blood flow. On the other hand, bland thrombus does not have intra-thrombus blood flow. Our purpose of this study was to demonstrate the presence of blood flow within the malignant thrombus using intravoxel incoherent motion (IVIM) diffusion-weighted (DW) MR imaging and investigate the utility of IVIM in distinguishing bland thrombus from malignant thrombus of the PV in patients with cirrhosis or hepatocellular carcinoma.

METHOD AND MATERIALS

Forty three patients with PV thrombosis (malignant thrombus n = 29 and bland thrombus n = 14) examined with gadoxetic acid-

enhanced MR imaging including IVIM were enrolled. IVIM DW imaging was acquired with free-breathing axial single-shot echo-planar two-dimensional imaging sequence and the following eight b values: 0, 25, 50, 75, 100, 200, 500 and 800 sec/mm². Diffusion coefficient (*D*), pseudo-diffusion coefficient (*D*^{*}), and perfusion fraction (*f*) were calculated with bi-exponential model using Matlab software and were compared between malignant and bland thrombi using unpaired t-test.

RESULTS

D^{*} of malignant thrombus (mean = 67.51 × 10⁻³mm²/sec) was significantly higher than that of bland thrombus (9.31 × 10⁻³mm²/sec, *p* < 0.001). However, there was no significant difference in *f* between malignant (18.47 %) and bland thrombi (18.46 %). *D* of bland thrombus (1.35 × 10⁻³mm²/sec) was significantly higher than that of malignant thrombus (1.03 × 10⁻³mm²/sec, *p* = 0.014). However, the mean *D* difference between the two thrombi was relatively small.

CONCLUSION

Increased pseudo-diffusion coefficient (*D*^{*}) of malignant thrombus suggests higher intra-thrombus micro-perfusion, which might be due to blood flow by arterial neovascularization within the malignant thrombus. Therefore, IVIM DW imaging appears to be a promising method for the discrimination between bland and malignant PV thrombi.

CLINICAL RELEVANCE/APPLICATION

Malignant thrombus had higher pseudo-diffusion coefficient, which might be due to increased intra-thrombus blood flow by neovascularization. IVIM imaging can discriminate bland thrombus from malignant thrombus.

SSK06-08 Functional Imaging of Small Bowel: Quantitative Perfusion Analysis with Dynamic Contrast Enhanced MRI in Vascular Assessment of Crohn's Localizations to Distinguish Fibrotic from Active Disease

Wednesday, Nov. 30 11:40AM - 11:50AM Room: E353A

Participants

Sophie Lombardi, Vimercate, 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
Chiara Trattenero, MD, Sirono, Italy (*Abstract Co-Author*) Nothing to Disclose
Sandro Sironi, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To differentiate Crohn's disease small bowel activity (fibrotic from active disease) by measurement of quantitative perfusion kinetics parameters obtained from dynamic contrast-enhanced magnetic resonance imaging.

METHOD AND MATERIALS

We analyzed 43 patients with known biopsy proven CD, who underwent MR-enterography, performed on 1.5T MRI system (Achieva, Philips), using a phased array sense body multi-coil, after oral administration of 1,5-2 of PEG solution. MRE protocol included T1 weighted, sSShT2, sBTFE and gadolinium enhanced THRIVE sequences acquired on coronal and axial planes. Dedicated workstation was used to generate colour permeability maps, and after the placing of Region of Interest (ROI) on bowel site involved by CD localization the following parameters were calculated and statistically analyzed: Relative Arterial, Venous and Late enhancement (RAE, RVE, RLE), Maximum Enhancement (ME) and Time To Peak (TTP).

RESULTS

Quantitative perfusion analysis showed a good correlation with local degree of Crohn's inflammation activity, showing significant differences (*p* < 0.001) between inflamed and fibrotic bowel wall vascularity for all the evaluated parameters, obtaining higher values in active Crohn's disease bowel site. Twenty-nine out of 43 patients showed active disease (reference standard disease activity on morphologic sequences: wall bowel thickness, hyper-enhancement and layered enhancement) with following perfusion parameters: RAE (%) 116.1, RVE (%) 125.3, RLE (%) 127.1, ME (%) 1054.7, TTP (sec) 157; the same parameters calculated in patients with mural fibrosis were: RAE 56.4, RVE 81.2, RLE 85.4, ME 809.6, TTP 203.4.

CONCLUSION

Evaluation of perfusion kinetics parameters of small bowel CD lesions, by dynamic contrast perfusion-MR analysis, represents a feasible and routinely applicable complementary diagnostic tool that enables quantitative evaluation of local inflammation activity in CD patients.

CLINICAL RELEVANCE/APPLICATION

MRI sequences combined with quantitative dynamic contrast enhanced analysis can add functional information, related to bowel vascularity, useful to differentiate active from chronic lesion in CD.

SSK06-09 Texture Analysis on MRI of Low Rectal Cancer Improves Evaluation of Tumor Response and Outcome after Combined Chemoradiation Therapy

Wednesday, Nov. 30 11:50AM - 12:00PM Room: E353A

Awards

Student Travel Stipend Award

Participants

Anthony Dohan, MD, Montreal, QC (*Presenter*) Nothing to Disclose
Vipul Bist, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Stephanie Nougaret, MD, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose
Marc Ychou, MD, PhD, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose
Philippe Rouanet, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose
Christophe Cassinotto, MD, Pessac, France (*Abstract Co-Author*) Nothing to Disclose
Frederic Bibeau, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose

Caroline Reinhold, MD, MSc, Montreal, QC (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc
Benoit P. Gallix, MD, PhD, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate texture analysis (TA) on magnetic resonance images for predicting pathological tumor response grade (TRG) and disease-free survival (DFS) in patients with locally advanced rectal tumors who underwent combined chemoradiation therapy (CRT) before mesorectal excision.

METHOD AND MATERIALS

Institutional review board approval was obtained for this observational retrospective study. Fifty-two patients were included. TA was performed using TexRAD® software on single-slices T2-weighted-images before and after CRT. The tumor volume reduction ratio, TA parameters and their changes were compared with the TRG and DFS. Receiver operating characteristic (ROC) curve analyses were performed and the 3 strongest parameters were incorporated into a multivariate regression model to identify predictive factors for response and their odds-ratios (OR). A score combining these 3 factors was built and optimal cutoff value for predicting response was assessed with ROC curve analysis. DFS was estimated with the Kaplan-Meier statistic and compared between groups with the log-rank test.

RESULTS

The strongest independent predictive factors for TRG were the decrease in volume (AUC=.84;.72-.96), the decrease in mean value(ssf=0) (AUC=.82;.69-.94) and the post-CRT entropy(ssf=4) (AUC=.80;.66-.93). In multivariate analysis, the predictive factors of TRG=3 or 4 were a decrease in volume>70%(OR=9.5,P=.033), decrease in mean value(ssf=0)>15%(OR=7.2,P=.037) and a post-CRT entropy(ssf=4)<5.74(OR=21.62,P=.002). A score ranging from 0 to 6 was built. AUC of the score for predicting good response was .92(.84-.99) with a sensitivity of 84% and a specificity of 80% for a cutoff value of 3. The mean follow-up of survivors at the time of analysis was 76 months±48(SD). Patients with a score>3 had a higher DFS (P=.005).

CONCLUSION

A score combining changes in signal intensity, entropy and volumes offer the best performances to predict TRG and outcome in rectal cancer.

CLINICAL RELEVANCE/APPLICATION

MRI Texture analysis performed on rectal cancer before and after CRT allows prediction of tumor response and patients DFS.

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/>

Stephanie Nougaret, MD - 2013 Honored Educator
Caroline Reinhold, MD, MSc - 2013 Honored Educator
Caroline Reinhold, MD, MSc - 2014 Honored Educator

SSK07

Gastrointestinal (Pancreas)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: E353B



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

Participants

Koenraad J. Morteale, MD, Boston, MA (*Moderator*) Nothing to Disclose
Aliya Qayyum, MBBS, Houston, TX (*Moderator*) Spouse, Founder, In Context Reporting

Sub-Events

SSK07-01 Comparison Between MRI with MRCP and EUS for Differentiating Malignant from Benign Intraductal Papillary Mucinous Neoplasms and Mucinous Cystic Neoplasms of the Pancreas: Focusing on Mural Nodule

Participants

Jiyoung Hwang, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Young Kon Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Hye Min, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Sook Hong, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun-Joo Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yun Woo Chang, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to compare the diagnostic performance between contrast-enhanced MRI with MRCP and EUS for differentiating malignant from benign intraductal papillary mucinous neoplasms (IPMN) and mucinous cystic neoplasms (MCN) of pancreas, especially focusing on mural nodule.

METHOD AND MATERIALS

This retrospective study included a total of 55 patients with surgically confirmed 48 IPMNs (12 malignant, 36 benign) and 7 MCNs (2 malignant, 5 benign) who underwent both gadoteric acid-enhanced MRI with MRCP and EUS. Two observers independently evaluated MR images, and another observer reviewed EUS images, and recorded their confidence for malignancy of the pancreatic IPMN and MCN. Diagnostic performance (ROC curve analysis), accuracy, sensitivity, specificity, positive predictive values (PPV), and negative predictive value (NPV) were evaluated. For feature of mural nodule, comparison between the malignant and benign groups at each modality was also evaluated.

RESULTS

The area under ROC curve values of MRI for predicting malignancy of the pancreatic IPMN and MCN were significantly higher than that of EUS (0.676 and 0.652 for MRI vs 0.543 for EUS; $p < 0.05$). The diagnostic accuracies (72.7%), specificity (78.1% and 80.5%), PPV (47.1% and 46.7%), and NPV (84.2% and 82.5%) of MRI in two observers were higher than those (56.4%, 58.5%, 29.2% and 77.4%, respectively) of EUS. There was no difference between the sensitivity of MRI and EUS (57.1% and 50.0% for MRI vs 50.0% for EUS). In term of mural nodule, the ability to predict malignancy were better in MRI (42.9% in malignant group vs 9.8% in benign group, $p < 0.05$) than in EUS (50.0% in malignant group vs 36.6% in benign group, $p > 0.05$).

CONCLUSION

Compared with EUS, contrast-enhanced MRI with MRCP shows better diagnostic performance with better specificity for prediction of malignancy of the pancreatic IPMN and MCN.

CLINICAL RELEVANCE/APPLICATION

Because MR imaging with MRCP showed better diagnostic accuracy and specificity for prediction of malignancy of the pancreatic IPMN and MCN compared with EUS, MRI is recommended as primary diagnostic test in surveillance of the pancreatic IPMN and MCN. Cautious interpretation is need during evaluation of the pancreatic IPMN and MCN with EUS, particularly in presence of mural nodule.

SSK07-02 Mechanisms of Main Pancreatic Duct Dilatation in Pancreatic Neuroendocrine Tumors: Radiopathologic Correlation

Wednesday, Nov. 30 10:40AM - 10:50AM Room: E353B

Participants

Maxime Ronot, MD, Clichy, France (*Presenter*) Nothing to Disclose
Alex Faccinetto, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Jerome Cros, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Alain Sauvanet, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Marie-Pierre Vullierme, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Valerie Vilgrain, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To elucidate the mechanisms of main pancreatic duct (MPD) dilatation observed in patients with pancreatic neuroendocrine tumors (PNETs) by performing radiopathologic correlations of resected tumors.

METHOD AND MATERIALS

From 2006 to 2016 all consecutive patients with surgically proven PNET and MPD dilatation seen on pre-operative contrast-enhanced MRI were included. MR images were independently reviewed by two radiologists. Readers noted tumor size, tumor size-MPD ratio, and tumor signal and enhancement (hypo, iso or hyper compared with adjacent pancreatic parenchyma). Histopathologic analysis of the tumors included fibrosis quantification, microvessel density [MVD], and serotonin antibodies.

RESULTS

The study included 17 patients (12 men, mean 51yo. [36-79]). The primary site of PNETs was the body (53%), and head (47%). All PNETs were non-hyperfunctioning. Pathological analysis identified two groups of PNETs: sclerosing (n=11), and non-sclerosing (n=6). Sclerosing tumors were smaller (mean 12 vs. 41mm; p=0.002), with smaller size-MPD ratio (median 1.4 [0.3-3.6] vs. 4.9 [3.7-7.0], p=0.002). Sclerosing tumors had significantly lower Ki-67 (mean 1.7±0.4% vs. 5.2±1.0%, p=0.008). All but one sclerosing tumors strongly expressed serotonin, while none of the non-sclerosing did. Sclerosing tumors harboured a more abundant fibrous stroma (60 vs. 39%, p=0.04) They had comparable MVD (mean 190±17 vs. 150±23 vessel/mm², p=0.20). Most (83%) non-sclerosing PNETs were hypointense on T1-w images while most sclerosing PNETs were isointense (64%, p=0.131). Four (67%) non-sclerosing PNETs were hyperintense on T2-w images while only one sclerosing PNETs was (9%, p=0.039). The MPD size was not different (median 8.5 [6-10] vs. 7mm [4.5-25], p=0.92). On pancreatic phase, 30% and 36% of sclerosing and non-sclerosing tumors were hypervascular (p=1.00). On portal venous phase images, these proportions rose to 50% and 73%, respectively (p=0.60).

CONCLUSION

A main pancreatic duct dilatation is observed either in large tumors due to tumor compression or in smaller low-proliferative sclerosing tumor, and is explained by local fibrotic deposition due to serotonin overexpression. Imaging helps differentiate both subgroups.

CLINICAL RELEVANCE/APPLICATION

In patients with PNETs, MPD dilatation is not always due to tumor invasion, but may be explained by marked focal peritumoral fibrosis due to particular tumor phenotype. This may have consequence on patient management.

SSK07-03 Subtype Differentiation of Pancreatic Neoplasm Using Biexponential Diffusion-Weighted Imaging Models

Wednesday, Nov. 30 10:50AM - 11:00AM Room: E353B

Participants

Zhen Li, MD, PhD, Wuhan, China (*Presenter*) Nothing to Disclose
Yao Hu, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Lili Liang, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the utility of biexponential Diffusion-weighted imaging models MRI for pancreatic neoplasm subtypes compared with focal pancreatitis and normal pancreas tissues.

METHOD AND MATERIALS

The study cohort consisted of 203 patients who underwent a 3-T MRI scanner (GE Healthcare 750 discovery, USA) with diffusion-weighted imaging at 12 b values (0~1000 sec/mm²) and were found to have 77 pathologically-proven pancreatic neoplasm. Fifteen focal pancreatitis (FP) cases and 21 normal pancreas (NP) were enrolled as control. An isotropic apparent diffusion coefficient (ADC) was calculated from DWI by using monoexponential model. Pseudo-ADC (ADCfast), true ADC (ADCslow), and perfusion fraction (f) were calculated from DWI by using biexponential model. All parameters were compared by one-way analysis of variance. Multiple comparisons between groups were accomplished using LSD test.

RESULTS

The 77 pancreatic neoplasm cases were including 38 pancreatic cancer (PC), 14 pancreatic mucinouscystadenoma (PMC), 14 pancreatic serous cystadenoma (PSC) and 11 solid pseudopapillary neoplasm (SPN). Monoexponential model can be used to differentiate PC vs PMC, PSC, SPN (P<0.001, P<0.001, P=0.02, respectively); PMC vs SPN, FP, NP (all P<0.001); PSC vs SPN, FP, NP (all P<0.001); SPN vs NP (P=0.01), but not able to differentiate PMC vs PSC, PC vs FP, (all P>0.05). Biexponential model can be used to differentiate PC vs SPN (ADCslow P=0.001, ADCfast P=0.027, respectively), PC vs PMC, PSC, (ADCslow P<0.001, P=0.001, respectively), PMC and FP (ADCslow P<0.001, ADCfast P=0.004, respectively), PSC vs FP (ADCslow P<0.001, ADCfast P=0.001 respectively), PC vs FP (ADCfast P=0.03), PMC vs SPN (ADCfast P=0.004), PSC vs SPN (ADCfast P=0.001), but it may be not able to differentiate PMC vs PSC (P>0.05). There were no significant differences in f values between the pancreatic diseases (P>0.05) except between PC and NP (p=0.037).

CONCLUSION

Monoexponential diffusion-weighted imaging models combined biexponential models can provide more parameters in differentiation of pancreatic diseases, especially the biexponential models maybe better than monoexponential models.

CLINICAL RELEVANCE/APPLICATION

Compared with monoexponential DWI models, biexponential DWI models may be more helpful to differentiate pancreatic neoplasm, and it can provide more information for clinical.

SSK07-04 Prediction of Pancreatic Neuroendocrine Tumor Grade on CT Images using A Software Based Texture Analysis

Wednesday, Nov. 30 11:00AM - 11:10AM Room: E353B

Awards

Student Travel Stipend Award

Participants

Rodrigo Canellas, MD, Cambridge, MA (*Presenter*) Nothing to Disclose

Sreejita Bhowmik, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Renata R. Almeida, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Kristine S. Burk, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), 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 our study is to investigate the role of computed tomography texture analysis (CTTA) in predicting the grade of pancreatic neuroendocrine tumors (pNETs).

METHOD AND MATERIALS

In this IRB approved retrospective study, CECT scans in 59 patients with surgically verified pancreatic NETs were included for analysis. Tumors were graded based on mitotic count and Ki-67 index (2010 WHO classification). Assessments of pNETs textural features were made using commercial CTTA software (TexRAD Ltd). CTTA generated filtered and unfiltered images were assessed to quantify heterogeneity using a set of predefined histogram-based texture parameters. Mann-Whitney U test and binary logistic regression was applied through all the filters to assess their effects on the likelihood of a lesion to be grade 2 or 3 (based on the 2010 WHO classification). ROC curves were used to identify accuracy of the predictive models.

RESULTS

Out of the 59 scans, there were 31 lesions low grade and 28 intermediate/ high grade. Statistical significance difference between mean values in both groups was only found for the texture parameter Skewness, using no filtration ($p=0.036$). When no filter was used ($SSF=0$), the model combining the 6 texture parameters (Mean, Mpp, Entropy, SD, Skewness and Kurtosis) achieved an AUC equal to 0.771 ($p<.001$); using fine filtration ($SSF=2$) the AUC for the same model was 0.745 ($p=0.001$); for $SSF=3$, AUC was 0.783 ($p<.001$); for $SSF=4$, AUC was 0.854 ($p<.001$); for $SSF=5$, AUC was 0.794 ($p<0.001$); for $SSF=6$, AUC was 0.799 ($p<.001$). The model combining all parameters and filters had an AUC equal to 0.726 ($p<.001$). All the predictive models were statistically significant ($p<0.05$).

CONCLUSION

CTTA parameters can enable predicting the grade of pancreatic NETs with high accuracy (85.4%).

CLINICAL RELEVANCE/APPLICATION

The management of small pancreatic neuroendocrine tumors is evolving. Since CTTA can help predicting the tumor grade, it can potentially serve as image biomarker to guide the management of small or incidental pNET.

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

SSK07-05 Sarcopenia Assessed by Computed Tomography is a Predictor of Pancreatic Fistula Occurrence after Pancreatoduodenectomy

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E353B

Participants

Maxime Ronot, MD, Clichy, France (*Presenter*) Nothing to Disclose
Giulio C. Vitali, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Michela Assalino, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Philippe Morel, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Sylvain Terraz, MD, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Alex Andres, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Thierry Berney, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the predictive value of sarcopenia assessed by computed tomography (CT) for the development of pancreatic anastomosis leak after pancreatoduodenectomy (PD)

METHOD AND MATERIALS

This study was IRB approved. All patients undergoing PD at our institution since 2000 were included. The surface of skeletal muscles was segmented on preoperative CT at the level of L3-L4 disc space. Patients were grouped according to the presence or not of sarcopenia as defined by a skeletal muscle index $<52.4 \text{ cm}^2/\text{m}^2$ for men and $<38.9 \text{ cm}^2/\text{m}^2$ for women. Post-operative pancreatic fistulas (POPF) were scored according to the ISGPF definition. A Cox-Mantel model was used to identify factors associated with POPF, and calculate a predictive score. The score was validated using the Hosmer-Lemeshow test and by determining an optimism-corrected area under ROC curve. Optimism was assessed by 1000 iterations.

RESULTS

A total of 183 patients met inclusion criteria (109 male [60%], mean age 66 ± 11 yo), of whom 164 (90%) had PD for malignant disease, and 154 (84%) were found to be sarcopenic. POPF occurred in 50 patients with sarcopenia, and 1 without (32% vs. 3.4%; $p < 0.001$). Grade B or C POPF occurred in 33 vs. 1 patients (21% vs. 3.4%; $p = 0.020$). There was no significant difference in hospital stay, occurrence of Clavien > 2 complications or perioperative mortality. Three factors were independently associated with POPF: sarcopenia, absence of pancreas fibrosis, and peri-operative blood loss $> 500 \text{ mL}$. The derived score was calculated as

follow: 3 x sarcopenia + 3 x absence of fibrosis + 1 x blood loss. The score was well calibrated (Hosmer-Lemeshow test, $p = 0.123$). The optimism-corrected area under the ROC curve was 0.79. Five-year survival rate was significantly higher in non-sarcopenic patients (58% vs. 35%; $p = 0.040$).

CONCLUSION

Sarcopenia is a strong predictor of the occurrence of pancreatic fistula after pancreatoduodenectomy. It is easily assessable on preoperative CT. It is a potentially reversible condition, and every effort should be undertaken to correct it before surgery.

CLINICAL RELEVANCE/APPLICATION

Imaging may help identify sarcopenic patients and trigger the call for their reconditioning before pancreatoduodenectomy.

SSK07-06 Incremental Role of MRI for Determination of Preoperative Resectability and Prediction of Survival in Patients with Pancreas Ductal Adenocarcinoma

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E353B

Participants

Hye Jin Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Mi-Suk Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Eun Chung, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin-Young Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joonseok Lim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chansik An, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Song-Ee Baek, MD, 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
Jin Young Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We investigated the additional effect of contrast enhanced MRI on overall survival and recurrence free survival of pancreas ductal adenocarcinoma (PDA) patients initially assessed by CT.

METHOD AND MATERIALS

This study was approved by the institutional review board, and the requirement to obtain informed consent was waived. We performed a retrospective study of data from 342 patients diagnosed with potentially operable PDA categorized with resectable, borderline resectable, and undetermined state due to liver lesions that are too small to characterize at CT from January 2005 to December 2012. Of these patients, 250 underwent additional evaluation with MRI (CT+MR group). The 92 patients who did not undergo MR imaging are referred to as the CT group. The characteristics of the two groups were compared using a chi-square test and a t test for categorical and continuous variables, respectively. Multivariable analyses were performed using a Cox-proportional hazard model.

RESULTS

The CT and CT+MR groups were comparable in most baseline characteristics. Preoperative resectability was changed from resectable or borderline resectable to unresectable state in 27 patients (12.1%) and from undetermined to unresectable state in 8 patients (30.8%) who underwent MR evaluation after CT, respectively. On multivariate analyses, the patients with curative surgical treatment had a significantly lower overall mortality (HR, 0.37; 95% CI, 0.27-0.44) than those without surgical treatment. The overall survival rate of the CT+MR group with resectability change by MR imaging was significantly lower than that of the CT+MR group without resectability change and the CT group ($p = .002$), with 4-year survival rates of 8.7%, 21.7%, and 26.1%, and respectively.

CONCLUSION

Among patients who underwent CT analysis of a potentially resectable PDA, additional evaluation by MR imaging led to the change in operability in 14% of patients and decreased overall survival rate.

CLINICAL RELEVANCE/APPLICATION

Our study showed that the additional MR imaging showed change of preoperative resectability in a significant proportion of patients and decreased overall survival of patients who initially were assessed to have potentially operable PDA by CT.

SSK07-07 Focal Tumor-like Autoimmune Pancreatitis: The Added Diagnostic Value of Contrast-enhanced Ultrasound

Wednesday, Nov. 30 11:30AM - 11:40AM Room: E353B

Participants

Wenping Wang, MD, PhD, Shanghai, China (*Presenter*) Nothing to Disclose
Yi Dong, MD, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Feng Mao, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Zhengbiao Ji, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Bei-Jian Huang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jiaying Cao, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Focal tumor-like autoimmune pancreatitis (AIP) is less common than diffuse AIP and manifests as a focal mass. It is still a challenge to make differentiate diagnose from pancreatic ductal adenocarcinomas (PDA) before surgery. The purpose of current study is to analyse contrast-enhanced ultrasound (CEUS) features of histologically proven focal tumor-like AIP, in comparison to PDA.

METHOD AND MATERIALS

The present study was approved by the institutional ethics committee and informed consent was waived. Twelve patients with

histologically proved focal tumor-like AIP lesions and 25 patients with histologically proved PDA lesions were retrospectively analyzed. The CEUS features of pancreatic lesions were compared to the surrounding normal pancreatic parenchyma. Two radiologists assessed the CEUS enhancement pattern in consensus.

RESULTS

All focal tumor-like AIP and PDA lesions were hypoechoic on BMUS. Most of AIP lesions (83.3%, 10/12) and PDA lesions (80%, 20/25) were located on the head of pancreas. On CEUS, all AIP lesions were isoenhanced both in arterial phase and late phase. In contrast, all PDA lesions showed hypoenhancement in the arterial phase as the most distinctive feature ($P < 0.01$).

CONCLUSION

CEUS of the pancreas has the potential to provide complementary information for improved differentiate diagnosis, particularly when used for characterization of focal tumor-like AIP to avoid surgery. The differential diagnosis to the typically hypovascularised pancreatic adenocarcinoma was always possible.

CLINICAL RELEVANCE/APPLICATION

CEUS can successfully visualize fine vessels in pancreatic lesions and may play a vital important role in the depiction and differential diagnosis of pancreatic tumors.

SSK07-08 Intravoxel Incoherent Motion MR Imaging for Assessment of Chronic Pancreatitis

Wednesday, Nov. 30 11:40AM - 11:50AM Room: E353B

Participants

Nobuhiro Fujita, MD, PhD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Akihiro Nishie, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshiaki Asayama, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Kousei Ishigami, MD, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Yasuhiro Ushijima, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukihisa Takayama, MD, Fukuoka, Japan (*Abstract Co-Author*) Research Grant, FUJIFILM Holdings Corporation
Daisuke Okamoto, MD, Fukuoka City, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the usefulness of intravoxel incoherent motion (IVIM) MR imaging parameters in patients with chronic pancreatitis (CP) with a special focus on its early stage.

METHOD AND MATERIALS

A total of 35 patients with early CP (eCP, n=24) and CP (n=11) were assessed with IVIM imaging using 8 b-values (0–1000 s/mm²) at 3T. Patients were diagnosed as eCP or CP based on the diagnostic criteria proposed by the Japan Pancreas Society and the Japanese Society of Gastroenterology. eCP was diagnosed by the presence of clinical symptoms plus mild changes of endoscopic ultrasonography (EUS) findings without characteristic imaging findings of CP such as stone in pancreatic ducts, multiple calcification or irregular dilatation of main pancreatic duct. For a comparison, a control group of 49 patients without CP was also enrolled. The perfusion fraction (f), true diffusion coefficient (D), pseudo-diffusion coefficient (D*) and apparent diffusion coefficient (ADC) of pancreatic parenchyma were calculated by fitting the bi-exponential model. These measurements were compared between three groups by Kruskal-Wallis test.

RESULTS

Compared with control group, patients with eCP and CP showed lower f (27.87 ± 9.02 in eCP, 22.04 ± 3.86 in CP and 32.53 ± 9.20 in control group; $p=0.039$ and $p<0.001$, respectively) and higher D (1.03 ± 0.18 in eCP, 1.11 ± 0.28 in CP and 0.88 ± 0.19 in control group; $p=0.003$ and $p=0.004$, respectively). Patients with CP showed lower D* than patients with eCP and control group (29.97 ± 25.69 in CP, 61.95 ± 31.41 in eCP and 50.12 ± 25.43 in control group; $p=0.005$ and $p=0.017$, respectively). ADC was not different between three groups.

CONCLUSION

Pancreas f decreased and D increased in eCP and CP compared to control group. D* decreased in CP compared to eCP and control group. IVIM MR imaging may be useful to detection of eCP and in monitoring patients with CP.

CLINICAL RELEVANCE/APPLICATION

IVIM MR imaging, by combining three parameters, may contribute to diagnosis, treatment decision and monitoring in CP. It could be recommended as a non-invasive imaging modality for evaluating CP.

SSK07-09 Estimating the Risk of Type 2 Diabetes with Non-Contrast Enhanced Abdominal CT: Model Development and Initial Validation

Wednesday, Nov. 30 11:50AM - 12:00PM Room: E353B

Participants

Bing-Qing Dong, MD, Nanjing, China (*Presenter*) Nothing to Disclose
Shenghong Ju, MD, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To establish a risk score model to predict the development of type 2 diabetes mellitus by using non-contrast enhanced abdominal computed tomography (CT) features.

METHOD AND MATERIALS

This retrospective study was approved by the local institutional review board, and informed consent was waived. Inpatients who underwent non-contrast enhanced abdominal CT in a tertiary teaching hospital from July 2014 to April 2015 (training cohort,

n=2075) and from May 2015 to February 2016 (validation cohort, n=2229) were included. CT features including liver steatosis, pancreatic steatosis, subcutaneous and visceral adipose tissue area, abdominal perimeter, abdominal aortic calcification and CT attenuation value of psoas major muscle were measured. In training cohort, a risk score model was constructed by using CT features which were independently associated with T2DM, identified by multiple logistic regression analysis. The model was further validated using the receiver operating characteristic (ROC) analysis in the validation cohort.

RESULTS

In the training cohort, the risk score model was constructed on the basis of five independent risk factors, including liver steatosis (odds ratio [OR] = 1.697; 95% confidence interval [CI]: 1.399, 2.060), abdominal perimeter (OR = 1.034; 95% CI: 1.024, 1.044), abdominal aortic calcification (OR = 1.149; 95% CI: 1.081, 1.222), CT attenuation value of psoas major muscle (OR = 0.976; 95% CI: 0.966, 0.987) and subcutaneous adipose tissue area (OR = 0.266; 95% CI: 0.086, 0.824). The area under the receiver operating characteristic curve (AUC) of the model was 0.678. When the model was applied to the validation cohort, the AUC was 0.683.

CONCLUSION

A risk score model, constructed on the basis of simple non-contrast enhanced abdominal CT, has the potential to estimate the risk of developing T2DM. However, future follow-up validation of this risk model is necessary.

CLINICAL RELEVANCE/APPLICATION

The risk score model, developed based on non-contrast enhanced abdominal CT, has the potential to predict the risk of developing T2DM for clinical purpose.

SSK08

Genitourinary (Abdominal DECT)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: E450B



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

FDA Discussions may include off-label uses.

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

Sub-Events

SSK08-01 Iodine Threshold for Discrimination of Papillary Renal Cell Carcinomas from Complex Cyst Using a Rapid kV-switching Dual Energy CT

Participants

Desmin Milner, MD, Birmingham, AL (*Presenter*) Nothing to Disclose
Jessica G. Zarzour, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Roberto C. Valentin, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Janelle West, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Bradford Jackson, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Desiree E. Morgan, MD, Birmingham, AL (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company
Soroush Rais-Bahrami, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Jennifer Gordestsky, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Determine the iodine content threshold to discriminate papillary renal cell carcinomas (pRCC) from complex cysts (CCs) using rapid kV-switching dual energy CT (rsDECT).

METHOD AND MATERIALS

IRB approved retrospective study of consecutive patients with pathologic diagnosis of renal cell carcinoma that underwent rsDECT from 2011-2015 at a tertiary care center. Control group included patients with complex cysts on DECT. Iodine content (IC) and other rsDECT variables for each papillary renal cell carcinoma (pRCC, n=27) were recorded on rsDECT workstation for arterial (n=15) and nephrographic phase (n=12), then compared to IC for clear cell renal cell carcinomas (ccRCC, n=46) and complex cysts (CC, n=54). An optimal iodine content threshold was estimated using logistic regressions and Youden's J based on maximum specificity and sensitivity. ROC curves were generated for each of the measurements.

RESULTS

Tumor IC threshold of 1.28 mg/cc was the optimal cutoff value to discriminate between pRCCs and CCs for nephrographic phase (sens 1.0, spec 0.96, PPV 0.92, and NPV 1.0; AUC 0.997, acc 0.97, p<0.0001). Statistically significant difference in mean IC for pRCC and CC was present for nephrographic phase (1.90 mg/cc and 0.82 mg/cc, respectively, p<0.0001). Tumor IC threshold of 1.22 mg/cc was the optimal cutoff value to discriminate between pRCCs and CCs in the arterial phase (sens 0.67, spec 0.97, PPV 0.91, NPV 0.85, AUC 0.76, acc 0.84, p=0.006). The optimal threshold to discriminate between cc RCCs and pRCCs was 1.85 mg/cc in the arterial phase (sens 0.87, spec 0.92, PPV 0.87, NPV 0.92, p<0.0001) and 2.71 mg/cc in the nephrographic phase (sens 1.0, spec 1.0, PPV 1.0, NPV 1.0, p<0.0001).

CONCLUSION

rsDECT accurately discriminates between papillary RCC and complex cysts in a post contrast acquisition. Iodine content threshold has higher sens, spec, PPV, NPV and accuracy when measured in the nephrographic phase. Our thresholds differ from previously published work primarily observed with dual source DECT.

CLINICAL RELEVANCE/APPLICATION

A reliable iodine content threshold for renal lesions evaluated by rsDECT in a single post contrast acquisition has direct implications for patient care as it can eliminate the need for additional studies and guide management for these patients.

SSK08-02 A Preliminary Study of Spectral CT Imaging in Gastrointestinal Stromal Tumor Risk Classification

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

Participants

Xueling Zhang, Lanzhou, China (*Presenter*) Nothing to Disclose
Junlin Zhou, Lanzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the value of spectral CT imaging in gastrointestinal stromal tumor (GIST) risk classification.

METHOD AND MATERIALS

41 patients with GIST were retrospectively reviewed, of which 13 were high risk, 12 were medium, 11 were low and 5 were very

low risk (low and very low risk were divided into low-risk group), all the patients underwent plain and triple phases contrast enhanced CT with spectral CT imaging mode. Quantitative parameters including CT value of 70keV monochromatic images, the slope of spectral curve and normalized iodine concentration(NIC) were measured and calculated. Data were compared with one-way ANOVA and rank sum test when it is heterogeneity of variance.

RESULTS

1, the CT value of 70 keV monochromatic images was negatively correlated with GIST risk (high to low) in arterial phase ($r = -0.173$), positively correlated with GIST risk ($r = 0.552$) in delay phase and no correlation with the GIST risk in venous phase. 2, the slope of spectral curve had significant difference in delay phase ($2.94 \pm 0.33, 2.50 \pm 0.29, 3.41 \pm 1.33$, $c_2 = 6.641, P = 0.036$), no significant difference in arterial phase and venous phase. 3, the NIC values for different risk of GIST were significant different in triple phases ($F = 3.646$, $c_2 = 6.046$, $F = 57.233$, $P = 0.035$, $P = 0.049$, $P < 0.001$), and correlated with GIST risk (from high to low) ($r = -0.564$) in delay phase.

CONCLUSION

Spectral CT imaging has distinct image findings of gastrointestinal stromal tumor (GIST) risk classification and can be used as a preoperative reference.

CLINICAL RELEVANCE/APPLICATION

CT spectral imaging has distinct imaging finding of gastric stromal tumors of different risk classifications, and may help the differential diagnosis and the preoperative therapy selection.

SSK08-03 Quantitative Spectral CT in Differentiation of Clear Cell Renal Cell Carcinoma and Fat Poor Renal Angiomyolipoma

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

Participants

Xiaotong Yang, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose

Yi Liu, MD, PhD, Shenyang, China (*Presenter*) Nothing to Disclose

PURPOSE

To explore the value of CT spectral imaging in differentiation of clear cell renal carcinoma (ccRCC) and fat poor renal angiomyolipoma (RAML) in the cortex phase (CP) and nephrographic phase (NP).

METHOD AND MATERIALS

In this institutional review board-approved study, we retrospectively analysed the data of spectral CT in 38 cases of ccRCCs and 9 cases of RAMLs. The monochromatic images and spectral curve were measured to get the iodine concentration (IC), normalized iodine concentration (NIC) and slope of spectral curve in the CP and NP. The independent sample t-test was used to compare the slope of spectral curve, ICs and NICs of the two kinds of lesions. The prediction parameters and diagnostic threshold were compared by drawing receiver operating characteristic curve (ROC). $P < 0.05$ was considered to indicate a significant difference.

RESULTS

The ICs and NICs of RAML were lower than those of ccRCC in the CP and NP ($p < 0.05$), and the slope of spectral curve of ccRCC was significant higher than RAML in the CP and NP (8.66 ± 2.53 versus 4.87 ± 2.50 in CP, 4.86 ± 1.17 versus 3.32 ± 1.30 in the NP, $p < 0.05$). The areas under ROC curve of NIC in CP and NP was the largest: 0.901 and 0.893, respectively. ROC curves indicated that $NIC < 0.389$ in CP and $NIC < 0.694$ in NP could differentiate ccRCC from fat poor RAML, Sensitivity: 73.5% and 91.2%, Specificity: 100% and 75%, respectively.

CONCLUSION

CT spectral imaging with multiple parameter quantitative analysis may help to increase the accuracy of differentiating ccRCC from fat poor RAML.

CLINICAL RELEVANCE/APPLICATION

Quantitative spectral CT could be a valuable method to enhancement the differential diagnosis ability of ccRCC from fat poor RAML. It is important for the planning of therapeutic.

SSK08-04 Photon-counting CT Assessment of Complex Renal Lesions: First Clinical Experience

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

Participants

Ashkan A. Malayeri, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

Rolf Symons, MD, Washington, DC (*Presenter*) Nothing to Disclose

Amir Pourmorteza, PhD, Bethesda, MD (*Abstract Co-Author*) Researcher, Siemens AG

Mohammad Hadi Bagheri, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

Rabindra Gautam, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

W. Marston Linehan, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

David A. Bluemke, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Research support, Siemens AG

PURPOSE

Renal cell carcinoma (RCC) is may be multifocal and identification of neoplasm often relies on determining changes in size of complex lesions. Accurate assessment of renal lesions in VHL patients is critical to determine lesion growth and possible indication for surgical intervention. The aim of this study was to determine the performance of a photon-counting detector (PCD) CT compared with an energy-integrating detector (EID) CT in assessment of renal lesions in VHL patients.

METHOD AND MATERIALS

This study used a hybrid (dual-source) whole-body prototype CT system (Siemens Healthcare, Germany), which consists of an EID

and a PCD. Seven VHL patients (mean age \pm standard deviation: 58.9 \pm 6.6 years) were prospectively enrolled between 11/2015 and 01/2016. Radiation dose-matched three-phase spiral EID and PCD scans were acquired at vendor recommended guidelines (tube voltage/current 120 kVp/20 mAs for average 75 kg patient). Images were reconstructed with sinogram-affirmed iterative reconstruction (SAFIRE strength 2), 2 mm slice thickness, and 1 mm increment. The maximum diameter of renal lesions was assessed by an independent radiologist blinded to the detector. Correlation between EID and PCD renal lesion measurements was assessed with the intra-class correlation coefficient (ICC) and Bland-Altman analysis.

RESULTS

In total, 200 renal lesions were measured (157 simple cysts, 31 complex cysts, and 12 solid masses). Reproducibility of measurements between EID and PCD was excellent (ICC = 0.97, 95% confidence interval 0.96-0.98, $P < 0.001$). Bland-Altman analysis showed narrow limits of agreement without significant bias (mean difference: 0.4 mm, 95% limits of agreement: [-2.7, 3.7 mm]).

CONCLUSION

Photon-counting CT provides excellent reproducibility of renal lesion measurements in VHL patients compared with conventional EID CT.

CLINICAL RELEVANCE/APPLICATION

Photon-counting CT can be used to accurately measure renal lesions in VHL patients. The spectral information of PCD can be used for additional virtual-non contrast images and iodine concentration maps.

SSK08-05 Iodine Concentration and Normalized Iodine Concentration in Diagnosis of the Inflammatory and Metastatic Lymph Nodes in Colorectal Cancer

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E450B

Participants

Xuejun Yang, Kunming, China (*Abstract Co-Author*) Nothing to Disclose

Wei Zhao, Kunming, China (*Abstract Co-Author*) Nothing to Disclose

Yaying Yang, Kunming, China (*Presenter*) Nothing to Disclose

Lin Xu, Shiyuan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the value of iodine concentration and normalized iodine concentration in dual-energy CT in the differential diagnosis of the inflammatory and metastatic lymph nodes in colorectal cancer.

METHOD AND MATERIALS

35 patients had pathologically confirmed colorectal cancer underwent arterial and venous phase contrast-enhanced dual energy CT scan. Iodine concentration, normalized iodine concentration and enhanced CT value of the inflammatory and metastatic lymph nodes were measured in Liver VNC software And compared by using independent sample t-test. Sensitivity, specificity and receiver operating characteristic curve (ROC) was performed for diagnosing metastatic lymph nodes in colorectal cancer.

RESULTS

35 patients had 105 local lymph nodes, including 56 metastatic lymph nodes, 49 reactive hyperplasia lymph nodes. Contrast enhanced CT value of metastatic and of reactive hyperplasia lymph nodes in the arterial and venous phase were 32.67 \pm 11.99 HU, 38.30 \pm 14.65 HU and 35.48 \pm 13.55 HU, 37.08 \pm 15.57 HU, respectively. The responding iodine concentration were 1.58 \pm 0.81 mg/ml, 3.17 \pm 1.07 mg/ml and 1.85 \pm 0.90 mg/ml, 3.56 \pm 1.38 mg/ml; and normalized iodine concentration were 0.12 \pm 0.06, 0.24 \pm 0.75 and 0.33 \pm 0.20, 0.62 \pm 0.24; respectively. The arterial and venous phase iodine content and normalized iodine concentration and arterial phase enhanced CT value had statistical differences ($p < 0.000$) in the two kinds of lymph nodes. There were no statistical differences ($p > 0.05$) for the venous phase enhanced CT value. Normalized iodine concentration was the most valuable in the diagnosis of metastatic lymph nodes with sensitivity, specificity and AUC of 88.9%, 73.2%, 0.895 and 80.6%, 82.1%, 0.877.

CONCLUSION

Iodine concentration and normalized iodine concentration can be used in the differential diagnosis of the inflammatory and metastatic lymph nodes in colorectal cancer. The diagnostic value of the normalized iodine concentration was superior to enhanced CT value and iodine concentration to differentiate inflammatory from metastatic lymph nodes.

CLINICAL RELEVANCE/APPLICATION

Iodine concentration and normalized iodine concentration can be used in the differential diagnosis of the inflammatory and metastatic lymph nodes in colorectal cancer.

SSK08-06 Choi Criteria and Iodine Quantification with Single Source Dual Energy CT (ssDECT) in the Evaluation of Treatment Response of Neuroendocrine Tumor Liver Metastases

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

Awards

Student Travel Stipend Award

Participants

Andrea Agostini, MD, Fermo, Italy (*Presenter*) Nothing to Disclose

Alessandra Borgheresi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Usman Mahmood, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Andrea Giovagnoni, MD, Ancona, Italy (*Abstract Co-Author*) Nothing to Disclose

Lorenzo Mannelli, MD, PhD, New York, NY (*Abstract Co-Author*) Speaker, Bracco Group; Speaker, General Electric Company

PURPOSE

To correlate the iodine quantification with single source dual energy CT (ssDECT) and Choi Criteria, for the evaluation of treatment response in liver metastases of neuroendocrine tumors.

METHOD AND MATERIALS

The present study was approved by the local IRB. Patients treated for liver metastatic neuroendocrine tumors (NET) with at least two ssDECT exams between March 2015 and March 2016 were included. ssDECT images were acquired in the arterial phase after administration of iodinated contrast material (Iohexol 300mg/mL) and bolus-tracking. Scanning parameters: 80/140 kVp fast switching; fixed mA; pitch 0.984:1; kernel standard; matrix 512x512; slice thickness/spacing: 5/5mm. A radiologist segmented hypervascular liver lesions >10mm using the GSI MD analysis on Advantage Workstation VolumeShare 7 (GE Healthcare) and measured maximum diameter, volume, and iodine concentration in the first and last ssDECT exams in two consecutive exams. Lesion density was measured on monochromatic 70 keV images. Iodine quantity (iodine concentration x volume), and differences among diameters, volumes, iodine concentrations, iodine quantities, and lesion densities were calculated for each lesion. Choi response was calculated for each lesion. Non parametric statistical tests were used and $p < 0.05$ were considered significant.

RESULTS

We included 9 patients (M/F=2/1, mean age 62 years), for a total of 33 lesions. Patients were treated with systemic therapy (n=5) or combined systemic and locoregional therapy (n=4). 8 lesions had Choi partial response (PR), 13 lesions had stable disease (SD) while 12 lesions had progressive disease (PD). Choi response significantly stratified the absolute and percentage differences in iodine quantity for each lesion (Kruskal-Wallis $p=0.003$). We found significant correlation between percentage differences in iodine quantity maximum diameters (Spearman's Rho 0.580, $p=0.0004$), while the Spearman's Rho among percentage differences of iodine quantities and volumes was of 0.759 ($p < 0.0001$).

CONCLUSION

Changes in iodine quantity of liver NET metastases correlate with Choi response, and changes in lesion diameters and volumes.

CLINICAL RELEVANCE/APPLICATION

Iodine quantification can be used as a marker of response in neuroendocrine tumor liver metastases

SSK08-07 Comparison of Single Source-dual Energy CT (SS-DECT) Imaging with 140 kVp Conventional MDCT in Hypervascular Liver Lesions in Cirrhosis

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

Participants

Ritu M. Kakkar, MBBS, DMRD, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Shrinivas B. Desai, MD, Mumbai, India (*Presenter*) Nothing to Disclose
Sameer S. Soneji, DMRD, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Compare Single source-dual energy CT (SS-DECT) imaging with 140 kVp conventional MDCT in hypervascular liver lesions in cirrhotic patients .
Determine whether there is improved detection of hypervascular liver lesions using SS-DECT

METHOD AND MATERIALS

30 cirrhotic patients (21:9 = M:F) with known or suspected liver lesions underwent SS-DECT during the late hepatic arterial phase using fast kV switching dual energy acquisition technology of GE. Conventional polychromatic images at 140 kVp and monochromatic images at 70 keV were reconstructed in the late hepatic arterial phase from the single spectral CT acquisition and evaluated . Virtual Monochromatic Spectral (VMS) image sets were created at 70 keV .ROIs were placed on tumor and the background liver .AD (Relative Attenuation Difference), CNR (contrast-to-noise ratio), SNR (signal-to-noise ratio) ,image noise and quality were also graded on a 5 point system by two experienced radiologists Averaged values of the image noise and image quality were calculated and compared. Statistical analysis was carried out using Mann-Whitney Rank Sum Test and paired t-test wherever applicable

RESULTS

Total of 45 lesions were detected on 70 keV image sets when 140 kVp image sets detected only 38 lesions. The mean attenuation difference at 140 kVp and at 70 keV was 69.5 ± 11 and 91.7 ± 9.1 HU. The difference in mean signal-to-noise ratio at 140 kVp and at 70 keV was 5.7 ± 1.3 and 7.0 ± 1.3 HU respectively. The difference in mean contrast-to-noise ratio at 140 kVp and at 70 keV was 3.0 ± 0.6 and 4.5 ± 0.9 HU respectively. The difference in mean image quality at 140 kVp and at 70 keV was 3.4 ± 0.7 HU rated as good and 2.2 ± 0.4 HU rated as poor respectively. The difference in mean image noise at 140 kVp and at 70 keV was 2.0 ± 0.2 HU rated as minimal and 3.7 ± 0.5 HU rated as moderate respectively. All the parameters used for evaluation were found to be statistically significant ($p < 0.01$).

CONCLUSION

Single source-dual energy MDCT offers improved detection and diagnosis of hypervascular liver lesions by increasing the image contrast and conspicuity at an acceptable level of increase in image noise and decreased image quality.

CLINICAL RELEVANCE/APPLICATION

Higher detection rates of hypervascular liver lesions can be achieved at low keV images (70 keV) images in comparison to 140 kVp conventional MDCT

SSK08-08 Dual Energy CT Workflow: Multicenter Consensus on Standardization of GU Exams

Wednesday, Nov. 30 11:40AM - 11:50AM Room: E450B

Participants

Bhavik N. Patel, MD,MBA, Durham, NC (*Presenter*) Nothing to Disclose
Lauren F. Alexander, MD, Atlanta, GA (*Abstract Co-Author*) Spouse, Stockholder, Abbott Laboratories; Spouse, Stockholder, AbbVie

Inc; Spouse, Stockholder, General Electric Company
Brian C. Allen, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Lincoln L. Berland, MD, Birmingham, AL (*Abstract Co-Author*) Consultant, Nuance Communications, Inc;
Amir Borhani, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Achille Mileto, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Courtney A. Coursey Moreno, MD, Suwanee, GA (*Abstract Co-Author*) Nothing to Disclose
Desiree E. Morgan, MD, Birmingham, AL (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company
Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company; Medical Advisory Board, Allena Pharmaceuticals, Inc
William P. Shuman, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, General Electric Company
Eric P. Tamm, MD, Houston, TX (*Abstract Co-Author*) Institutional Research Grant, General Electric Company
Mitchell E. Tublin, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;
Daniele Marin, MD, Durham, NC (*Abstract Co-Author*) Research support, Siemens AG

PURPOSE

To standardize workflow for dual energy computed tomography (DECT) involving renal cell carcinoma (RCC), genitourinary (CTU), and renal stone exams.

METHOD AND MATERIALS

9 institutions (1 ssDECT, 4 dsDECT, 4 both) with 32 participants (average # yrs. (range) in practice and DECT experience 12.3 (1-35) and 4.6 (1-14), respectively) filled out a single survey (n=9). A five-point agreement scale (0,1,2,3,4 – contra-, not, mildly, moderately, strongly indicated, respectively) and utilization scale (0 – not performing and shouldn't; 1- performing but not clinically useful; 2 – performing but not sure if clinically useful; 3 – not performing it but would like to; 4 – performing and clinically useful) were used. Consensus was considered with a score of 2.5 or higher. Survey results were discussed over three separate live webinar sessions.

RESULTS

5/9 (56%) institutions exclude large patients from DECT, 2 (40%) use weight, 2 (40%) use transverse dimension, and 1 (20%) uses both. 7/9 (78%) use 2.5 mm slice thickness for interpretation in the axial plane. 7/9 (78%) use 50 keV for low and 70 keV for medium monochromatic reconstructed images. 5/6 (56%) use the same order when viewing DECT exams, while 4/9 (44%) use an exam dependent approach. DECT for RCC exams is indicated (AS 3.44; US 3.33) in the arterial phase (AS 3.33; US 2.78) but not in the venous phase (AS 2.44; US 2.22). DECT for CTU is indicated (AS 3.33; US 3.22) in the nephrographic phase (AS 3.11; US 2.89). Virtual unenhanced (VUE) reconstructed images cannot replace a true enhanced exam (AS 2.78; US 2.78). DECT for renal stone exams is indicated (AS 3.00) though most centers are not performing it (US 1.89).

CONCLUSION

There is strong agreement that DECT is indicated and should be performed during the arterial phase for RCC exams and nephrographic phase for CTU. There is a role for DECT for renal stone exams but most centers are not performing it. VUE cannot replace true unenhanced exams.

CLINICAL RELEVANCE/APPLICATION

Despite the advances in the technology, there is not widespread adoption of DECT into practice. Workflow standardization is essential to guide implementation of DECT into practice.

Honored Educators

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Courtney A. Coursey Moreno, MD - 2016 Honored Educator
Dushyant V. Sahani, MD - 2012 Honored Educator
Dushyant V. Sahani, MD - 2015 Honored Educator
Dushyant V. Sahani, MD - 2016 Honored Educator

SSK08-09 Implementation of a Volume-mode Dual Energy CT Protocol for Hepatocellular Carcinoma: Prospective 4-readers Study for Selection of the Most Valuable Post-processing Options and Comparison with Subtraction

Wednesday, Nov. 30 11:50AM - 12:00PM Room: E450B

Participants

Luis S. Guimaraes, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Seng Thipphavong, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Sarah A. Johnson, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Christin Farrell, Toronto, ON (*Abstract Co-Author*) Employee, Toshiba Corporation
Azadeh Khalatbari, MD, MSc, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Patrik Rogalla, MD, Toronto, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Speakers Bureau, Bayer AG

PURPOSE

To determine the best post-processing options in the arterial and delayed phases for dual energy (DE) CT in patients with hepatocellular carcinoma (HCC), as well as the added value of subtraction (St).

METHOD AND MATERIALS

Arterial and delayed phases were performed in DE volume mode in patients with HCC. 120 kV equivalent (120 Eq), 100 kV equivalent

(100 Eq), "Best CNR" (BCNR) and "Enhanced" (ENH) blending, monochromatic images (arterial phase: 55, 60, 65 keV; delayed phase: 70 keV), iodine maps (IM) and St images were reconstructed. Four abdominal radiologists blindly rated IQ (5=excellent) and ranked the 4 preferred series for IQ and LC (1=preferred). Quantitative assessment [contrast-to-noise-ratio (CNR), lesion-to-liver contrast (LLC) and lesion-to-liver CNR (LLCNR)] was performed for nodules >1 cm.

RESULTS

This ongoing study included 27 patients with 95 hypervascular and 90 hypodense lesions. All readers was rated IQ as 4/5 in >91%. Readers ranked the series with unequal preference ($p \leq 0.05$). For the arterial phase IQ, for all readers, BCNR ranked 1st or 2nd in terms of percentage of ratings 1 or 2 for preference (59.3%, 48.2%, 62.7% and 70.4%, readers 1-4). For LC, IMs ranked 1st in 55.6% for readers 1 and 4. St ranked 4th (7.4%) and 2nd (51.9%), respectively. Excluding IM and St, readers 1 and 3 preferred the 80 kv or 55 keV images (together rated as best or 2nd in 88.9% and 96% respectively). Readers 2 and 4 preferred 100 Eq series (51.9% and 18.5%, respectively). For the delayed phase, series that were either the 1st or 2nd more frequently chosen as the best or 2nd best were BCNR for IQ (by 3 readers - 92.6%, 48.2%, 85.2% and 40.7%, readers 1-4) and ENH for LC (also by 3 readers - 66.7%, 25.9%, 51.9% and 48.2%, readers 1-4). Arterial phase series with the best LLC and LLCNR averages were 55 keV (LLC=88.3) and 100 Eq (LLCNR=5.2). For the delayed phase, 1st for LLCNR (2.2) was BCNR, 1st for LLC was 80 kv (31.5).

CONCLUSION

Despite the idiosyncrasy of radiologists' preferences, BCNR provides the best overall image quality. For lesion conspicuity, the best series are IMs, 80 kv, 55 keV and 100 Eq images for the arterial phase and ENH for the delayed phase. Subtraction does not seem to add value.

CLINICAL RELEVANCE/APPLICATION

The identification of the most valuable post-processing DE options permits reduction of post-processing times, which may allow for the feasibility of widespread implementation of HCC DE protocols.

SSK09

Science Session with Keynote: Genitourinary (Prostate Intervention and New Imaging Methods)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: N228



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

FDA Discussions may include off-label uses.

Participants

Fergus V. Coakley, MD, Portland, OR (*Moderator*) Nothing to Disclose
Harriet C. Thoeny, MD, Bern, Switzerland (*Moderator*) Advisory Board, Guerbet SA

Sub-Events

SSK09-01 Genitourinary Keynote Speaker: Image-guided Prostate Intervention-Changing the Paradigm

Participants

Aytekin Oto, MD, Chicago, IL (*Presenter*) Research Grant, Koninklijke Philips NV

Honored Educators

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Aytekin Oto, MD - 2013 Honored Educator

SSK09-02 Transrectal MR Guided Focal Laser Ablation of Intermediate Grade, T1a Prostate Cancer: Phase I Clinical Trial

Wednesday, Nov. 30 10:40AM - 10:50AM Room: N228

Participants

Steven S. Raman, MD, Santa Monica, CA (*Presenter*) Nothing to Disclose

PURPOSE

MR guided focal laser ablation (FLA) is a thermal ablative technique that is now being used to treat T1a prostate cancer in a region-confined manner via coagulative necrosis. This phase 1 trial examines the safety and feasibility of transrectal MRI-guided FLA in men with intermediate-risk prostate cancer.

METHOD AND MATERIALS

In this HIPAA compliant, IRB-approved prospective single arm trial, the study cohort included eight men with multiparametric MR (MP-MRI) detected, MR-US fusion biopsy proven, intermediate-risk, presumed stage T1a prostate cancer (Gleason 3+4 in all but one). treated with transrectal MR guided focal ablation. Secondary safety monitors (temperature probes) were inserted to assess the accuracy of MR thermometry. Follow-up MP-MRI and MR-US fusion biopsy was performed after six months.

RESULTS

MR guided focal laser ablation was technically successful in all 8 subjects. No Clavian-Dindo adverse events > Grade 3 occurred, and no changes in IPSS ($p=0.37$), or IIEF-5 ($p=0.76$) were observed during 6 months of follow-up. Ablation zones, as measured by post-treatment contrast enhanced MP-MRI, had a median volume of 3 cc or 7.7% of prostate volume. A significant drop in serum PSA level was observed in 7/8 men after six months ($p<0.01$). An average of 15 cores were taken during follow-up 6 months MR-US fusion bx, in which no ablation zone cancer was detected in 5/8 men (62.5%).

CONCLUSION

Transrectal MR guided focal laser ablation of the prostate is feasible and safe in men with intermediate-grade, stage 1a prostate cancer without serious adverse events or changes in urinary or sexual function. Comprehensive MR-US guided fusion biopsy follow-up indicates that larger margins than previously thought may be necessary for effective focal therapy.

CLINICAL RELEVANCE/APPLICATION

Transrectal MR guided focal laser ablation (FLA) may offer a safe and effective minimally invasive therapy for a small minority of patients with T1a intermediate risk prostate cancer as demonstrated in this pilot T1a trial.

SSK09-03 A Pilot Study to Evaluate Outpatient, Transrectal, Magnetic Resonance Image-guided Laser Focal Therapy of Prostate Cancer

Wednesday, Nov. 30 10:50AM - 11:00AM Room: N228

Participants

John F. Feller, MD, Indian Wells, CA (*Presenter*) Consultant, Koninklijke Philips NV; Consultant, Visualase, Inc ; Consultant, Hitachi, Ltd; Speaker, Hitachi, Ltd

Bernadette M. Greenwood, BS, RT, Indian Wells, CA (*Abstract Co-Author*) Speakers Bureau, GenomeDx Biosciences Inc

Stuart T. May Sr, MD, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose

Wes Jones, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In the United States alone, new prostate cancer cases for 2014 were estimated at 233,000 and deaths at 29,480. Focal therapies for low risk and intermediate risk localized prostate cancer are increasingly being explored. Additionally, new treatments for patients with biochemical recurrence of prostate cancer are also under investigation. Our objective is to investigate the safety and feasibility of using outpatient MR-guided laser focal therapy for MR visible prostate cancer utilizing a transrectal approach for laser applicator placement and therapy delivery in an outpatient setting.

METHOD AND MATERIALS

All MRI-guided therapy was delivered using a 1.5 Tesla Philips Achieva XR system (Philips Healthcare, Best, The Netherlands) for both image acquisition and real-time thermometry. DynaCAD and DynaLOC (Invivo, Orlando, FL, USA) software were used for image analysis and interventional planning. Laser therapy was delivered using a Visualase (Medtronic, Minneapolis, MN, USA) 15W, 980 nm diode laser applicator introduced transrectally using the DynaTRIM (Invivo, Orlando, FL, USA).

RESULTS

64 men were treated. 91 cancer foci were treated. Total procedure time was between 1.5 and four hours MRI volume of coagulation necrosis ranged from 0.57 to 22.93 cc. No serious adverse events or morbidity were reported. 17 treatment regions were positive at six months biopsy, consistent with residual or recurrent cancer 26% of subjects 18% of treated regions. We observed a 35% decrease in mean PSA at 1 year post therapy and no statistically significant change in IPSS and SHIM scores at 6 months post-treatment.

CONCLUSION

Our data indicate that outpatient, transrectally delivered MRI-guided laser focal therapy for prostate cancer is both safe and feasible.

CLINICAL RELEVANCE/APPLICATION

In the current climate of cost-reduction and emphasis on minimally-invasive treatment of cancer, focal treatment of prostate cancer may be an attractive option. The precise energy delivery under MRI-guidance may have favorable results for cost control and quality of life without eliminating the possibility of whole-gland treatment in the patient's future.

SSK09-04 Real Time Magnetic Resonance Guided Focused Ultrasound(MRgFUS) Guided Focal Therapy of Locally Confined Low-Intermediate Risk Prostate Cancer: Phase 1 Study

Wednesday, Nov. 30 11:00AM - 11:10AM Room: N228

Participants

Sangeet Ghai, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Eugen Hlasny, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Masoom A. Haider, MD, Toronto, ON (*Abstract Co-Author*) Consultant, Bayer AG; ;
Stuart McCluskey, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Walter Kucharczyk, MD, Toronto, ON (*Abstract Co-Author*) Research Grant, InSightec Ltd
John Trachtenberg, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the feasibility and safety of focal therapy for low-intermediate risk prostate cancer (PCa) with magnetic resonance guided focused ultrasound (MRgFUS) – Phase 1 trial

METHOD AND MATERIALS

This phase 1 prospective study was approved by institutional review board. Following informed consent, eight patients with prostate specific antigen (PSA) ≤ 10 ng/mL, \leq cT2a and Gleason (G) score ≤ 7 (4+3) disease were prospectively enrolled and underwent multiparametric magnetic resonance imaging (MRI) and confirmatory trans-rectal ultrasound (TRUS) guided systematic and targeted biopsy. Under MRI guidance and real-time MR thermography, focused high frequency ultrasound energy was delivered to ablate the target tissue. Incidence and severity of treatment-related adverse events were recorded for 6-months after treatment. Oncologic outcomes were evaluated with multiparametric MRI and repeat TRUS guided biopsy at 6-months after treatment.

RESULTS

Eight patients with a total of 10 peripheral zone target lesions were successfully treated (prostate volume range 25-50cc; mean procedure time - 248 minutes per patient; mean sonication duration - 65 minutes per target lesion). Six lesions were G1 6, 2 G1 7 (3+4) and 2 were G1 7(4+3) on pre-treatment biopsy. Mean target volume was 2.7cc (range 0.4 – 5.7cc) and mean post treatment non perfused volume was 4.3cc (range 2.2 – 7.6cc). Quality of life parameters were similar between baseline and 6-months in 6 of 8 patients. One patient with bilateral ablation had International Prostate Symptom Score (IPSS) score rise by >5 ; a second patient developed prostatitis and decrease in erectile function at 6 months, which has improved since. All 8 patients were MRI negative in their treated regions (100%). Five patients were clear of disease in their treated regions on biopsy (62.5%), representing complete ablation of 7 target lesions (70%). MRI not visible 2mm G1 8 disease was seen in 1 of 5 cores from treatment site in 1 patient (initial 4+3 disease) who subsequently underwent prostatectomy with negative surgical margins. Mean PSA decreased from 5.06 at baseline to 3.4 ng/ml at 6 months.

CONCLUSION

MRgFUS is a feasible and safe method of noninvasively ablating low-intermediate risk PCa

CLINICAL RELEVANCE/APPLICATION

MRgFUS is a feasible method of noninvasively ablating low-intermediate risk localized PCa and has the potential to provide the best balance between oncologic control and quality of life in these patients

SSK09-05 Results of Direct in-Bore Magnetic Resonance Image-Guided Prostate Biopsy in a Large Cohort of

Males with Elevated PSA

Wednesday, Nov. 30 11:10AM - 11:20AM Room: N228

Participants

Wulphert Venderink, MD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Annemarijke van Luijtelaar, BSC, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Joyce G. Bomers, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marloes van der Leest, MD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jelle O. Barentsz, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research Consultant, SPL Medical
Michiel Sedelaar, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jurgen J. Futterer, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, Medtronic, Inc; Research Grant, Siemens AG

PURPOSE

Multiparametric Magnetic Resonance Imaging (mpMRI) and subsequent targeted biopsy of suspicious lesions has improved prostate cancer (PCa) detection. Currently, the literature is mainly focusing on Transrectal Ultrasound (TRUS)-MRI fusion biopsy to detect PCa. However, the value of direct in-bore MRI targeted biopsy (MRGB) is not extensively described. Therefore, the aim of our study is to give insights in the yield of MRGB in daily clinical practice in men with PI-RADS ≥ 3 lesions on mpMRI.

METHOD AND MATERIALS

We retrospectively included men who underwent both mpMRI and subsequent MRGB in our institution between January 2014 and December 2015. Patients were excluded if they 1) participated in another trial; 2) had prior targeted biopsy; or 3) had biopsy-proven PCa. We determined the overall detection rate for PCa and for clinically significant (cs)PCa, respectively in patients with and without prior negative TRUS biopsy (TRUSgb). A Gleason score of $\geq 3+4$ was considered to be csPCa. Detection rates were determined for lesions which were scored, by radiologists with a variable experience with prostate MRI, as equivocal, likely or highly likely to be csPCa (PI-RADS 3, 4 or 5). Chi-square statistics were used to calculate any differences between the biopsy naïve and prior negative TRUSgb group.

RESULTS

After exclusion, 209 of 536 men who underwent MRGB, were eligible for our study; 163 (77.9%) with prior negative TRUSgb and 46 (22.1%) biopsy naïve, respectively. 129 (62%) were scored according to PI-RADS version 1 and 80 (38%) according to version 2. Overall PCa detection rate was 65.1% (136/209). csPCa was detected in 44.5% (93/209). No significant difference was found in the detection of PCa between men with and without prior negative TRUSgb (63.2% and 71.7%, $p=0.28$) and no significant difference was found for csPCa between both groups (44.8% and 43.5%, $p=0.87$). The overall detection rate of csPCa for PI-RADS 3, 4 and 5 lesions were 19.4%, 36.9% and 61.8%, respectively.

CONCLUSION

Our study demonstrates the yield of mpMRI and subsequent MRGB. Despite the retrospective nature of this study, the results indicate that MRI and MRGB is highly effective to detect and localize csPCa in daily clinical practice.

CLINICAL RELEVANCE/APPLICATION

This study revealed the results of the biggest cohort of men with suspicious lesions on mpMRI and subsequent MRGB.

SSK09-06 24 Months Follow-Up Results of MRI-Guided Transurethral Ultrasound Ablation for Localized Prostate Cancer

Wednesday, Nov. 30 11:20AM - 11:30AM Room: N228

Participants

David Bonekamp, MD, PhD, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Maya B. Wolf, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Sascha Pahernik, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Boris Hadaschik, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Timur Kuru, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Ionel V. Popeneciu, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gencay Hatiboglu, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Joseph Chin, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Michele Billia, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
James D. Relle, MD, West Bloomfield, MI (*Abstract Co-Author*) Nothing to Disclose
Jason M. Hafron, MD, West Bloomfield, MI (*Abstract Co-Author*) Nothing to Disclose
Kiran R. Nandalur, MD, Bloomfield Hills, MI (*Abstract Co-Author*) Nothing to Disclose
Mathieu Burtnyk, DIPLOPHYS, Toronto, ON (*Abstract Co-Author*) Employee, Profound Medical Inc
Matthias Roethke, MD, Heidelberg, Germany (*Abstract Co-Author*) Speaker, Siemens AG
Heinz-Peter W. Schlemmer, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MRI-guided transurethral ultrasound ablation (TULSA) is a novel minimally-invasive technology for prostate tissue ablation, both malignant and benign, aiming to provide localized prostate cancer (PCa) control with low morbidity. Directional plane-wave high-intensity ultrasound generates a continuous and precise volume of thermal coagulation shaped to conform to the prostate using real-time MR-thermometry feedback control. A prospective, multi-institutional Phase I clinical study investigated safety and feasibility of TULSA.

METHOD AND MATERIALS

Thirty patients with biopsy-proven organ-confined PCa were enrolled: age ≥ 65 y, T1c/T2a, PSA ≤ 10 ng/ml, Gleason $\leq 3+3$ (3+4 in Canada only). Under general anaesthesia, the ultrasound device (TULSA-PRO, Profound Medical Inc.) was positioned in the prostatic urethra with 3T MRI guidance (Siemens, Germany). Treatment planning was performed under MRI prostate visualization, with therapeutic intent of whole-gland ablation, including 3mm safety margins at the gland periphery, and 10% residual viable

prostate expected around the capsule. Treatment was delivered under continuous MRI thermometry feedback control.

RESULTS

Median (IQR) age was 69 (67-71) years and PSA 5.8 (3.8-8.0) ng/ml, with 24 (80%) low-risk and 6 (20%) intermediate-risk cancers (D'Amico). Treatment time was 36 (26-44) min and prostate volume 44 (38-48) cc. Spatial control of ablation was ± 1.3 mm on MRI thermometry, and correlated well with the non-perfused volume confirmed on CE-MRI. Successful treatment was further indicated by a median PSA decrease of 87% at 1 month, stable to 0.8 (0.6-1.1) ng/ml at 12 months (n=30), and to 0.7 (0.4-1.5) ng/ml at 24 months (n=18). MRI at 12 months shows diminutive prostates with median volume reduction of 88% (83-95%), consistent with the near whole-gland treatment plan. Positive biopsies at 12 months show 61% reduction in total cancer length, clinically significant disease in 9/29 patients (31%), and any disease in 16/29 patients (55%).

CONCLUSION

MRI-guidance enables accurate treatment planning, real-time dosimetry and control of the thermal ablation volume. Phase I data demonstrate safety and tissue ablation performance of TULSA. A larger TULSA trial with reduced safety margins is scheduled to begin in 2016.

CLINICAL RELEVANCE/APPLICATION

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

SSK09-07 Radiomic Features on Pre-Treatment Multi-Parametric Magnetic Resonance Imaging Predict which Prostate Cancer Patients will Develop Biochemical Recurrence

Wednesday, Nov. 30 11:30AM - 11:40AM Room: N228

Participants

Rakesh Shiradkar, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose
Soumya Ghose, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Purysko, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Anant Madabhushi, PhD, Piscataway, NJ (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A number (~30%) of prostate cancer (PCa) patients who undergo radiation therapy (RT) or radical prostatectomy (RP) develop biochemical recurrence (BCR) post-treatment. These patients are at higher risk of mortality from PCa progression. If identified early, they could be treated more aggressively and undergo adjuvant therapy. In this study, we aim to explore if radiomic or computer-extracted texture features on pre-treatment mp-MRI are able to predict BCR in patients following therapy.

METHOD AND MATERIALS

In this single center retrospective study, 115 patients with PCa who underwent a 3T mp-MRI scan prior to RT or RP and then followed for ≥ 3 years, were identified in an IRB approved database. Of these, 38 patients had incomplete imaging datasets and were excluded. The regions of interest (ROIs) for the dominant cancer lesions were delineated by expert radiologist in the remaining 77 patients. The imaging data was corrected for intensity drift and signal bias, and a set of 126 radiomic features including first, second order statistics on image intensities, co-occurrence of local anisotropic gradient orientations, Gabor and Haralick features were extracted on T2-weighted (T2w) and apparent diffusion coefficient (ADC) sequences on a per-voxel basis. A set of different statistical metrics were computed on features within the ROIs to obtain a feature vector per-patient.

RESULTS

The set of 77 patients was randomly divided into a learning (N = 50) and an independent validation set (N = 27). The skewness (deviation from the normal distribution of a signal) of 12 radiomic features (primarily Haralick, Gabor) on the learning set showed statistically significant differences ($p < 0.05$) between patients who developed BCR and those who didn't, indicating that distribution of these features within the cancer ROIs are different for BCR patients. A linear regression classifier was trained using the top 4 discriminating features from the learning set in a 3-fold cross validation over 50 runs. This classifier gave an AUC of 0.83 on the independent validation set.

CONCLUSION

Radiomic features on pre-treatment mp-MRI for prostate cancer patients developing BCR are statistically significantly different from those that do not develop BCR.

CLINICAL RELEVANCE/APPLICATION

Radiomic features may help in predicting prostate cancer patients who are likely to develop biochemical recurrence post treatment, allowing for better course of treatment and patient management.

SSK09-08 Detection and Characterization of Primary Prostate Cancer using 18F-FACBC PET/CT, PET/MRI and Multiparametric MRI: Preoperative Evaluation

Wednesday, Nov. 30 11:40AM - 11:50AM Room: N228

Participants

Ivan Jambor, MD, Turku, Finland (*Presenter*) Nothing to Disclose
Anna Kuisma, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose
Jukka Kempainen, MD, PhD, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose
Esa Kahkonen, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose
Mai Mkim, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose
Susan Ramadan, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose
Harri Merissari, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose
Olli Eskola, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose
Jarmo Teuvo, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose
Markku Kallajoki, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose

Hannu J. Aronen, MD, PhD, Kuopio, Finland (*Abstract Co-Author*) Nothing to Disclose

Peter Bostrom, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose

Pekka Taimen, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose

Heikki R. Minn, MD, PhD, Turku, Finland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate diagnostic accuracy of 18F-FACBC PET/CT, PET/MRI and multiparametric MRI (mpMRI) for detection of primary prostate cancer (PCa) and prediction of its aggressiveness.

METHOD AND MATERIALS

Twenty six patients with histologically confirmed PCa underwent PET/CT performed immediately after injection of 369 ± 10 MBq 18F-FACBC (fluciclovine) followed by PET/MRI starting 55 ± 7 min from injection. MRI part of PET/MRI consisted of T2-weighted imaging (T2-WI), diffusion weighted imaging (DWI), second order rotating frame (RAFF) imaging, and T2 mapping. DWI was performed using 14 (0-500 s/mm²) and 12 (0-2000 s/mm²) b values. T2-WI, DWI (four separate acquisitions), proton magnetic resonance spectroscopy (1H-MRS) and dynamic contrast enhanced (DCE) MRI were acquired as part of a separate mpMRI within a week of PET/CT. DWI was post-processed using kurtosis, mono-, and biexponential functions. Presence of PCa was estimated in 12 regions with radical prostatectomy findings as "ground true". For each imaging modality area under the curve (AUC) values for PCa detection and Spearman correlation coefficient (r) between the quantitative parameters and Gleason score groups (3+3, 3+4, >3+4) to predict aggressiveness were determined.

RESULTS

In the region based analysis, 164 (53%, 164/312) regions contained PCa and 41 tumor foci larger than 0.5 cm³ were identified. PET/CT demonstrated the highest sensitivity of 87% while the lowest specificity of 56%. AUC of both PET/MRI and mpMRI significantly ($p < 0.01$) outperformed that of PET/CT while no significant differences were present between PET/MRI and mpMRI. Correlation (r) between Gleason score and tumors' maximum standardized uptake value of PET/CT and PET/MRI was 0.42 ($p = 0.01$) and 0.12 ($p > 0.05$), respectively. The best DWI derived parameters had r in the range of 0.32 ($p < 0.05$) to 0.68 ($p < 0.01$) and RAFF - 0.49 ($p < 0.01$). T2 mapping, 1H-MRS, and DCE-MRI parameter values were not useful in prediction of PCa aggressiveness.

CONCLUSION

Quantitative 18F-FACBC PET/CT significantly correlated with Gleason score but failed to outperform DWI derived parameters in predicting PCa aggressiveness.

CLINICAL RELEVANCE/APPLICATION

18F-FACBC PET/CT and PET/MRI provide limited added value to mpMRI in detection and characterization of primary PCa

SSK09-09 Intravoxel Incoherent Motion (IVIM) MRI for the Interpretation of Pelvic Lymph Nodes in Prostate Cancer: Can We Discriminate Benign from Malignant Nodes?

Wednesday, Nov. 30 11:50AM - 12:00PM Room: N228

Participants

Marc Regier, Hamburg, Germany (*Presenter*) Nothing to Disclose

Christiane Schmitt, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

Christian Seiwerts, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

Cyrus Behzadi, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

Michael G. Kaul, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

Frank Oliver G. Henes, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

Dirk Beyersdorff, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the accuracy of intravoxel incoherent motion (IVIM) MRI for pelvic lymph node staging in prostate cancer using a multi-criteria approach and to compare these to the results of histopathology.

METHOD AND MATERIALS

43 consecutive patients classified as high-risk following D'Amico underwent pelvic MRI one day prior to radical prostatectomy. The imaging protocol consisted of an axial T2w STIR, a DWI (b-values: 0, 25, 75, 100, 200, 500 and 900) and contrast enhanced T1w 3D-GRE sequence. Reading the T1w and T2w images the short and long axis diameters of all pelvic lymph nodes were assessed. The ImageJ based software IVIMit© was applied to generate IVIM maps from the DWI data and to perform a non-linear regression fit. By placing a Region-of-interest encompassing the entire lymph node the parameters Dmean, Dmin, ADC and the perfusion fraction f were recorded. At radical prostatectomy, 924 lymph nodes were removed and referred to histopathologic workup. Sensitivity, specificity, positive and negative predictive values for the discrimination of benign and malignant nodes were calculated using Wilcoxon and chi-square test.

RESULTS

Histopathology identified malignancy in 25 nodes. The mean short and long axis diameter of these lymph nodes was 8.1mm (range, 3-16mm) and 11.8mm (range, 5-25mm), respectively. Applying diameter measurements as the exclusive discriminator resulted in a false negative rate of >60%. In contrast, the calculation of the diffusion fraction Dmean allowed for the discrimination of benign and malignant nodes with high accuracy. The Dmean was 1.10×10^{-3} mm²/sec in benign and 0.54×10^{-3} mm²/sec in malignant nodes ($p < 0.001$). Further, Dmin (0.27×10^{-3} mm²/sec vs. 0.81×10^{-3} mm²/sec; $p < 0.001$) and ADC (0.88×10^{-3} mm²/sec vs. 1.67×10^{-3} mm²/sec; $p = 0.02$) were significantly lower in malignant nodes. A higher perfusion fraction f was found in malignant lymph nodes (33.43% vs. 27.13%), although this difference was not statistically significant ($p, 0.07$).

CONCLUSION

In a high-risk collective, IVIM MRI can be used to assess lymph node metastases prior to prostatectomy. Dmean and Dmin values of 0.54×10^{-3} mm²/s and 0.27×10^{-3} mm²/s allow for the discrimination of benign and malignant lymph nodes with high accuracy.

CLINICAL RELEVANCE/APPLICATION

The application of IVIM MRI can help to detect nodal metastases in prostate cancer prior to prostatectomy and might serve as a complementary tool in the preoperative diagnostic workup.

SSK10

Science Session with Keynote: Health Service, Policy and Research (Education)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S102D



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

Participants

Laura M. Fayad, MD, Baltimore, MD (*Moderator*) Nothing to Disclose
Paul P. Cronin, MD, MS, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SSK10-01 Contrast Reaction Training in US Radiology Residencies: A COARDRI Study

Participants

Christina A. LeBedis, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Andrew B. Rosenkrantz, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hansel J. Otero, MD, Silver Spring, MD (*Abstract Co-Author*) Nothing to Disclose
Summer J. Decker, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Robert J. Ward, MD, Boston, MA (*Presenter*) Nothing to Disclose

PURPOSE

To assess current contrast reaction training in U.S. diagnostic radiology residency programs.

METHOD AND MATERIALS

A 16 question anonymous electronic survey was distributed to diagnostic radiology residency program directors in the U.S. from 9/2015-11/2015. Programs were classified as small or large (≤ 20 vs. >20 residents). Descriptive analyses were performed, and small and large programs were compared using a combination of Fisher's exact test and chi-square test for trend.

RESULTS

25.7% responded to the survey. Radiology residents are the first responders to contrast reactions in 91.5% of programs. 95.7% of programs provide contrast reaction management training. 89.4% of programs provide didactic lectures. The frequency of didactic lectures was significantly different ($p=0.011$) for small vs. large programs (one time: 52.9% vs. 84.0%; two times: 29.4% vs. 16.0%; three times 5.9% vs. 0%; at least four times, 11.8% vs. 0%, respectively). 37.8% of programs provided hands-on simulation training with only one program providing pediatric contrast reaction simulation. Among these 17 programs, residents participate once per year in 14, two times per year in 1, and at least three times per year in 2. Only residents participate in 5 programs; residents and fellows in 4; and residents, fellows, and staff in 8. Additional educational tools utilized by programs include simulation computer modules offered by another academic medical center, post-event debriefing, ACR CME materials on contrast reactions, and a safety curriculum consisting of required readings and an assessment exam. 57.7% of programs with a contrast reaction training program indicated that they were willing to share their contrast allergy curriculum with other radiology residency programs. A significantly larger fraction of small than large programs (66.7% vs. 51.9%, respectively) was willing to share its curriculum ($p=0.026$).

CONCLUSION

In comparison with prior literature, contrast reaction management training is increasingly incorporating simulation training and online content (including standardized modules and online material shared among centers). However, training in contrast reaction management remains inadequate in a majority of programs.

CLINICAL RELEVANCE/APPLICATION

To address patient safety needs, it is imperative that a national curriculum which includes periodic simulation be developed and implemented.

SSK10-02 Student Navigator: Healthcare and Learning Benefits in a Breast Unit

Wednesday, Nov. 30 10:40AM - 10:50AM Room: S102D

Participants

Begona Marquez-Argente-del-Castillo, MS, Murcia, Spain (*Abstract Co-Author*) Nothing to Disclose
Juana M. Plasencia-Martinez, MD, Murcia, Spain (*Abstract Co-Author*) Nothing to Disclose
Carmen Trejo-Gallego, MS, Murcia, Spain (*Abstract Co-Author*) Nothing to Disclose
Lucia Hernandez Sanchez, MBBS, Murcia, Spain (*Presenter*) Nothing to Disclose
Maria Martinez Galvez, Murcia, Spain (*Abstract Co-Author*) Nothing to Disclose
Jose Maria Garcia Santos, MD, PhD, Murcia, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate health care and mammogram learning benefits by involving medical students in a radiological breast unit (RBU).

METHOD AND MATERIALS

We randomized 327 consecutive RBU women in two groups by a permuted-block approach. All them had been appointed for a mammogram due to cancer follow-up, breast symptoms or familiar risk. Group 1 patients were welcomed, navigated and, when normal, finally informed on the outcome by a medical student. Group 2 patients were navigated by a technician as usual. Women with abnormal mammograms or needing ultrasound were excluded. Those included took the State Trait Anxiety Inventory (STAI)

before and after the appointment, considering other information like age, family status, number of children, level of education, feeling of support at the RBU and wish to know the results. The students (n=6) took a simple mammogram test before and after their 10-days attending period to the RBU. Anxiety level was assessed by univariate and multivariate (binary logistic regression – BLR- and general lineal model-GLM-) analysis and student-radiologist diagnostic agreement, by kappa test.

RESULTS

Finally, 199 normal mammogram patients were included. First, both groups were similar in State (21.43 ± 11.61 vs. 22.21 ± 11.75 , $P = 0.646$) and Trait (21.94 ± 11.33 vs. 23.56 ± 12.25 , $P = 0.346$) anxiety. When leaving, anxiety was significantly lower in group 1 (median: 13, interquartile range: 8-21 vs. median: 19.5; interquartile range: 11.75-28.25, $P = 0.001$; patients with anxiety level $\geq P75$ 32.3% vs. 67.7%, $P = 0.028$. State anxiety reduction 6.6 vs. 1.7. $P = 0.001$). Students' intervention independently reduced anxiety according to the multivariate analysis (RLB: OR 3.1; 95%CI: 1.39-7.11; $P = 0.006$. GLM: $F = 9.3$; $P = 0.003$) regardless the particular student ($P = 0.275$). The absolute reduction in risk was 0.18 (95%CI 0.05-0.30) and the number needed to treat, 6 (95%CI 3-19). Student-radiologist agreement improved in 9 of 12 comparison (final kappa = 0.405-0.692).

CONCLUSION

Students involved in the RBU decreased women anxiety independently and increased their mammogram skills moderately.

CLINICAL RELEVANCE/APPLICATION

Integrating university and health system could offer mutual benefits.

SSK10-03 Radiology Rounds with the NICU Through a Telepresence Model: Technology that may Resurrect the Tradition of Daily Film Review

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S102D

Participants

Janet R. Reid, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Christina Chougar, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
John Chuo, MD,MS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Anne M. Ades, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Jorge Delgado, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Parvez Kazmi, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
David T. Saul, MD, Garnet Valley, PA (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the impact of a novel teleconferenced film review.

METHOD AND MATERIALS

From Jan-April 2016, 15 min interactive rounds were delivered by a radiologist (Rad) from a central reading room to a clinical team in a 98 bed neonatal ICU using a telepresence system. Stations were equipped with panoramic web-cams with polycom high fidelity audio. Each session included a 3 min microlecture followed by discussion of a case. Rad and neonatologists (Neo) completed the following assessments: Pre and Post Trial Evaluation; Short survey following each session. Evaluations included: confidence in image interpretation; necessity of interaction between Rad and Neo; graded value of interaction based on modality (scale 1-10 (median, range)) and obstacles to interaction.

RESULTS

Pre-post trial evaluation: 21 and 9 Rad and 22 and 2 Neo answered the pre- and post- trial evaluation, respectively. **Confidence:** for Rad, pre-trial score: 7 (5-9); post-trial score: 8 (7-10) ($P=0.028$); for Neo, pre-trial score: 7.5 (3-10); post-trial score: 7.5 (7-8). **Necessity of rounds:** for Rad, pre-trial score: 7 (4-10); post-trial score: 9 (7-10) ($P=0.008$); for Neo, pre-trial score: 8 (3-10); post-trial score: 9 (8-10). **Obstacles to interaction:** Rad: most important obstacles were time and perceived value (14/21); Neo: time away from patient care (18/22). **Modalities needing more interaction:** for Rad there was no difference between interaction for different modalities ($p=0.99$); Neo required more interaction for nuclear medicine and abdominal/chest MRI/CT, and least for abdominal/chest XR ($p<0.01$). **Surveys: Rad:** 8/9 Rads' imaging interpretation matched the clinical interpretation; 7/9 reinforced the interpretation; 1/9 did not impact interpretation and 1/9 cases changed the interpretation. All reported having a better understanding of the case after the interaction. **Neo:** For 22/25 the intervention reinforced the care plan, for 3/25 the intervention did not impact the care plan. Level of confidence in their radiologic interpretation: major improvement in 5/25, moderate in 17/25, no change in 3/25.

CONCLUSION

Our novel film review between NICU and radiology using telepresence was highly desirable, effective and educational and can replace the traditional model.

CLINICAL RELEVANCE/APPLICATION

This project embodies Radiology 3.0 in adding value to patient care through improved communication and interdisciplinary education.

SSK10-04 Multi-year Evaluation of Inter-professional Simulation Team-training (TT) for Management of Acute Contrast Reactions (ACR): Educational Impact on Team-Performance

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S102D

Participants

Alexi Otrakji, MD, Boston, MA (*Presenter*) Nothing to Disclose
Hillary R. Kelly, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Alexandra Penzias, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Joanne Forde, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sanjay Saini, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gloria M. Salazar, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Shawn Bonk, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the impact of cognitive aids (CA) and TT skills in the proper medical management of simulated contrast reactions.

METHOD AND MATERIALS

A retrospective analysis of objective performance of radiology inter-professional teams (physician, technologist, and/or nurse) undergoing high-fidelity simulation training for the management of ACR was conducted from October 2012 through June 2015. Participants underwent two-hour simulation sessions in a learning laboratory, where two simulated cases of anaphylactoid reactions to contrast media were presented in addition to CA tools (posters, pocket cards). To evaluate the educational impact of simulation, the following metrics were reviewed: time to institute correct medical treatment and time to call for help (seconds), appropriateness of medication administration (route and dosage) and designating a team leader. Statistical analysis was performed with Fisher's exact test.

RESULTS

We identified 280 radiology teams where 30 % (n=85) utilized CA and 37 % (n=103) designated a team leader to help manage the ACR. Teams administered the correct medication at 3.6 minutes (average) of the beginning of the simulated ACR (SD 1.3, 2– 7 minutes). There were no statistical differences in time to response and correct administration of epinephrine auto-injector when comparing teams that utilized CA versus teams that did not (Table 1). When evaluating the impact of non-technical skills during simulation, our data showed that designating a team leader resulted in significantly higher correct utilization of auto-injector as compared to teams that did not assigned a leader (p=0.004), however no differences were detected when evaluating time to institute epinephrine and calling for additional help (Table 2).

CONCLUSION

Our study demonstrates no significant improvement of objective performance when CA is utilized. Moreover, correct administration of epinephrine auto-injector seems to be significantly improved when inter-professional participants designated a team leader. Further research is needed to evaluate the impact of these two variables in simulation performance for ACR.

CLINICAL RELEVANCE/APPLICATION

Effective management of anaphylaxis secondary to ACR depends on well-designed cognitive aids (CA) and recurrent training of staff. We sought to evaluate the impact of simulation in team performance.

SSK10-05 Perceptions of Radiology Education among Advanced Practice Providers, Nurse Practitioners, and Physician Assistants

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S102D

Awards

Student Travel Stipend Award

Participants

Jamie L. Richard, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Jeanne M. Horowitz, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Tracey Anderson, Aurora, CO (*Abstract Co-Author*) Faculty, Johnson & Johnson
Benjamin P. Liu, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Nurse practitioners (NP) and physician assistants (PA) have significant impact on imaging utilization but there is a wide variation in radiology understanding and prior education. These healthcare providers order imaging in multiple patient care settings ranging from outpatient clinics to ICUs. Their perceptions of radiology may provide insight into how to improve the delivery of radiologic services to patients, and help radiologists in determining how select radiology education of advanced practice providers may be of benefit.

METHOD AND MATERIALS

A survey was conducted at the American Association of Neurological Surgeons (AANS) Advanced Practice Providers (APP) educational course consisting of a 14-point questionnaire about the context in which the course participants utilized imaging and their perceived understanding of radiology. Multivariate analysis was performed with STATA statistical software to compare perceptions based on prior radiology education and years of practice experience.

RESULTS

Completed surveys obtained from 92 APPs, 61% nurse practitioners and 39% physician assistants. Most worked for less than 2 years or 2-5 years, representing 35% and 25%, respectively. 99% of respondents felt that radiology education should be included in a NP or PA degree program but 45% reported that they had not received formal classroom education. 71% of APPs influenced the supervising physician about what type of imaging to order. However, confidence of imaging knowledge was not significantly associated with whether or not the physician extender influenced the supervising physician on imaging studies (p>0.05). Only 2% felt "very confident" about diagnostic imaging knowledge. 6% felt "not at all confident" and 44% felt "somewhat confident" with imaging knowledge. Confidence of imaging knowledge and comfort in discussing radiology with patients were positively associated with number of years of practice (p=0.01).

CONCLUSION

A survey of APPs in neurosurgery showed that a majority influenced imaging orders of physician counterparts despite a lack of education or high comfort level in understanding radiology. APPs overwhelmingly felt that radiology education should be included in their formal degree programs.

CLINICAL RELEVANCE/APPLICATION

Nurse practitioners and physician assistants have a significant role in influencing imaging ordered by supervising physicians despite a lack of education or high comfort level in understanding radiology.

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/>

Jeanne M. Horowitz, MD - 2016 Honored Educator

SSK10-06 A Digital Patient Engagement Platform to Enhance Patient Knowledge about Diagnostic Imaging

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S102D

Participants

Joseph R. Steele JR, MD, Houston, TX (*Presenter*) Consultant, Adient Medical Inc; Stockholder, Adient Medical Inc;
A. Kyle Jones, PhD, Houston, TX (*Abstract Co-Author*) Shareholder, Sirtex Medical Ltd
Stowe Shoemaker, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ryan K. Clarke, MHA, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Simit Parmar, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

High quality healthcare requires that well informed patients work in concert with their providers to make good decisions. Many patients lack health literacy around imaging. In particular, they do not understand the use of ionizing radiation, and as a result may make decisions that are not in their best interest. The primary objective of this study was to determine if an interactive online program (HealthLoop, Mountain View, CA) is more effective for educating patients about diagnostic imaging than conventional aids (paper documents).

RESULTS

A total of 1153 participants completed the full survey, 302 (26%) in the HealthLoop group, 363 (31%) in the PDF group, and 488 (42%) in the control group. When asked "Do you know the definition of ionizing radiation", 66% of the HealthLoop group, 57% of the PDF group, and 22% of the control group answered "Yes". When asked which imaging modalities used ionizing radiation, the HealthLoop group was significantly more knowledgeable than the other two groups. When asked about the relative radiation doses used by different imaging modalities, the HealthLoop group again significantly outperformed the other two groups. The HealthLoop group was significantly less concerned about radiation exposure than the other two groups. The overwhelming majority of participants in the HealthLoop groups (84%) were satisfied or very satisfied with their experience and found it helpful or very helpful (85%).

CONCLUSION

Health literacy in imaging is a problem. Our control population demonstrated a basic lack of understanding of the use of ionizing radiation in diagnostic imaging and the relative radiation doses used by different modalities. A quality improvement effort consisting of educating patients before their procedure using either conventional paper educational materials or an innovative online platform increased knowledge, however, the online platform produced significantly higher increases in most endpoints. Further, patients who used the online platform were less apprehensive about radiation and found their educational experience both satisfying and helpful. As national patient awareness increases as a result of educational initiatives, including Image Wisely, Image Gently, and Choosing Wisely, imaging practices should consider expanding the use of online education platforms.

METHODS

Two weeks prior to a scheduled imaging appointment, patients were contacted via email and asked if they would like to participate. They were then sent either a login to the HealthLoop program, a PDF document, or no educational aid. Within one week following their imaging exam, all participating patients were emailed a link to a 22 question survey. The primary endpoints were responses to survey questions about facts and risks related to diagnostic imaging. To evaluate for nonresponse bias, those who did not complete the survey were sent a second, abbreviated survey and the two sub groups were compared. Finally, the HealthLoop group was sent a second survey to rate their experience with the web-based educational tool.

PDF UPLOAD

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/>

Joseph R. Steele Jr, MD - 2013 Honored Educator

SSK10-07 Do Medical Students and Commencing First Year Radiology Residents Perform Differently in a Standardized Radiology Exam?

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S102D

Participants

Petra J. Lewis, MD, Lebanon, NH (*Presenter*) Book contract, Oxford University Press; Consultant, Siemens AG

PURPOSE

Radiology residents start their training with highly variable levels of baseline knowledge of radiology, dependant on their prior experiences. To try and reduce this variability, for the last 4 years, we have had our first year residents take part in the identical July educational experience as the 4th year student elective, including the end of elective exam. This study was a review of the exam scores obtained by the two groups, student (S) and resident (R).

METHOD AND MATERIALS

Students and residents underwent the same lecture and workshop series during July (2012-2015). Our student elective course includes about 50 hours of didactic/interactive teaching, workshops & games and about 25 hours of general radiology resident teaching that all residents and students attended. The elective course covers all modalities/specialties but focuses on appropriate image ordering, basic image interpretation and technique, anatomy, patient safety etc. Both groups were provided with the same text book (Oxford Handbook of Radiology) and all completed 17 CORE cases online (Med-u.org). Exams were deployed through Radiology ExamWeb, using exams developed by Alliance of Medical Student Educators (AMSER). Both had access to a 20 question practice test and completed a 113 question final exam after 4 weeks (AMSER SE1).

RESULTS

20 S and 22 R took part in the July course. Anecdotal feedback from residents was very positive They felt that this provided them with an excellent grounding in radiology and there were no complaints about being taught alongside students. There were no significant differences in the the final test results between students and residents but both groups scored significantly higher than the national mean ($p < 0.001$). Final test score % (mean/sd) S (n=20): 87.1/3.8 , R (n=22): 84.7/5.7 . National results on this test (n=1702):75.0/8.7

CONCLUSION

At the end of a one month course in radiology at the start of residency, student and residents perform no different from each other on a standardized exam despite 24 months difference in education. Performance was significantly better in both groups than the national mean. This latter may be due to the intensive nature of our course.

CLINICAL RELEVANCE/APPLICATION

Residency programs should consider a short intensive basic course at the beginning of PGY2 to establish uniformity of entry knowledge with a standardized post course evaluation such as the AMSER Standardized Exam.

SSK10-08 Health Literacy and Online Radiology Patient Education Resources-An Opportunity to Enhance the Radiologist-Patient Relationship with Improved Communication

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S102D

Awards

Student Travel Stipend Award

Participants

David R. Hansberry, MD,PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Suzanne S. Long, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study evaluates the level of readability of online radiology resources written specifically for patients to see if they meet the guidelines set forth by the American Medical Association (AMA) and National Institutes of Health (NIH). Given the relative ease of Internet access, patients and their families frequently turn to the Internet as a source of further information. The online resources we provide as radiologists can help enhance the communication between us and our patients.

METHOD AND MATERIALS

The online patient education resources from professional organization including the Society of Interventional Radiology, Cardiovascular and Interventional Radiology Society of Europe, American Society of Neuroradiology, Society of Neurointerventional Surgery, European Society of Radiology, and the jointly sponsored ACR-RSNA website radiologyinfo.org were evaluated for their level of readability. Further readability analysis was performed on 8 different websites that provide educational resources on radiation safety. The level of readability is quantitatively evaluated using 10 well-established readability scales.

RESULTS

Collectively, the 300 individual patient education resources were written at a 12.8 grade level. The level of readability ranged from a low a 12.2 grade level for resources available on radiologyinfo.org to the 14.5 grade level for resources on the SIR website. None of the 300 articles were written at the AMA and NIH recommended 3th - 7th grade level to meet the needs of the average American that reads at an 8th grade level.

CONCLUSION

The readability of online patient education resources from the major radiologic societies as well as those with an interest in radiation safety, largely miss the guidelines of the AMA and NIH. Providing educational resources for patients is critical in helping patients better understand their disease, how it's diagnosed, and their treatment options. Rewriting patient education resources in a simpler format will increase the number of readers who can fully comprehend the material and ultimately derive more benefit with the goals of improved outcomes and patient satisfaction.

CLINICAL RELEVANCE/APPLICATION

Patients frequently use the Internet as an educational resource; it is therefore imperative that these resources be written no higher than the NIH and AMA recommended 7th grade level to ensure widespread understanding by the average American.

SSK10-09 Health Service, Policy and Research Keynote Speaker: Methodologies in Medical Education Studies

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S102D

Participants

Laura M. Fayad, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

SSK11

Molecular Imaging (Oncology)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S504CD



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

FDA Discussions may include off-label uses.

Participants

Umar Mahmood, MD, PhD, Charlestown, MA (*Moderator*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Ltd;

Yasuhisa Fujibayashi, PhD, Fukui, Japan (*Moderator*) Nothing to Disclose

Sub-Events

SSK11-01 A Dual-Labeled Anti-CD 146 Monoclonal Antibody for PET/NIRF Detection of Liver Malignancies

Awards

Student Travel Stipend Award

Participants

Emily B. Ehlerding, Madison, WI (*Presenter*) Nothing to Disclose

Reinier Hernandez, MSc, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

Haiyan Sun, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

Yunan Yang, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

Christopher England, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

Todd Barnhart, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Due to hepatic clearance of the majority of contrast agents, molecular imaging of liver malignancies is challenging. However, overexpression of CD146 has been associated with aggressiveness and metastatic potential in liver cancer. Herein we develop a CD146-targeted probe for high contrast positron emission tomography (PET) and nearinfrared fluorescence (NIRF) imaging of liver cancer.

METHOD AND MATERIALS

In vitro expression levels of CD146 were characterized in the liver cancer cell lines HepG2 (+) and Huh7 (-) via several in situ methods. YY146, an anti-CD146 monoclonal antibody, was conjugated to the NIRF dye ZW800-1 and to deferoxamine (Df) for radiolabeling with 89Zr. Sequential PET and NIRF imaging were performed after intravenous injection of 3.7 – 7.4 MBq of 89Zr-Df-YY146-ZW800 in athymic nude mice bearing HepG2 or Huh7 subcutaneous (s.c.) xenografts. Orthotopic tumors were generated by injection of luciferase-transfected HepG2 cells into the liver, allowing progression monitoring by bioluminescent imaging. Multimodality imaging was carried out in mice with confirmed orthotopic liver tumors as described for s.c. tumors. At 168 h p.i., tissues were collected for ex vivo NIRF imaging, biodistribution, and histological studies.

RESULTS

PET and NIRF imaging unveiled a prominent and persistent uptake of 89Zr-Df-YY146-ZW800 in HepG2 tumors that peaked at 31.7 ± 7.2 %ID/g 72 h p.i. Owing to such marked accumulation, the detection of orthotopic HepG2 tumors was successful despite the relatively high liver background. CD146-negative Huh7 and CD146-blocked HepG2 tumors exhibited significantly lower 89Zr-Df-YY146-ZW800 accretion (6.1 ± 0.5 and 8.1 ± 1.0 %ID/g at 72 h p.i., respectively), demonstrating the CD146-specificity of the tracer in vivo. Ex vivo studies verified the accuracy of the imaging data and correlated 89Zr-Df-YY146-ZW800 uptake with in situ CD146 expression.

CONCLUSION

Overall, 89Zr-Df-YY146-ZW800 showed excellent properties as a PET/NIRF imaging agent, including high specificity for CD146-expressing liver cancer. Molecular imaging using dual-labeled YY146 had great potential for noninvasive detection and image-guided resection of liver malignancies.

CLINICAL RELEVANCE/APPLICATION

Liver malignancies are often difficult to distinguish from background tissue. Thus, we present a dual nearinfrared- and radio-labeled antibody targeting CD146 for detection of these malignancies.

SSK11-02 Role of 11C-Acetate and 18F FDG Dual Tracer PET-CT Scan for Detection of Hepatocellular Carcinoma

Wednesday, Nov. 30 10:40AM - 10:50AM Room: S504CD

Participants

Wan Hang K. Chiu, MBBCh, FRCR, Hong Kong, Hong Kong (*Presenter*) Nothing to Disclose

Pek Lan Khong, MBBS, FRCR, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

Tony Kwok Loon Loke, MBBS, FRCR, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

Joseph K. Lee, MD, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Up to 45% of Hepatocellular Carcinoma (HCC) show atypical contrast enhancement (CE) pattern on CT/MR, thereby requiring

histologic confirmation. The aim of this study is to evaluate the additional value of Dual Tracer (DT) PET with 11C Acetate (Ac) and 18F FDG for detection and characterization of HCC.

METHOD AND MATERIALS

Consecutive patients who had histological confirmation of HCC and underwent CT/MR and DT in our centres from 2014-16 were identified. CE and PET uptake patterns were reviewed. Typical CE pattern on CT/MR was arterial hyperenhancement followed by portovenous/delayed phase washout. All other CE patterns were considered atypical. On PET, a lesion was deemed positive by visual inspection of lesion above background liver uptake on Ac and/or FDG. Results were compared with tumor size and grade on histology. Tumour size were separated into <3 cm, 3-5 cm and >5 cm groups as each has different treatment option. Grading was based on Edmondson and Steiner system. Pearson's Chi-Square tests were applied to compare the sensitivities and ANOVA-test for subgroup analysis.

RESULTS

Thirty-two HCC lesions from 24 patients were identified (mean size \pm SD 34 ± 27 mm). The sensitivity of CT/MR by CE pattern was 53%, FDG alone 56%, Ac alone 94%, DT 97% and combined CT/MR with DT 100% ($p < 0.0001$). Two lesions were non-Ac avid. Enhancement pattern were not affected by tumour size whereas FDG sensitivities increase with tumour size from 39% to 67% and 75% for lesions <3 cm, 3-5 cm and >5cm respectively. Histological grade available in 30 lesions were well differentiated HCC ($n=7$), moderately-differentiated HCC ($n=22$) and poorly differentiated HCC ($n=1$). Atypical enhancement pattern was more common in well-differentiated compared to moderately-differentiated lesions (71% vs 45%). No trend was observed for tracer avidities in different grades of HCC.

CONCLUSION

DT combined with CT/MR increases the sensitivity of HCC detection compared to CT/MR alone, providing 100% sensitivity and hence, being most helpful in equivocal liver lesions with atypical contrast enhancement.

CLINICAL RELEVANCE/APPLICATION

The use of DT obviates tissue sampling for diagnosing HCC in patients with liver lesions with atypical CT/MR contrast enhancement.

SSK11-03 64Cu-Labeled Ipilimumab for Determination of CTLA-4 Levels in Lung Cancer

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S504CD

Participants

Emily B. Ehlerding, Madison, WI (*Presenter*) Nothing to Disclose
Christopher England, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Stephen Graves, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Glenn Liu, 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

CTLA-4 is expressed on the surface of activated T cells and some cancer cells, and is the target of the clinically-approved monoclonal antibody Ipilimumab. Ipilimumab is only successful in a small subset of patients, making neoadjuvant patient selection crucial. In this study, we employ radiolabeled 64Cu-DOTA-Ipilimumab to monitor CTLA-4 expression levels in subcutaneous (s.c.) lung cancer xenografts using positron emission tomography (PET).

METHOD AND MATERIALS

Ipilimumab was conjugated with the chelator 1,4,7,10-tetraazacyclododecane-1,4,7,10-tetraacetic acid (DOTA) for radiolabeling with 64Cu ($t_{1/2} = 12.7$ h). Western blot, ELISA, flow cytometry, and live cell imaging were employed to determine the CTLA-4 expression levels of three lung cancer cell lines: A549, H460, and H358. Longitudinal PET studies following intravenous injection of 64Cu-DOTA-Ipilimumab into mice bearing s.c. xenografts of the aforementioned lung cancer cells allowed for tracer uptake to be quantified up to 48 h p.i. Ex vivo biodistribution and histological studies were employed to verify PET results.

RESULTS

By in situ analysis, A549 was found to have the highest CTLA-4 expression level, and H358 the lowest. PET quantification verified these results, with A549 tumor uptake peaking at 13.1 ± 3.9 %ID/g, H460 at 10.5 ± 1.9 %ID/g, and H358 at 8.3 ± 1.3 %ID/g, 48 h p.i. A549-blocked mice also displayed decreased tracer uptake values at 8.1 ± 1.0 %ID/g. Ex vivo analysis following the terminal imaging timepoint also corroborated these findings.

CONCLUSION

Radiolabeled 64Cu-DOTA-Ipilimumab is able to differentiate tumors based on their CTLA-4 expression levels noninvasively using PET. Thus, this antibody holds promise to be employed in small doses prior to immunotherapy treatment to predict the success of such anti-CTLA-4 therapy and aid in patient selection.

CLINICAL RELEVANCE/APPLICATION

Anti-CTLA-4 immunotherapies are effective in a small subset of patients. Thus, we use 64Cu-DOTA-Ipilimumab to determine tumors which have high expression levels and may respond well to such therapy.

SSK11-04 Molecular Optical Imaging in Radiofrequency Heating-Enhanced Direct Intratumoral HSV-TK Gene Therapy of Cholangiocarcinoma

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S504CD

Participants

Yin Jin, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Feng Zhang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jun Gao, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

Xiaoming Yang, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To validate the feasibility of using molecular optical imaging to monitor radiofrequency heating (RFH)-enhanced herpes simplex virus thymidine kinase (HSV-TK)/ganciclovir (GCV) therapy of cholangiocarcinomas.

METHOD AND MATERIALS

This study included in-vitro confirmation experiments with luciferase/mCherry-labelled human cholangiocarcinoma cells (Mz-Cha-1) and in-vivo validation experiments using mouse models with luciferase/mCherry-cholangiocarcinomas. Both in-vitro and in-vivo experiments were divided into four groups with treatments of: (i) combination therapy (green fluorescent protein (GFP)/HSV-TK/plasmid gene transfection plus RFH at 42°C, and followed by ganciclovir administration; (ii) gene therapy alone; (iii) RFH alone; and (iv) saline. GFP optical imaging was first performed to detect successful expression of GFP/HSV-TK genes, while bioluminescent optical imaging used to follow up tumor responses to various treatments among different groups, which were correlated with subsequent histologic confirmation.

RESULTS

Of in-vitro experiments, MTS assay demonstrated the lowest cell proliferation in combination therapy compared with three control groups (24.1±7.2% vs 41.6±4.9% vs 72.3±7.9% vs 100%, p<0.05). Of in-vivo experiments, GFP optical imaging detected greater green fluorescent signal from GFP/HSV-TK/plasmid-transfected tumors than non-gene transfected tumors (200.73±37.85 VS 52.80±17.36, p<0.05), which indicated successful expression of GFP/HSV-TK genes. Bioluminescent optical imaging demonstrated decreases of both bioluminescence signals and tumor sizes in combination therapy, compared to other control groups (0.68±0.11 vs 1.47±0.19 vs 2.01±0.33 vs 2.33±0.41, p<0.05), which were confirmed by histologic correlation (Figure).

CONCLUSION

We have established the "proof-of-principle" of using molecular optical imaging to monitor RFH-enhanced GFP/HSV-TK/plasmid gene expression and HSV-TK/GCV gene therapy of cholangiocarcinoma. This concept may pave a new avenue for management of pancreaticobiliary malignancies by simultaneous integration of molecular optical imaging, radiofrequency technology, interventional oncology, and direct intratumoral gene therapy.

CLINICAL RELEVANCE/APPLICATION

This concept may pave a new avenue for management of cholangiocarcinoma by simultaneous integration of molecular optical imaging, radiofrequency technology, interventional oncology, and gene therapy.

SSK11-05 89Zr-Labeled Pembrolizumab for Neoadjuvant Imaging and Human Dosimetry Estimation

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S504CD

Participants

Emily B. Ehlerding, Madison, WI (*Presenter*) Nothing to Disclose
Christopher England, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Reinier Hernandez, MSc, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Stephen Graves, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Todd Barnhart, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pembrolizumab is a clinically-available humanized monoclonal antibody that targets programmed cell death protein (PD-1) on the surface of activated T and B cells. In order to potentially identify patients who would benefit from such therapy, herein we evaluate the pharmacokinetics, biodistribution, and dosimetry of 89Zr-labeled pembrolizumab in vivo using positron emission tomography (PET).

METHOD AND MATERIALS

Pembrolizumab was conjugated with the chelator desferrioxamine (Df) for radiolabeling with 89Zr (t_{1/2} = 3.3 days). Whole-body tracking of the radiolabeled antibody was compared in two murine models, including NSG and PBL mice (NSG mice reconstituted with human peripheral blood mononuclear cells). Mice were injected with 5-10 MBq of radiolabeled antibody. Timepoints from 0.5 h to 168 h p.i. were utilized in the PET study to fully capture the pharmacokinetics of Pembrolizumab. Biodistribution data obtained from PET scans were extrapolated to predict radiation dose estimates in humans.

RESULTS

In all groups, 89Zr-Df-Pembrolizumab stayed in circulation throughout the study and accumulated greatest in liver and spleen. Notable biodistribution differences between PBL and NSG mice included significant uptake in salivary glands in PBL mice, indicating the specificity of Pembrolizumab for human T-cells, which localize here following an autoimmune response. Peak uptake values for the liver of 14.40 ± 1.55 %ID/g for PBL and 12.93 ± 1.96 %ID/g for NSG mice, and for the spleen of 7.33 ± 1.53 %ID/g for PBL and 5.48 ± 0.71 %ID/g for NSG were found 0.5 h p.i. with values steadily declining thereafter. Even with relatively high uptake in these clearance organs, the estimated doses remained well within safe limits, with a total body effective dose of 0.515 ± 0.005 mGy/MBq calculated.

CONCLUSION

The low total body and major organ doses found in this study indicate the potential use of 89Zr-Df-Pembrolizumab for the clinical selection of patients that may benefit from anti-PD-1 therapy. The techniques in this study may be further applied to other antibodies for better understanding of the pharmacokinetics, biodistribution, and dosimetry for future clinical applications.

CLINICAL RELEVANCE/APPLICATION

Herein we evaluate a radiolabeled, clinically-approved antibody, 89Zr-Df-Pembrolizumab, targeting PD-1, that could potentially screen for patients who would respond to such anti-PD-1 immunotherapy.

SSK11-06 Prolactin Receptor-Mediated Internalization of Imaging Agents Detects Epithelial Ovarian Cancer with

Enhanced Sensitivity and Specificity

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S504CD

Participants

Karthik M. Sundaram, MD, PhD, Nashville, TN (*Presenter*) Nothing to Disclose
Yilin Zhang, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Brian B. Roman, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Joseph A. Piccirilli, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ernst Lengyel, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop a highly sensitive, specific, and clinically amenable molecular imaging agent for ovarian cancer diagnosis that enables (i) detection of tumors when they are still small, confined to the pelvis, and curable and (ii) differentiation between benign and malignant ovarian tumors.

METHOD AND MATERIALS

We used tissue microarray analysis to identify the prolactin receptor (PRLR) as a high specificity biomarker for malignant OvCa. We conjugated gadolinium-chelates and near-infrared fluorescence imaging probes to human placental lactogen (hPL), a specific and high affinity PRLR ligand, and evaluated internalization by PRLR (+) and PRLR (-) ovarian cancer cells. We further evaluated that capacity of hPL-conjugates and reduced binding hPL analog conjugates to imaging mouse xenografts of human ovarian cancer by magnetic resonance imaging and near-infrared fluorescence imaging.

RESULTS

Our results indicate that > 98% of OvCas over-express PRLR regardless of stage, grade, and type. Furthermore, we show both hPL-gadolinium conjugates and hPL-near-infrared probes conjugates internalize specifically and efficiently into PRLR (+) cancer cells in OvCa mouse models. This enables detection of xenograft PRLR (+) tumors in mice with substantially greater specificity and sensitivity than currently used clinical contrast agents.

CONCLUSION

Using prolactin receptor-mediated internalization, hPL-conjugates demonstrate the specificity to distinguish PRLR (+) from PRLR (-) tumors in mouse models of ovarian cancer. Given that > 98% of OvCas over-express PRLR, we believe our ability to image PRLR will enhance specificity and sensitivity of ovarian cancer diagnosis.

CLINICAL RELEVANCE/APPLICATION

Given the difficulties of currently used methods for ovarian cancer diagnosis, we believe molecular PRLR imaging using hPL-conjugates will engender a new paradigm for targeted molecular imaging of OvCa. Coupled with magnetic resonance imaging, molecular PRLR imaging holds the potential to achieve a more precise and earlier diagnosis of OvCa, thereby reducing the number of unnecessary surgeries and increasing patient survival.

SSK11-07 Designed Multifunctional Gold Nanocomposites for Targeted Tri-Mode CT/MR/ Optical Imaging of Human Non-Small Cell Lung Cancer Cells

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S504CD

Participants

Jingwen Chen, Shanghai, China (*Presenter*) Nothing to Disclose
Qian Chen, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Gui-Xiang Zhang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Xiang-Yang Shi, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Han Wang, MD, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The high incidence and mortality rate of non-small cell lung cancer (NSCLC) prompts exhaustive efforts to develop new effective methods for its diagnosis at the early-stage to improve the survival rate. We are developing multifunctional gold nanocomposites to use as the nanoprobe for targeted tri-mode CT / MR / optical imaging of human non-small cell cancer cells both in vitro and in vivo.

METHOD AND MATERIALS

Amine-terminated generation 5 poly(amidoamine) dendrimers were used as a nanoplatfrom to be covalently modified with Gd chelator, Cy5.5, and FA. Then the multifunctional dendrimers were used as templates to entrap gold nanoparticles, followed by chelating Gd(III) ions and acetylation of the remaining dendrimer terminal amines. The thus-formed multifunctional Au DENPs (in short, Cy5.5-Gd-Au DENPs-FA) were characterized via different techniques, and then were used for both in vitro and in vivo targeted CT/ MR/ NIR optical tri-mode imaging of human NSCLC cells (NCI-H460 cells) and the xenograft tumor model.

RESULTS

CT/MR/optical images show that NCI-H460 cells can be detected after incubation with the Cy5.5-Gd-Au DENPs-FA in vitro and the xenograft tumor model can be imaged after intravenous administration of the particles. Combine the inductively coupled plasma-atomic emission spectroscopy (ICP-AES) measurements with the transmission electron microscopy (TEM) data confirm that the Cy5.5-Gd-Au DENPs-FA is able to be uptaken by the treated cells. MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay show that the Cy5.5-Gd-Au DENPs-FA has a good biocompatibility at the given concentration range.

CONCLUSION

The findings of this study suggest that the developed Cy5.5-Gd-Au DENPs-FA may be used as a promising tri-mode nanoprobe for targeted CT/MR/optical imaging of human NSCLC and other folate receptor (FR) over-expressing cancers.

CLINICAL RELEVANCE/APPLICATION

In consideration of the special structural characteristic, the dendrimer based nanocomposites may be further modified with therapeutic antibodies or small interfering RNA (siRNA) to be expectably developed for the personalized theranostics of cancers at early-stage with the high accuracy and sensitivity.

SSK11-08 Differential Uptake of CD146-Specific Antibody in Solid Lung Malignancies

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S504CD

Participants

Christopher England, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Haiyan Sun, Da Lian, China (*Abstract Co-Author*) Nothing to Disclose
Reinier Hernandez, MSc, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Yunan Yang, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Todd Barnhart, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recent studies have revealed that a cell surface protein called CD146 is a marker of epithelial-to-mesenchymal transition (EMT) in cancer cells whose overexpression has also been found to correlate with cancer progression, invasion, and metastasis. Additionally, CD146 has low background levels in normal tissue as well as differential expression in metastases and advanced primary tumors, showing its significant potential in cancer therapies. This study evaluates the utilization of YY146, an anti-CD146 monoclonal antibody, for molecular imaging of solid lung malignancies.

METHOD AND MATERIALS

The anti-CD146 antibody (YY146) was conjugated to 1,4,7-triazacyclononane-triacetic acid (NOTA) and radiolabeled with ⁶⁴Cu. CD146 expression was evaluated in six human lung cancer cell lines (A549, NCI-H358, NCI-H522, HCC4006, H23, and NCI-H460) by flow cytometry and quantitative Western blot studies. The biodistribution and tumor uptake of ⁶⁴Cu-NOTA-YY146 was assessed by sequential PET imaging in athymic nude mice bearing subcutaneous lung cancer xenografts. The correlation between CD146 expression and tumor uptake of ⁶⁴Cu-NOTA-YY146 was evaluated by graphical software while ex vivo biodistribution and immunohistochemistry studies were performed to validate the accuracy of PET data and spatial expression of CD146.

RESULTS

Flow cytometry and Western blot studies showed similar findings with H460 and H23 cells highly expressing CD146. Small differences in CD146 expression levels were found between A549, H4006, H522, and H358 cells. Tumor uptake of ⁶⁴Cu-NOTA-YY146 was highest in CD146-expressing H460 and H23 tumors, peaking at 20.1 ± 2.86 and 11.6 ± 2.34 %ID/g at 48 h post-injection (n=4). Tumor uptake was lowest in the H522 model (4.1 ± 0.98 %ID/g at 48 h post-injection; n=4), while H4006, A549 and H358 exhibited similar uptake of ⁶⁴Cu-NOTA-YY146. A positive correlation was found between tumor uptake of ⁶⁴Cu-NOTA-YY146 (%ID/g) and relative CD146 expression ($r^2=0.98$, $p<0.01$). Ex vivo biodistribution corroborated the accuracy of PET data.

CONCLUSION

The strong correlation between tumor uptake of ⁶⁴Cu-NOTA-YY146 and CD146 expression demonstrates the potential use of this radiotracer for imaging tumors that elicit varying levels of CD146.

CLINICAL RELEVANCE/APPLICATION

This imaging tracer may promote enhanced monitoring of therapeutic response and improved patient stratification.

SSK11-09 Smartphone based Diagnostics (D3) Enable Molecular Characterization of Lymphoma in Resource-limited Countries

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S504CD

Awards

Student Travel Stipend Award

Participants

Aoife Kilcoyne, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose
Divya Pathania, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hyungsoon Im, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hakho Lee, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Cesar Castro, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ralph Weissleder, MD, PhD, Boston, MA (*Abstract Co-Author*) Investor, T2 Biosystems, Inc

PURPOSE

A major hurdle in cancer therapy is its timely diagnosis and treatment. This is of particular concern in resource-limited settings. For example, aggressive forms of non-Hodgkins lymphoma are major health concerns in sub-Saharan Africa. A substantial number of cases evade comprehensive evaluation and are not appropriately classified due to the lack of proper tissue specimens, diagnostic reagents and specialists. Although a good proportion of cases are curable even in low and middle income countries, windows of therapeutic opportunity are often missed due to delay in diagnosis. This necessitates the need for a low-cost, rapid and accurate detection technology to expedite the diagnosis of aggressive lymphomas (and other prevalent cancers) in the resource-limited environment.

METHOD AND MATERIALS

We have developed a digital diffraction diagnostic (D3) platform that allows modern smartphones to be used for molecular cancer diagnostics of scant clinical samples (fine needle aspirates). Fine Needle Aspirate (FNA) samples are immunolabeled with microbeads in a microfluidic module and then holographically detected by the smartphone camera.

RESULTS

Diffraction patterns generated by the antibody-microbeads were detected with the smartphone camera using bright-field settings.

Digital signal processing was used to reconstruct images to count bead-bound cells. We optimized the assay so that thousands of cells could be analyzed without washing steps in near real-time. The D3 profiling results on lymphoma cell lines demonstrated excellent agreement with those by flow cytometry (gold standard). We further analyzed scant clinical samples (FNAs) from 8 patients. The D3 assay generated readouts within an hour and demonstrated agreement (100%) with standard pathology.

CONCLUSION

The D3 approach of molecular analysis could have far reaching applications. The major advantages are the simplicity of the method, the accuracy and it's ability to be used in resource-limited settings.

CLINICAL RELEVANCE/APPLICATION

Leveraging smartphones as a mobile diagnostic terminal could empower resource-poor communities with complex laboratory tests. This work addresses the practical diagnostic needs of low and middle income countries and reflects the type of technologies that may gain sustainable traction in such settings.

Musculoskeletal (Tumor)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: E353C

MK **MR**AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**FDA** Discussions may include off-label uses.**Participants**

Mark J. Kransdorf, MD, Phoenix, AZ (*Moderator*) Nothing to Disclose
 Frank W. Roemer, MD, Boston, MA (*Moderator*) Chief Medical Officer, Boston Imaging Core Lab LLC; Research Director, Boston Imaging Core Lab LLC; Shareholder, Boston Imaging Core Lab LLC; ;

Sub-Events**SSK12-01 Mid-term Outcomes after Percutaneous Cryoablation of Venous Vascular Malformations****Participants**

Francois Marin, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
 Nicolas Grenier, MD, Bordeaux CEDEX, France (*Presenter*) Advisory Board, Supersonic Imagine; Travel support, Guerbet SA
 Christine Labreze, MD, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
 Yann Le Bras, MD, Niort, France (*Abstract Co-Author*) Nothing to Disclose
 Francois Comelis, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To report the mid-term outcomes of percutaneous cryoablation (PCA) of venous vascular malformations (VVM).

METHOD AND MATERIALS

In this mono-institutional retrospective study, 24 patients (6 were male and 18 female; mean age: 31 years, range: 12–64) presenting VVM in soft tissue and treated with PCA for symptomatic recurrences after sclerosis (N=16) or in case of non-indication of sclerosis (N=8) were consecutively included from 2011 to 2015. Eligibility criteria included initial radiological diagnosis of VVM and clinical and MR imaging follow-up of at least 6 months. The pain assessed by visual analogic scale and volume were 41.7mm (0-80) and 22.4cm³ (0.9-146) in mean, respectively. The safety was evaluated using the toxicity scale NCI-CTCAE. Disease-free survival (DFS) and local tumor progression (LTP) were calculated based on symptoms and volume evolution, respectively.

RESULTS

The mean follow-up was 18.7 months (6-48). Three severe adverse effects occurred. Pain and volume decreased significantly to 20.3mm (0-80) (P=0.01) and 8.35cm³ (0-81.3) (P<0.001) in mean, respectively. Pain recurred in 9 patients and one lesion increased. The DFS and LTP rate were 54% [95%CI: 22.94-77.27] and 93.33% [61.26-99.03] at 24 months, respectively.

CONCLUSION

PCA appears to be safe and effective for local control of VVM.

CLINICAL RELEVANCE/APPLICATION

As cryoablation seems to be safe and effective in treating symptoms related to venous vascular malformations, this minimally-invasive therapeutic option could contribute to the improvement of quality of life of patients.

SSK12-02 ADC Histogram Analysis of Whole Tumor Volume: Is It Helpful in the Differentiation of Malignant from Benign Soft Tissue Tumors over Single-slice Average ADC at 3 T?

Wednesday, Nov. 30 10:40AM - 10:50AM Room: E353C

Participants

Junsung Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
 Won-Hee Jee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Investigator, Bayer AG; Research support, Bayer AG ;
 Joon-Yong Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
 Yohan Son, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
 Mun-Young Paek, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Siemens AG
 Chan-Kwon Jung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
 Seung Han Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
 Yang-Guk Chung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the reliability and accuracy of apparent diffusion coefficient (ADC) histogram analysis of whole tumor volume and single-slice average ADC to differentiate malignant from benign soft tissue tumors at 3-T magnetic resonance (MR) imaging.

METHOD AND MATERIALS

This study was approved by the institutional review board and informed consent was waived. 3-T MR images including diffusion-weighted imaging in 72 patients with pathologically confirmed soft tissue tumors were retrospectively analyzed. There were 48 malignant and 24 benign soft tissue tumors. ADC histogram analysis of whole tumor volume was performed using Oncotreat software. Two independent readers measured average ADC within the solid portion on single slice. Interobserver agreement for ADC measurement was assessed using intraclass correlation coefficient (ICC). The receiver operating characteristic (ROC) curve

and areas under the curve (AUC) were obtained with and without ten myxoid malignant soft tissue tumors.

RESULTS

In ADC histogram analysis of whole tumor volume, mean and 95th percentile of ADC of malignant tumors were significantly lower than those of benign tumors ($P=.002$ and $P=.013$): 1244 vs 1659 $\mu\text{m}^2/\text{sec}$ in mean ADC, 1659 vs 2060 $\mu\text{m}^2/\text{sec}$ in 95th percentile. Skewness was significantly higher in malignant tumors compared to benign tumors ($P=.014$): 0.4 vs 0.2. Single-slice average ADCs of malignant tumors were significantly lower than those of benign tumors ($P<.001$): 1089 vs 1664 $\mu\text{m}^2/\text{sec}$ and 1068 vs 1523 $\mu\text{m}^2/\text{sec}$ for two readers, respectively. Interobserver agreement was excellent ($\text{ICC}=0.934$). AUCs of single-slice average ADC in two readers were significantly higher than AUC of whole volume ADC: 0.815 and 0.782 vs 0.689 ($P=.014$ and $P=.039$) and when excluding myxoid malignant tumors, 0.876 and 0.859 vs 0.761 ($P=.029$ and $P=.041$). With cutoff value of 1379 $\mu\text{m}^2/\text{sec}$, sensitivity, specificity, and accuracy were all 75% in single-slice average ADC, while in cases without myxoid malignant tumors those were 84%, 88% and 86% with cutoff value of 1233 $\mu\text{m}^2/\text{sec}$.

CONCLUSION

Single-slice average ADC is more reliable and accurate in differentiating malignant from benign soft tissue tumors than ADC histogram analysis of whole tumor volume at 3T MR imaging.

CLINICAL RELEVANCE/APPLICATION

Single-slice average ADC within solid portion should be used in differentiating malignant from benign soft tissue tumors instead of ADC histogram analysis of whole tumor volume at 3 T MR imaging.

SSK12-03 Value of Diffusion-weighted MR Imaging in Evaluation of Peritumoral Contrast Enhancement in Patients with Soft Tissue Sarcoma at 3 T: Initial Observation for Preoperative Evaluation

Wednesday, Nov. 30 10:50AM - 11:00AM Room: E353C

Participants

Seo Yeon Youn, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Won-Hee Jee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Investigator, Bayer AG; Research support, Bayer AG ;
Ji Hyun Hong, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon-Yong Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chan-Kwon Jung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Han Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yang-Guk Chung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the value of diffusion-weighted imaging (DWI) in the preoperative evaluation of peritumoral contrast enhancement on standard magnetic resonance (MR) imaging in patients with soft tissue sarcoma at 3 T.

METHOD AND MATERIALS

The institutional review board approved this retrospective study and informed consent was waived. Twelve patients who underwent 3-T MR imaging including DWI and had soft tissue sarcoma with circumscribed margin at pathology were included in this study. Two independent musculoskeletal radiologists retrospectively reviewed standard MR imaging. Then, they assessed a combination of standard MR imaging and DWI.

RESULTS

Among 12 soft tissue sarcomas with circumscribed margin at pathology, peritumoral contrast enhancement was observed in 83% (10/12) and 75% (9/12) of circumscribed soft tissue sarcoma on standard MR imaging for each reader, respectively. Among cases that showed peritumoral contrast enhancement on standard MR imaging, 10% (1/10) and 22% (2/9) cases showed impeded water diffusivity (diffusion restriction) on DWI. Overall, impeded water diffusivity that could suspect the peritumoral invasion was observed in 8% (1/12) and 17% (2/12) of patients at DWI, respectively. Specificity of peritumoral invasion was increased with addition of DWI to standard MR imaging: 17% vs 92% and 25% vs 83% for each reader, respectively.

CONCLUSION

The addition of DWI to standard MR imaging improves the preoperative determination of peritumoral invasion in patients with soft tissue sarcoma at 3 T.

CLINICAL RELEVANCE/APPLICATION

Diffusion-weighted MR imaging should be added to standard MR imaging protocols to help determine the peritumoral invasion in patients with soft tissue sarcoma for preoperative evaluation.

SSK12-04 Are the Fibromatoses a Homogeneous Group? Can MR and DW Imaging Characteristics be Used as a Prognostic Indicator in Patients with Extra-Abdominal Fibromatoses?

Wednesday, Nov. 30 11:00AM - 11:10AM Room: E353C

Participants

Joo Yeon Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hye Won Chung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Seok Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Hee Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Hoon Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myung Jin Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the prognostic factors of extra-abdominal fibromatoses among the MR and DW imaging features.

METHOD AND MATERIALS

Among the 233 patients (pts) with pathologically proven extra-abdominal fibromatoses, we selected the 29 pts with conventional MRI and DWI (b-factors: 0, 400, and 800 s/mm²). One radiologist blinded to clinical information measured the apparent diffusion coefficient (ADC) value of whole-volume region of interest (ROI) within the solid tumor as well as the sizes, signal intensity, locations, margins, contours, extra-compartment extension, bone involvement, and neurovascular involvement of the tumors. The whole-volume ROI was manually placed on the ADC map and the areas with internal dark signal intensity component on T2-weighted image was excluded. The MR imaging findings and mean ADC of fibromatoses were compared between 2 groups: group 1 with recurrence or progression, and group 2 with no recurrence or stable without treatment.

RESULTS

The mean ADC of group 1 of recurred or progressed fibromatoses was lower than that of group 2 with marginal statistical significance ($P = 0.054$). Group 1 revealed higher rate of ill-defined margin ($P = 0.0004$), irregular or spiculated contour ($P = 0.037$), neurovascular involvement ($P = 0.035$), extra-compartment extension ($p = 0.005$), and higher percent of internal dark signal intensity (SI) component within the tumor on T2-weighted images ($P = 0.042$).

CONCLUSION

MRI features including ill-defined margin, irregular or spiculated contour, and higher percent of internal dark SI could be used as poor prognostic factors warning recurrence or progression. The lower mean ADC value of whole-volume of the tumor also could suggest high probability of recurrence or progression.

CLINICAL RELEVANCE/APPLICATION

MR and DW imaging features regarding margin, contour, internal dark signal intensity component, extra-compartment extension as well as ADC value could imply biological activity of fibromatoses.

SSK12-05 The White Toe Finding (WTF) on Forefoot MRI: Incidence and Potential Significance

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E353C

Awards

Student Travel Stipend Award

Participants

Ian Hayden, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Jordan Gold, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

William B. Morrison, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc

Adam C. Zoga, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

Johannes B. Roedel, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Anecdotally, we noticed abnormal bone marrow signal within the distal phalanges on forefoot MRI. We sought to determine the incidence, associations, and clinical significance of this previously unreported finding.

METHOD AND MATERIALS

We searched our radiology information system (RIS) for MRI forefoot reports containing the keywords "phalanx" and "edema". We found 16 studies with T2 hyperintensity in the distal phalanges of the foot. Artifact was excluded based on corresponding low T1 marrow signal and lack of heterogeneous fat suppression in the distal forefoot. We reviewed patient records and MRI questionnaire for symptoms, location of pain, demographic factors, injury, metabolic diseases, and other conditions to determine whether there was a common association. We then developed a questionnaire to further assess the patient's pertinent history. Lastly, we invited patients back for a limited MRI of the forefoot to evaluate for resolution of the abnormal signal.

RESULTS

16 examinations were found, with 3 male and 13 female patients. Average age was 35. All 5 toes were involved in 75% of cases, and the great toe was involved in 94% of cases. There was no associated adjacent tendon, ligament, capsular, or articular abnormalities. 3 studies had associated nailbed abnormalities.

According to the MRI questionnaires provided at the time of scanning, 25% patients had pain localized to the toes. 31% of patients reported history of recent or remote foot injury. 69% of patients reported a history of exercise.

Of the 16 patients, 4 responded to the follow-up questionnaire. All of the patients' foot pain had resolved. 1 patient had an inflamed ingrown toenail which improved after treatment. 2 patients described subsequent diagnoses of Raynaud's phenomenon. As part of our study, 1 patient chose to undergo a follow-up MRI 3 years after initial MRI. 4 other patients had follow up imaging (range 1 - 7 months after their initial encounter). All 5 demonstrated residual abnormal signal in the distal phalanges. 1 patient also demonstrated abnormal signal in the contralateral, unaffected foot.

CONCLUSION

We have reported an unusual finding in the distal phalanges of the foot with a low incidence. The etiology and significance of this finding remains unclear, but it does not appear to result in specific symptoms.

CLINICAL RELEVANCE/APPLICATION

The white toe finding may indicate underlying local or systemic pathology; further clinical workup may be warranted

SSK12-06 Assessing Myeloma Focal Lesion Conspicuity on Dixon Images

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E353C

Awards

Student Travel Stipend Award

Participants

Saurabh Singh, MBBCHIR, MA, London, United Kingdom (*Presenter*) Nothing to Disclose
Timothy J. Bray, MBBCHIR, MA, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Arash Latifoltojar, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Kannan Rajesparan, MBBS, MRCS, Chigwell, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Farzana M. Rahman, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Research Consultant, Everyday Health, Inc
Sahar Naaseri, MBBS, BSc, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Priya Narayanan, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alan Bainbridge, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Shonit Punwani, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Margaret A. Hall-Craggs, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Whole body MRI (WBMRI) has an increasingly important role in the assessment and monitoring of multiple myeloma (MM). The optimal choice of 'anatomical' sequence is unclear. In this study, we evaluate myeloma lesion detection rates on the four Dixon image types: in phase (IP), out of phase (OP), water only (WO) and fat only (FO).

METHOD AND MATERIALS

Thirty patients (13 male and 17 female, median age 55, range 36-82) with suspected multiple myeloma underwent WBMRI imaging on a 3.0T wide-bore system (Ingenia; Phillips, Netherlands). Each patient had four image series. All 120 series were randomised and read by four consultant radiologists. On each series, each observer counted and labelled the number of lesions present in the bony pelvis (up to a maximum of 20). Additionally, observers provided a confidence score based on their degree of certainty (1-no lesions, 2-indeterminate, 3-likely myeloma, 4-very likely myeloma). After scoring, each labelled lesion was compared to a reference standard consisting of diffusion-weighted and post-contrast imaging; evaluated by another consultant radiologist with expertise in myeloma imaging.

RESULTS

Four observers read 120 image series each for 30 patients and identified 610, 955, 549 and 734 lesions respectively compared to 1560 reference lesions. The mean number of lesions for each image type was: 7 for FO, 5.8 for OP, 5.7 for WO, 5.2 for IP; sensitivity was: FO, 42%; WO, 36%; IP, 34%; and OP 32%; positive predictive values were: IP, 86%; FO 80%; WO, 80%; and OP, 64% and mean confidence scores were: FO 2.8, WO 2.7, OP 2.7, IP 2.5. Lesion detection rates ($p=0.006$), sensitivity ($p=0.023$) and both confidence scores ($p=0.001$) were significantly higher than on FO images than IP images. Furthermore, the positive predictive values ($p=0.146$) was comparable between FO and IP images.

CONCLUSION

These data suggest that the use of Dixon imaging offers improved lesion detection rates and observer confidence compared to using IPT1-weighted imaging alone. The fact that positive predictive values were comparable between FO and IP images suggests that this difference reflects a true increase in lesion conspicuity rather than a lower reader 'threshold' for lesion identification.

CLINICAL RELEVANCE/APPLICATION

We suggest that Dixon imaging should be used in preference to T1-weighted imaging alone in WB-MRI protocols for multiple myeloma. FO images offer additional diagnostic information and should be specifically reviewed when reporting.

SSK12-07 Clinical, Radiological, and Pathological Features of Extra-skeletal Osteosarcoma

Wednesday, Nov. 30 11:30AM - 11:40AM Room: E353C

Awards

Student Travel Stipend Award

Participants

Lauren A. Roller, MD, Boston, MA (*Presenter*) Nothing to Disclose
Ivan Chebib, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Miriam A. Bredella, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Connie Y. Chang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate clinical, pathological, and radiological features of pathology-proven extra-skeletal osteosarcomas.

METHOD AND MATERIALS

This retrospective study was IRB approved and HIPAA-compliant. Our pathology database was queried for cases of pathologically proven extra-skeletal osteosarcoma from 1992 to 2015. Tumor location, size, imaging appearance, presence of metastases, and clinical outcome were documented.

RESULTS

Seventeen patients met inclusion criteria (14M, 3F; mean age 58 ± 16 (range 28-85) years). Tumors occurred in the lower extremities (11/17, 64%), pelvis/gluteal region (3/17, 18%), thorax (2/17, 12%), and elbow (1/17, 6%). Pathologically, 14/17 tumors were high-grade (82%). 2/17 (12%) tumors occurred at prior radiation sites, one of which was a high-grade tumor. Tumors typically presented as soft tissue masses measuring 9.1 ± 7.0 (range 2-27) cm. On either imaging or pathology, tumor mineralization was present in 4/17 cases (24%), central necrosis in 10/17 (59%), and tumor invasion of neurovascular structures, bone, or solid organs in 3/17 cases (18%). On MRI, tumors typically appeared hyperintense on T2-weighted sequences with enhancement in 11/12 (92%). Low-grade tumors were smaller (<4 cm) (3/3, 100%), lacked central necrosis (3/3, 100%), and did not metastasize (3/3, 100%). 7/17 malignant tumors (41%) had metastases, most commonly to lung (6/17, 35%) and bone (2/17, 12%). 2/8 patients (25%) with metastases and 7/8 (88%) without metastases achieved recurrence-free survival (mean follow-up 4.0 ± 4.1 (range 0.2-14.2) years). No deaths occurred in patients with low-grade histology.

CONCLUSION

Extra-skeletal osteosarcomas are rare and typically high-grade malignancies that commonly metastasize to lung and bones. Low-

grade tumors and those without metastases have good prognosis. MRI appearance is non-specific with T2-hyperintense signal and heterogeneous enhancement. In contrast to conventional osteosarcoma, mineralization is rare.

CLINICAL RELEVANCE/APPLICATION

A soft tissue tumor without any mineralization can be consistent with extra-skeletal osteosarcoma. Identification of central necrosis on CT, MRI, or pathology portends poorer prognosis.

SSK12-08 F-18 FDG PET Differentiation of Benign and Low-Grade Chondroid Neoplasms from Intermediate/High-Grade Chondrosarcoma: A Meta-Analysis

Wednesday, Nov. 30 11:40AM - 11:50AM Room: E353C

Participants

Aaron D. Winn, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose
Juan A. Pretell-Mazzini, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Darcy Kerr, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Jean Jose, MS, DO, Miami Beach, FL (*Abstract Co-Author*) Nothing to Disclose
Sheila Conway, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Ty K. Subhawong, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Discriminating benign and low-grade chondroid lesions managed either with observation or intralesional procedures, respectively from grade 2/3 chondrosarcoma that requires wide local resection is critically important and frequently difficult to achieve with standard imaging modalities, and core needle biopsies are prone to sampling error. The role of PET-CT in making this distinction has only been explored previously in smaller series.

METHOD AND MATERIALS

We identified 256 PubMed- and Embase-indexed articles containing combinations of "chondrosarcoma," "enchondroma," "chondroid," "cartilage," and "PET/CT," "PET," "positron," in the title or abstract; 13 articles comprising 194 lesions were included after excluding case reports, opinions, editorials, and other reviews. Demographic data, tumor size, histologic grade, and SUV max were extracted for individual lesions when possible, and otherwise recorded as aggregated data. Comparisons in SUV among benign, low-grade, and intermediate/high-grade chondroid neoplasms were made.

RESULTS

Individual SUVs were available for 100 lesions; 94 additional lesions were reported as aggregated data. There were 115 malignant (grade 1, 2, or 3) and 79 benign (grade 0) tumors; when specified there were 28 grade 1, 44 grade 2/3 tumors. Malignancy was associated with older age [49.2 vs 39.3 years, $p = 0.026$, t-test], and larger size [9.35 cm vs 3.21 cm, $p=0.004$, t-test]. SUV for Grade 0 (1.59 +/- 0.78) was lower than Grade 1,2, or 3 (4.56 +/- 2.9), $p<0.0001$, t-test; threshold SUV of 2.2 yielded a sensitivity/specificity of 85/92%, with area under ROC curve 0.93. SUV for Grade 0/1 (1.67 + 0.94) was lower than grade 2/3 (5.59 + 3.1), $p <0.0001$, t-test; threshold SUV of 3.1 yielded a sensitivity/specificity of 79/85% for identifying grade 2/3 chondrosarcoma, with area under ROC curve 0.91. Grade 0/1 tumor SUV never exceeded 4.1.

CONCLUSION

PET/CT shows excellent discriminatory ability in distinguishing benign and low-grade chondroid neoplasms from intermediate/high-grade chondrosarcoma, and could play an important role in the management of these tumors.

CLINICAL RELEVANCE/APPLICATION

High SUV values (> 4) in chondroid lesions are highly suggestive of grade 2 or 3 chondrosarcoma, and should compel appropriate surgical planning for wide local excision rather than intralesional treatment regardless of grade on prior biopsy due to potential sampling error.

SSK12-09 Compressed Sensing-Accelerated SEMAC Metal Artifact Reduction MRI for the Evaluation of Periprosthetic Tumor Recurrence following Complex Oncologic Limb Salvage Reconstructions

Wednesday, Nov. 30 11:50AM - 12:00PM Room: E353C

Participants

Jan Fritz, MD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG
Laura M. Fayad, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Gaurav K. Thawait, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Carol Morris, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Adam Levin, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Effective imaging is important for surveillance of complex oncologic limb salvage reconstructions; however, metal artifacts of conventional MRI and CT often obscure areas of concern around tumor prostheses. SEMAC MRI affords powerful metal suppression, but is time consuming. Sparsity-driven compressed sensing (CS) based data sampling; however, affords 8-fold accelerated SEMAC acquisition with reduction of scan time by 50-70%. Thus, we assessed an accelerated SEMAC MRI prototype protocol for the evaluation of oncologic limb salvage implant reconstructions.

METHOD AND MATERIALS

Following IRB approval and written informed consent, 15 consecutive patients [8 female, 7 male; age, 39 (18-72) years] underwent CS-SEMAC MRI at 1.5T for evaluation of bone and soft tissues adjacent to oncologic limb salvage reconstructions with metallic implants. The protocol included PD-weighted, STIR as well as pre- and post-contrast T1-weighted axial and sagittal or coronal sequences with 15-19 SEMAC encoding steps. Outcome variables included the ability to evaluate the area of interest as compared to other imaging modalities utilized, accuracy of diagnosis and change in oncologic management or operative plan.

RESULTS

All 15 patients had at least a CT or conventional MRI, which was unable to fully evaluate the area of interest. In all cases CS-SEMAM MRI resulted in improved visibility and confidence of the area of interest around the metallic implants. In 8/9 (89%) patients, CS-SEMAM MRI was able to entirely replace CT. In 9/15 (60%) cases, CS-SEMAM MRI demonstrated findings that were not visualized on CT or conventional MRI. CS-SEMAM MRI findings were accurate in 14/15 (93%) patients and altered management and operative plan for 7/15 (47%) patients.

CONCLUSION

Compressed sensing-accelerated SEMAM MRI has the potential for more accurate and efficient evaluation of areas of concern around oncologic reconstructions. The high degree of metal artifact suppression improved our ability to detect local recurrence and diagnose alternative conditions.

CLINICAL RELEVANCE/APPLICATION

Our initial experience shows a higher degree of accuracy and efficiency of CS-SEMAM MRI when compared to CT and conventional MRI. Although continued prospective investigation is necessary, our initial results have already begun to change our clinical practice for these complex limb salvage patients toward using CS-SEMAM MRI as the principle modality for surveillance.

SSK13

Nuclear Medicine (Central Nervous System and Head and Neck Imaging)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S505AB



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

FDA Discussions may include off-label uses.

Participants

Gary A. Ulaner, MD, PhD, New York, NY (*Moderator*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd
Frederik L. Giesel, MD, MBA, Heidelberg, Germany (*Moderator*) Patent application for F18-PSMA-1007

Sub-Events

SSK13-01 Improved Detection of Transosseous Meningiomas Using 68Ga-Dotatate PET-CT Compared to MRI

Awards

Trainee Research Prize - Resident

Participants

Wolfgang G. Kunz, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Lisa Jungblut, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp M. Kazmierczak, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Axel Rominger, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Nathalie L. Albert, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Clemens C. Cyran, MD, Munich, Germany (*Abstract Co-Author*) Research Grant, Bayer AG Research Grant, Novartis AG Speakers Bureau, Bayer AG
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze the diagnostic performance of 68Ga-DOTATATE PET-CT and contrast-enhanced MRI for detection of the transosseous extension of intracranial meningiomas and to find associations with quantitative imaging parameters.

METHOD AND MATERIALS

In this retrospective study, subjects were selected from a cohort of 325 consecutive patients who underwent 68Ga-DOTATATE PET-CT of the head for evaluation of confirmed or suspected intracranial meningioma. Inclusion criteria were (1) MRI imaging within 1 month of either pre- or postoperative matching PET-CT imaging, and (2) as standard of reference pathology-confirmed meningioma diagnosis with inclusion or exclusion of transosseous extension. Imaging was independently analyzed by two readers with respect to osseous involvement, absolute tracer uptake measured as SUVmax, volume of meningioma and surrounding edema. Chi square, Mann-Whitney U or exact McNemar's tests as well as receiver operating characteristics (ROC) analyses were performed to compare variables and diagnostic test performance.

RESULTS

Eighty-two patients (mean age 56±13 years) fulfilled the inclusion criteria. Patients with transosseous extension of meningioma (n=67) showed significantly larger lesions (median 10 ml vs. 3 ml, p=0.002) and significantly higher SUVmax (median 14 vs. 8, p=0.032) compared to extraosseous meningiomas. 68Ga-DOTATATE PET-CT in comparison to contrast-enhanced MRI performed at a considerably higher sensitivity (98.5% vs. 55.2%) while maintaining high specificity (86.7% vs. 100.0%) in the pre- as well as postoperative setting; statistically significant differences between the tests were observed (p<0.001). In ROC analysis, PET-CT assessment performed best (AUC: 0.933), followed by MRI assessment (0.866), meningioma volume (0.765) and SUVmax (0.680) while surrounding edema added no valuable information (0.483).

CONCLUSION

68Ga-DOTATATE PET-CT enables improved detection of the transosseous extension of intracranial meningiomas compared to MRI in pre- and postoperative settings.

CLINICAL RELEVANCE/APPLICATION

Transosseous extension of meningiomas affects growth and recurrence and is important for surgical management. Improved detection using 68Ga-DOTATATE PET-CT has the potential to impact decision making.

SSK13-02 Pittsburgh Compound B (PiB) PET Imaging of Meningioma and Other Intracranial Tumors

Wednesday, Nov. 30 10:40AM - 10:50AM Room: S505AB

Awards

Student Travel Stipend Award

Participants

Derek R. Johnson, MD, Rochester, MN (*Presenter*) Consultant, F. Hoffmann-La Roche Ltd
Christopher H. Hunt, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Mark A. Nathan, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Val J. Lowe, MD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Eli Lilly and Company Advisory Board, Bayer AG
Joseph E. Parisi, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

Ronald C. Petersen, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Geoffrey B. Johnson, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Meningioma is by far the most common intracranial tumor, with a prevalence of up to 3% in autopsy studies. While diagnosis by MRI is generally straightforward, lack of specificity may raise a diagnostic dilemma in patients with a history of cancer. We and others have reported cases of focal Pittsburgh compound B (PiB) PET activity within meningiomas; herein we report our institutional experience with this technique.

METHOD AND MATERIALS

Records of all patients who underwent PiB PET/CT at our institution from 2006 through 2015 were reviewed to identify those with intracranial tumors. Inclusion criteria included at least one MRI with contrast demonstrating enhancement of the suspected tumors, a minimum dimension of at least 0.5 cm, and either pathological confirmation of tumor or greater than 6 months of radiographic follow-up for patients in whom observation was recommended.

RESULTS

2472 patient records were reviewed; 45 patients (1.8%) met inclusion criteria for probable or definite intracranial tumor. Tumor types were meningioma (29/45, 64%), vestibular schwannoma (7/45, 16%), pituitary macroadenoma (4/45, 9%), metastatic disease (2/45, 4%), and others (3/45, 7%). An ROC curve was created for the lesion:cerebellum SUVmax ratio, with an AUC of 0.91 for the ratio value of 1.65. At or above this ratio, specificity for meningioma was 100% (95% CI 79.4-100%) and sensitivity was 75.9% (95% CI 56.5-89.7%). The positive predictive value was 100% (95% CI 84.6-100%).

CONCLUSION

A tumor:cerebellum uptake ratio of 1.65 or greater on PiB PET is a highly specific and reasonably sensitive marker of intracranial meningioma. Further prospective evaluation is warranted to validate this result as well as to fully define the performance of this technique with emerging technologies such as PET/MRI and commercially available amyloid radiotracers.

CLINICAL RELEVANCE/APPLICATION

Pittsburgh compound B PET imaging may distinguish meningioma from other intracranial tumors with a high level of specificity, allowing for appropriate patient triage and treatment without the need for invasive testing and associated potential morbidity.

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/>

Geoffrey B. Johnson, MD, PhD - 2015 Honored Educator

SSK13-03 A Meta-analysis of Test-retest Repeatability of Amyloid PET Imaging with 11C-PiB and 18F-labeled Amyloid Radiotracers in Alzheimer's Disease Patients and Healthy Controls

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S505AB

Participants

Sara Sheikhabahaei, MD, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose

Nancy A. Obuchowski, PhD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Siemens AG; Research Consultant, QT Ultrasound Labs; Research Consultant, Elucid Bioimaging Inc

Victor L. Villemagne, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Rathan M. Subramaniam, MD, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In this meta-analysis we aim to determine the repeatability of amyloid PET imaging with 11C-Pittsburgh compound-B (11C-PiB) and 18Fluorine (18F) labeled radiotracers using the available literature.

METHOD AND MATERIALS

Systematic electronic search were performed in PubMed and EMBASE (last updated in Jan 2016) to identify studies addressing the test-retest repeatability of amyloid PET imaging with 11C-PiB and 18F labeled radiotracers in patients with Alzheimer's disease (AD) or healthy controls (HCs). The individual patient data or the mean test-retest variability (TRV%) and the standard deviation of two PET tracer retention measurements were extracted from the eligible studies. The study authors were contacted seeking for more information. The average neocortical SUVR were considered as a measure of amyloid load and the cerebellar cortex as the reference region. The percent repeatability coefficient (RC%) was calculated as an index of absolute reliability. The pooled estimates of mean TRV% with SE and the RC% with bootstrapped 95%CI were generated for summary effect.

RESULTS

A total of 7 studies were included in this individual patient data meta-analysis. Four studies evaluated the test-retest variability of 18F labeled amyloid tracers (Florbetapir, AZD4694, Flutemetol, Florbetaben). The test-retest amyloid PET studies were performed between 1 to 4 weeks apart. The pooled mean TRV% for average cortical SUVR was 2.77(SE=0.75) in patients with AD (n=26) with a RC% of 10.36% (4.76-14.92). The pooled mean TRV% for average cortical SUVR was 3.12 (SE=1.39) in HCs (n=22) with a RC% of 10.41 (3.33-20.3). Three studies evaluated the test-retest variability of 11C-PiB amyloid imaging. The test-retest amyloid PET studies were performed on same day and up to 60 days apart. The pooled mean TRV% for average cortical SUVR was 4.33 (SE=0.25) for AD (n=12) with a RC% of 15.4% (8.49-20.05). The pooled mean TRV% for average cortical SUVR was 3.61 (SE=0.59) in HCs (n=16) with a RC% of 9.38% (7.55-10.92).

CONCLUSION

Our results showed no significant differences in RC% of 18F labeled and 11C-PiB amyloid tracers for neocortical SUVR.

CLINICAL RELEVANCE/APPLICATION

The repeatability coefficient of 18F amyloid radiotracers is about 10% for neocortical SUVR in both Alzheimers Disease patients and healthy controls. This effect should be considered when using neocortical SUVR as an outcome measure for assessing anti-amyloid therapy.

SSK13-04 Applying Amide Proton Transfer MR Imaging to Hybrid Brain PET/MR: Concordance to Gadolinium Enhancement and a Complementary Value to 18F-FDG PET

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S505AB

Participants

Hongzan Sun, Shenyang, China (*Presenter*) Nothing to Disclose
Jun Xin, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Zaiming Lu, MD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Qiyong Guo, MD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Jinyuan Zhou, PhD, Baltimore, MD (*Abstract Co-Author*) License agreement, Koninklijke Philips NV

PURPOSE

To evaluate the diagnostic concordance and metric correlations of amide proton transfer (APT) imaging with Gd-enhanced MRI and 18F-FDG PET using hybrid brain PET/MR.

METHOD AND MATERIALS

Twenty-one subjects with suspected brain lesions on prior CT or MRI were prospectively enrolled. Brain 18F-FDG PET/MR with gadolinium (Gd) enhancement (plus whole-body 18F-FDG PET/MR) was performed. Six diagnostic criteria based on brain lesion morphology and final diagnosis were used to compare the accuracy of unenhanced MRI (T1WI, T2WI, FLAIR plus DWI), enhanced MRI (T1WI), APT imaging and 18F-FDG PET. In cases of tumors, we further evaluated the concordance between Gd enhancement, APT-weighted (APTW) signal intensity and 18F-FDG avidity by the McNemar test, and also the associations between metrics from APT imaging and PET by Pearson correlation analysis.

RESULTS

There were totally 23 lesions (from 21 subjects), including 13 metastases, 3 gliomas (2 WHO grade IV and 1 WHO grade II), 3 meningiomas (WHO grade I), and 4 chronic infarctions. Enhanced MRI and APT imaging showed superior and similar diagnostic accuracy, compared to unenhanced MRI and 18F-FDG PET in tumor detection and final diagnosis. APTW signal intensity and Gd enhancement were concordant in all the 19 tumors (100%), while high 18F-FDG avidity was shown in only 12 (63.2%) with statistical difference ($P < 0.05$). There was no significant association between APTW_{max} and SUV_{max}, or APTW_{mean} and SUV_{mean} in all the brain tumors ($P > 0.05$). However, significant correlations were identified between APTW_{max} and SUV_{max} ($r = 0.609$, $P = 0.027$), as well as APTW_{mean} and SUV_{mean} ($r = 0.599$, $P = 0.030$) for 13 FDG hypermetabolic brain tumors (11 metastases and two meningiomas).

CONCLUSION

APT imaging using endogenous proteins and peptides can be used as to increase diagnostic accuracy with unnecessary administration of exogenous gadolinium chelate. APT imaging may play a complementary role to FDG metabolic activity during brain PET/MR study.

CLINICAL RELEVANCE/APPLICATION

APT imaging might be applied as a routine imaging sequence to streamline the scan protocol and extend clinical indications for brain 18F-FDG PET/MR.

SSK13-05 Anti-3-[18F]FACBC (Fluciclovine) Dynamic PET Differentiates Low-Grade and High Grade Gliomas in Patients with Minimal Prior Intervention

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S505AB

Awards

Student Travel Stipend Award

Participants

Marc D. Benayoun, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose
Ijeoma Ibeanu, MD, MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Padma P. Manapragada, MD, atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Olson, PHD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Vikram Adhikarla, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jonathon Nye, PhD, Atlanta, GA (*Abstract Co-Author*) Consultant, Lantheus Medical Imaging, Inc
David M. Schuster, MD, Atlanta, GA (*Abstract Co-Author*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Consultant, WellPoint, Inc; ;
Mark M. Goodman, PhD, Atlanta, GA (*Abstract Co-Author*) Royalties, Nihon Medi-Physics Co, Ltd

PURPOSE

Fluciclovine is an amino acid analogue PET radiotracer which is transported into tumor cells mainly via ASCT-2 and LAT-1 amino acid transport systems. The purpose of this study was to examine the role of fluciclovine dynamic PET in differentiating low-grade gliomas (LGGs) and high grade gliomas (HGGs) in systemic therapy naive patients.

METHOD AND MATERIALS

Biopsy proven LGGs (WHO grade II; N=5) and HGGs (WHO grades III and IV; N=11) from 14 patients post stereotactic biopsy or partial resection and therapy naive, underwent dynamic fluciclovine PET imaging on a High-Resolution Research Tomograph (Siemens Medical Solutions). Two HG glioma patients exhibited bifocal disease. The protocol was approved by IRB and supported by an NIH RO1 grant (5RO1CA121320). Using ROIs determined by the PET Edge tumor margin detection tool and manually selected ROIs of the contralateral normal brain, time activity curves were obtained for standardized uptake values (SUV_{max} and SUV_{mean})

over a 60 minute acquisition time using a MIMVista workstation (MIM 6.1; MIM Software Inc). Statistical analysis was performed using ANOVA followed by pairwise post-hoc Tukey tests and was carried out in MATLAB 2015a (Mathworks, Mass.).

RESULTS

On average, time activity curves for max SUV reveal a shape consistent with initial rise and plateau without washout for HGGs, LGGs, and normal brain parenchyma. Individual lesions occasionally revealed persistent increase and mild washout. Asymptotic fluciclovine uptake was reached at approximately 20 minutes with a statistically significant difference in metabolic activity between all pairwise post hoc comparisons among max SUV values for HGGs and LGGs and mean SUV values for normal contralateral brain parenchyma at multiple time points (for example, $p < 0.0001$ for comparison of max SUV of HGGs to LGGs at 20 minutes).

CONCLUSION

Fluciclovine dynamic PET reveals predominant rapid increase followed by plateau kinetics in radiotracer uptake in LGGs, HGGs, and normal brain parenchyma. Significantly increased uptake was observed in HGGs relative to LGGs and normal background parenchyma. Equilibrium is reached within 20 minutes and may be an optimal time for static fluciclovine PET imaging.

CLINICAL RELEVANCE/APPLICATION

Fluciclovine PET is helpful in differentiating between low grade and high grade gliomas showing rapid increase then plateauing, reaching equilibrium approximately 20 minutes following injection.

SSK13-06 Incidental Brain Pathology on Whole Body FDG PET-MRI

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S505AB

Awards

Student Travel Stipend Award

Participants

Ana M. Franceschi, MD, New York, NY (*Presenter*) Nothing to Disclose
Robert Matthews, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Lev Bangiyev, DO, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Ammar A. Chaudhry, MD, Elkridge, MD (*Abstract Co-Author*) Nothing to Disclose
Nand K. Relan, PhD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Dinko Franceschi, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Routine FDG PET-CT imaging for oncology is performed from the base of the skull to the mid thighs. Both benign and malignant brain findings can occur in the oncology patient that would be missed on the typical PET scan. In our institution, when performing whole body PET-MRI for cancer patients, we routinely include the entire head. The aim of our study was to characterize both PET and MRI brain findings incidentally detected on the included head portion of the study.

METHOD AND MATERIALS

234 FDG PET-MRI body scans that included the head were retrospectively reviewed. Images were obtained on hybrid PET-MRI with simultaneous acquisition using body coil and dedicated body sequences without IV contrast. Of the 234 studies, 204 individual patients were scanned (125 female, 79 male). Only the patient's first PET-MRI was reviewed. Mean age was 55 y (range 7-89). 191 studies were for cancer assessment (72 staging, 119 restaging). Other 14 indications were for 5 paraneoplastic syndrome, 3 adenopathy, 3 lung nodule, 1 vasculitis, and 2 monoclonal gammopathy. Of these 4 were later diagnosed with cancer. Images of the brain were reviewed by a neuroradiologist in conjunction with a nuclear radiologist.

RESULTS

Of the 204 patients, 30 patients (14.7 %) had positive brain findings on PET-MRI body sequences. 11 (5.4 %) had vascular disease (avg age 72 y) with 7 chronic microvascular ischemic changes and 4 had brain infarcts. One infarct was a subacute stroke in a paraneoplastic patient and another newly discovered infarct was in a 38 y female. Detection rate for microvascular ischemic changes was likely lower due to the body MRI sequences. 9 patients (8.7 %) had post-therapy changes in the brain due to either radiation (n=2), surgery (n=3), or chemotherapy (n=4). Three others had benign cystic lesions. 8 patients (9.4 %) had serious brain pathologies including 4 paraneoplastic patients (leptomeningeal metastases, metabolic encephalopathy, Creutzfeldt-Jakob disease, and lymphoma), 1 metastases, 2 pituitary tumors, and 1 chronic subdural collection with mean age 63 y.

CONCLUSION

FDG PET-MRI imaging is a rapidly evolving modality that is commonly employed for cancer evaluation. The standardized base of skull to mid thigh imaging may miss many important brain pathologies that are discovered even using MRI body sequences.

CLINICAL RELEVANCE/APPLICATION

FDG PET-MRI body sequences that include the head may show added value in the management of patients.

SSK13-07 Feasibility Demonstration of Ultra High Definition Neuro PET From Whole Body /Large Field of View Acquisition

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S505AB

Participants

Katherine Binzel, PhD, Columbus, OH (*Presenter*) 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
Maryam Lustberg, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Veena A. Nagar, MD, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Chi-Hua Tung, Cleveland, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Neurologic PET has traditionally required long acquisition times with a dedicated, smaller field of view (FOV) protocol than whole body imaging. With the introduction of next generation solid state, digital photon counting PET technology (dPET) we explored the potential to achieve excellent neuro image quality using ultra high definition (UHD, 1 mm³ voxel volume) reconstruction from acquisitions using the large FOV. We performed phantom and intra-individual comparisons using both whole body and dedicated brain acquisition and UHD reconstruction to assess the image quality and quantitative accuracy.

METHOD AND MATERIALS

20 patients were imaged on a pre-commercial release dPET (Vereos, Philips) (50 or 110 min post-injection, dose 13 mCi FDG). A single bed position was centered on the brain and a 90s acquisition was performed using the brain FOV 256 mm. Immediately following, standard whole body acquisition including the brain was performed using 90s per bed and the whole body FOV 576 mm. Both data sets were then reconstructed with a 1 mm³ voxel volume. An atlas based analysis was performed measuring SUV_{max} and z-score. A phantom comparison was completed, using a Hoffman brain phantom with three acquisitions each with the brain and whole body FOVs. A blinded reader analysis performed for image quality.

RESULTS

The intra-individual comparison between 256 FOV and 576 FOV revealed no significant differences in SUV_{max}, z-score measures or image quality reads. The phantom data showed similar results, with no significant differences in quantitative readouts between the two FOV.

CONCLUSION

This feasibility studies indicates that next generation digital detector PET may not require smaller, dedicated acquisition FOV and can acquire neurological PET using the full, standard whole body FOV. Equivalent quantitative and visual quality was achieved. This may facilitate improved workflow, particularly when larger anatomic or even whole body acquisitions are combined with neuro-imaging. While longer acquisition times over the brain may still be desirable, incorporation of variable bed times into whole body acquisitions can easily accommodate such needs.

CLINICAL RELEVANCE/APPLICATION

Next generation digital PET/CT systems can perform accurate and equivalent quality brain PET metabolic imaging using the standard full field of view acquisition reducing the necessity for small FOV.

SSK13-08 Added Diagnostic Value of Complementary Gadoteric Acid-enhanced MRI to 18F-DOPA-PET/CT for Liver Staging in Medullary Thyroid Carcinoma

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S505AB

Participants

Philipp M. Kazmierczak, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Axel Rominger, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Brendel, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Wolfgang G. Kunz, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Clemens C. Cyran, MD, Munich, Germany (*Abstract Co-Author*) Research Grant, Bayer AG Research Grant, Novartis AG Speakers Bureau, Bayer AG
Harald Kramer, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Robert Stahl, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Josef Sargsyan-Bergmann, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Christine Spitzweg, Munich, Germany (*Abstract Co-Author*) Advisory Board, Swedish Orphan Biovitrum AB; Advisory Board, Bayer AG; Advisory Board, Eisai Co, Ltd ; Advisory Board, AstraZeneca PLC ; Speaker, Swedish Orphan Biovitrum AB; Speaker, Bayer AG; Speaker, Eisai Co, Ltd; Speaker, AstraZeneca PLC

PURPOSE

To investigate the added diagnostic value of complementary gadoteric acid-enhanced MRI to 18F-DOPA-PET/CT for liver staging in medullary thyroid carcinoma (MTC).

METHOD AND MATERIALS

Twenty-nine consecutive Patients (n=17 f, n=12 m, median age 58 years) with histologically confirmed MTC undergoing gadoteric acid-enhanced liver MRI within one month of matching contrast-enhanced 18F-DOPA-PET/CT between 2010 and 2015 were included for retrospective analysis. 18F-DOPA-PET/CT and multiparametric MRI (T2w; DWI; unenhanced, arterial, portal venous, delayed, and hepatobiliary phase T1w GRE fs) data sets were read consecutively and liver lesions were categorized on a 5-point scale analogously to the LI-RADS criteria (1–definitely benign; 2–probably benign; 3–intermediate risk for metastasis; 4–probably metastasis; 5–definitely metastasis). It was noted if gadoteric acid-enhanced MRI detected additional, 18F-DOPA-PET/CT-occult metastases (category 5) or if gadoteric acid-enhanced MRI allowed for a definite classification (categories 1 and 5) of lesions for which the 18F-DOPA-PET/CT scan remained inconclusive (categories 2-4).

RESULTS

A total of n=141 liver lesions (18F-DOPA-PET/CT n=107, MRI n=141; n=99 metastases, n=27 benign cysts, n=15 hemangiomas) were analyzed. N=34 additional lesions were detected by MRI, of which n=30 were additional metastases (median diameter 0.5 cm [0.4 – 1.9 cm]) occult on 18F-DOPA-PET/CT. MRI allowed for a definite lesion classification (categories 1 and 5) in 89 % (125/141) (18F-DOPA-PET/CT 69 %, n=74/107). MRI lead to a change in lesion categorization in 17 cases (from category 2 to 1: n=10; from category 3 to 1: n=3; from category 4 to 5: n=4).

CONCLUSION

Gadoteric acid-enhanced MRI allows for a more accurate liver staging in MTC patients compared to 18F-DOPA-PET/CT alone, particularly for 18F-DOPA-negative metastases and lesions <1 cm.

CLINICAL RELEVANCE/APPLICATION

Gadoxetic acid-enhanced MRI optimizes the detection of liver metastases with potential direct impact on clinical patient management and may be included as standard imaging in MTC staging protocols.

SSK13-09 Differentiation of Incidental Tracer Uptake in the Head and Neck Area: A Comparison Between PET/CT and PET/MR

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S505AB

Participants

Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Benedikt Gomez, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic accuracy of 18F-fluorodesoxyglucose positron emission tomography/magnetic resonance (18F-FDG PET/MR) imaging to 18F-FDG PET/computed tomography (18F-FDG PET/CT) concerning incidental tracer uptake in a dedicated head and neck protocol.

METHOD AND MATERIALS

A retrospective analysis of 81 patients that underwent contrast-enhanced 18F-FDG PET/CT and 18F-FDG PET/MR on the same day for oncological indications was performed. Fused PET/CT and PET/MR datasets were analyzed by two independent readers in random order in two separate sessions for PET/CT and PET/MR under consideration of the clinical indication. Incidental tracer uptake was classified in the three following groups: most likely benign, indeterminate and most likely malignant. Potential discrepancies were resolved in a separate consensus reading. Then, the reference standard was defined for all lesions by an expert reader using clinical reports, cross sectional imaging and histopathological reports. Differences between the total number of accurately and inaccurately classified lesions were investigated using McNemar's test between both modalities. A $p < 0.05$ indicated statistical significance.

RESULTS

A total of 46 lesions were available for further analysis. Twenty-seven and 31 lesions were classified as most likely benign, 18 and 14 as indeterminate and one as most likely malignant in PET/CT and PET/MR respectively. According to the reference standard, 43 lesions were benign, one was malignant and in two lesions, a definite diagnosis was not possible. PET/MR was not superior to PET/CT concerning the correct diagnosis of an incidental 18F-FDG uptake ($p=0.125$). While the correct classification of an incidental uptake was possible in 28 findings on PET/CT and PET/MR, 14 findings were misclassified by either modality and four findings that were misclassified on PET/CT could be classified correctly on PET/MR.

CONCLUSION

PET/MR is not superior to PET/CT in the classification of incidental tracer uptake in the head and neck area.

CLINICAL RELEVANCE/APPLICATION

Incidental tracer uptake of the head and neck is a diagnostic dilemma in hybrid imaging. Our data indicate, that PET/MR does not increase the diagnostic accuracy of PET/CT in this specific problem.

SSK14

Neuroradiology (Cognitive and Psychiatric Disorders)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: N226

NR

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

FDA

Discussions may include off-label uses.

Participants

Benjamin Y. Huang, MD, MPH, Chapel Hill, NC (*Moderator*) Consultant, LQ3 Pharmaceuticals, Inc
David M. Wilson, MD, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSK14-01 Prefrontal Volume Mediates Effect of COMT Polymorphism on Interference Resolution Capacity in Healthy Male Adults

Participants

Jiayuan Xu, Tianjin, China (*Presenter*) Nothing to Disclose
Huaigui Liu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Qiaojun Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wen Qin, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Chunshui Yu, tianjin, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Although gender-dependent pairwise relationships of gene, anatomy and cognition have been extensively investigated, there is lack of any direct evidence on the gender-specific gene-anatomy-cognition pathways that account for the association between COMT Val158Met and interference resolution. Here, we used a mediation analysis to test the hypothesis that prefrontal volume may mediate the modulation of COMT Val158Met on the interference resolution in a gender-dependent manner. If so, we further want to know whether the functional changes induced by the structural abnormality also mediate the gene-cognition pathway in a gender-dependent manner.

METHOD AND MATERIALS

A total of 261 Chinese healthy subjects were analysed. MR images were acquired using a Signa HDx 3.0 Tesla MR scanner (General Electric, Milwaukee, WI, USA). Resting-state fMRI data were obtained using the Single-Shot Echo-Planar Imaging (SS-EPI, TR/TE = 2000/30 ms; FOV = 240 mm × 240 mm; matrix = 64 × 64; FA = 90°, slice thickness = 4 mm; no gap; 40 interleaved transversal slices; 180 volumes). Both the main and interaction effect of genotype were calculated and compared using a full factorial ANOVA. We used a mediation analysis to assess the gender-dependent gene-anatomy/function-cognition pathway.

RESULTS

ANOVA showed a COMT × gender interaction ($P=0.023$) on interference resolution capacity. Val/Val subjects performed worse in Stroop than Met carriers only in males ($P=0.027$). Voxel-wise analysis both in the whole brain and ECN also exhibited a COMT × gender interaction on GMV in the left frontal pole (FP). Val/Val males exhibited decreased GMV in the left FP than Met male carriers. Mediation analysis revealed the GMV of left FP mediated the association between COMT and interference resolution only in males.

CONCLUSION

We identified a sex-specific gene-anatomy-cognition pathway to explain how COMT affects interference resolution via modulating GMV of the left FP in healthy male subjects. This pathway may not only provide us a better understanding of interference resolution in healthy subjects, but also provide a reference frame for investigating the mechanisms of executive impairments in brain disorders.

CLINICAL RELEVANCE/APPLICATION

It would help to understand the sex-specific genetic susceptibility, to identify the mechanisms of executive impairments, to design the treatment target to improve the executive function, and to monitor the efficacy of the potential treatment.

SSK14-02 Multiple Sclerosis and Cognitive Reserve: Changes in Anterior Insular Resting-State Functional Connectivity of the Salience Network

Wednesday, Nov. 30 10:40AM - 10:50AM Room: N226

Participants

Bernardo C. Bizzo, MD, Boston, MA (*Presenter*) Nothing to Disclose
Sean Tobyne, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
John D. Bireley, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Renata R. Almeida, boston, MA (*Abstract Co-Author*) Nothing to Disclose
Victoria Smith, BS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Daria Boratyn, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company; Institutional Research Support, General Electric Company; Stockholder, General Electric Company; Consultant, MedyMatch Technology, Ltd; Consultant, Takeda Pharmaceutical Company Limited; Consultant, D-Pharm Ltd
Eric Klawiter, Boston, MA (*Abstract Co-Author*) Consultant, Biogen Idec Inc Researcher, F. Hoffmann-La Roche Ltd

PURPOSE

The dorsal anterior insula (dAI) is an important hub for large-scale neurocognitive networks. Cognitive impairment occurs in 40-60%

of patients with multiple sclerosis (MS) and recent data suggest that cognitive reserve modulates these effects. Our aim was to assess whole-brain dAI intrinsic functional connectivity (iFC) using resting-state functional MRI in people with MS patients. Moreover, we sought to relate dAI iFC with measures of cognitive status and cognitive reserve.

METHOD AND MATERIALS

Twenty-eight people with MS underwent 3T MRI, including 2 resting state acquisitions, as well as the Minimal Assessment of Cognitive Function in MS (MACFIMS) and the Standard Expanded Disability Status Scale (EDSS). The insula was parcellated on the basis of task evoked coactivation, intrinsic (i.e., task-independent) functional connectivity, and grey matter structural covariance. Image processing was with FSL, FreeSurfer and custom MATLAB scripts. iFC signal was extracted and correlated to all other vertices of the brain. Mean correlation values from each node of 17 RS network components were extracted, and correlated with clinical disability & cognitive performance. Subjects were classified as cognitively impaired based on two standard deviation below the mean on 2 or more tests. Cognitive reserve was calculated based on the Test of Pre-Morbid Function, years of education and cognitive leisure activities. Multiple-R Anova was used for statistical correlations.

RESULTS

A significant correlation between cognitive reserve and bilateral dAI iFC was found to the left dorsal prefrontal cortex ($p = 0.01$) and left parahippocampal cortex ($p = 0.03$). Patients with cognitive deficit presented a significant reduced iFC to the right posterior cingulate cortex ($p = 0.02$) and left retrosplenial cortex ($p = 0.02$) when compared to those without cognitive impairment.

CONCLUSION

These results support recent findings relating the insula to a tripartite cognition-emotion-interoception framework where the dAI shows strong connections with frontal areas and plays a role in high-level cognitive processes including network switching, attention, and inhibition. Level of cognitive reserve may modulate dAI connectivity in MS.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that the dorsal anterior insula may be an attractive target for non-invasive strategies to modulate connectivity in order to improve cognitive dysfunction in MS.

SSK14-03 Cerebral Perfusion Alterations in Type 2 Diabetes and Its Relation to Insulin Resistance and Cognitive Dysfunction

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

Participants

Ying Cui, Nanjing, China (*Presenter*) Nothing to Disclose

Gao-Jun Teng, MD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the cerebral perfusion between T2DM and healthy controls, and to explore the relationship between perfusion changes and cognitive impairment as well as diabetic variables in T2DM patients, by using a whole-brain arterial spin-labeling (ASL) MRI technique.

METHOD AND MATERIALS

This prospective study was approved by the local institutional review board and was performed between November 2012 and October 2013. All subjects provided informed consent. Forty T2DM patients and 41 age-, sex- and education-matched healthy controls were included. Cerebral blood flow (CBF) map was obtained by pulsed ASL perfusion imaging at 3T MRI. Voxel-wise comparisons on CBF maps with and without partial volume effects (PVEs) correction were performed between groups. Associations between CBF and cognitive functioning, and between CBF and diabetic variables were investigated by using voxel-wise, whole-brain correlation analyses.

RESULTS

In T2DM patients, PVEs uncorrected CBF was decreased in the posterior cingulate cortex (PCC), precuneus and bilateral occipital lobe, and was increased in the anterior cingulate cortex (corrected $P < 0.05$). These findings were largely unchanged after PVEs correction. Correlation analyses revealed that in T2DM patients group, hypoperfusion in PCC and precuneus regions were related to higher insulin resistance level and deficits in clock-drawing performance, while the occipital hypoperfusion was associated with worse visual-memory performance, regardless of PVEs correction.

CONCLUSION

The cerebral hypoperfusion pattern in T2DM resembles the pattern observed in the early stage of dementia, and increased insulin resistance might be an important risk factor as well as treatment target for CBF dysregulation in diabetic population.

CLINICAL RELEVANCE/APPLICATION

The hypoperfusion in the PCC and precuneus was strongly correlated with increased IR level and cognitive deficits, suggesting that such hypoperfusion pattern might be a promising biomarker for cognitive impairment in T2DM patients. Besides, insulin resistance might be a potential treatment target in the modulation of cerebral CBF and prevention of dementia development in diabetic population.

SSK14-04 Differential Associations between Systemic Markers of Global Health and Cortical Thickness in Cognitively Normal Middle Aged and Older Adults

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

Awards

Student Travel Stipend Award

Participants

Artur M. Coutinho, MD,DSc, Boston, MA (*Presenter*) Nothing to Disclose

Jean-Philippe Coutu, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose

Emily R. Lindemer, BSC, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Bruce R. Rosen, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
David Salat, PhD, Jamaica Plain, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate possible correlations between cortical thickness and a large variety of laboratorial parameters in a cohort of cognitively normal subjects in different stages of life, ranging from middle-aged to older subjects.

METHOD AND MATERIALS

This study included 138 individuals between 40 to 86 years old, physically healthy and cognitively intact. Eleven markers were obtained from blood sampling of all subjects. Blood markers were clustered into five factors with a principal component analysis, resulting in factors comprising markers of: insulin/lipid metabolism (factor 1), glucose regulation (factor 2), kidney function (factor 3), cholesterol (factor 4) and protein (factor 5).

T1-weighted 3T MRI scans of all subjects were used to evaluate possible correlations between gray matter cortical thickness (CortThick) and each of the factors using a general linear model approach in FreeSurfer. CortThick data was analyzed before and after corrections for age, gender and each of the factors as covariates.

RESULTS

Regional significant correlations between each of the factors and CortThick were found, specially in factors 1,3 and 4. Factors 1 (insulin/metabolic) and 3 (kidney function) presented with large areas of negative correlation between these factors and cortical thickness, which survived correction for multiple comparisons. Such areas included the prefrontal lobes and association cortical areas such as temporal parietal transitions, posterior cingulate and also medial temporal lobes. Factor 4 presented with areas of positive correlation with cortical thickness in lateral parietal, occipital and frontal areas.

CONCLUSION

Differential region-specific associations between Cortical thickness and each of the global health factors was seen. Insulin/lipid metabolism and particularly kidney function factors were inversely correlated with cortical thickness (independently of age) in the temporal and parietal association cortices, areas commonly related to risk of dementia and less prone to atrophy in normal aging.

CLINICAL RELEVANCE/APPLICATION

These results may provide information about distinct mechanisms of gray matter changes through time in aging. It could help to understand possible influences of global health in "normal" brain aging and also emphasize the need to determine whether modulation of systemic health and adoption of different stratification levels of "normality" may reduce the decline in brain structural integrity.

SSK14-05 Biological Vulnerability to Depression Relapse: Negative Association between Number of Depressive Episodes and Default Mode Network

Wednesday, Nov. 30 11:10AM - 11:20AM Room: N226

Participants
Chunhong Liu, MD, Beijing, China (*Presenter*) Nothing to Disclose

PURPOSE

Patients with a future recurrence of major depressive disorder (MDD) easily follows their previous depressive episodes. However, the neural mechanism underlying increased risk for multiple episodes remains unclear. This goal of this study is to explore both regional and inter-regional spontaneous brain activity at rest in patients experiencing different episodes of MDD.

METHOD AND MATERIALS

Using resting-state functional magnetic resonance imaging (rs-fMRI) in patients with single episode MDD (SEMDD, n = 30), multiple episode MDD (MEMDD, n = 54), as well as age-, gender- and educational level-matched healthy controls (n = 72), we examined both the fractional amplitude of low-frequency fluctuations (fALFF) and functional connectivity when choosing the right precuneus as seed point. Meanwhile, the associations between the fALFF values or the strength of functional connectivity as well as the number of depressive episodes were also inspected for pooled MDD patients.

RESULTS

Compared to MEMDD patients and healthy controls, the patients with SEMDD showed increased fALFF values in the right subgenual anterior cingulate cortex (sgACC) whereas decreased fALFF values in the left hippocampus gyrus. The peak values of fALFF in the right precuneus (peak coordinate: 3, -45, 42) and left dorsomedial prefrontal cortex (dmPFC, peak coordinate: 39, 3, 6) were found to be negatively correlated with the number of depressive episodes across the pooled MDD patients. More specifically, the negative correlation between the strength of functional connectivity between the right precuneus-dmPFC and number of depressive episodes for the pooled MDD patients were also identified by using voxel-wise correlation analysis. In contrast, an inverse negative correlation was also revealed between the strength of functional connectivity (i.e., between the right precuneus and right PCC) and the number of depressive episodes in the pooled MDD patients.

CONCLUSION

The reduction in precuneus activity at rest increases as depression episodes reoccur more frequently. More importantly, the generated negative association between the strength of right precuneus-dmPFC connectivity and the number of depressive episodes determines the role of default mode network in the pathology of depression relapse.

CLINICAL RELEVANCE/APPLICATION

The resting-state functional magnetic resonance imaging has made it an ideal candidate in the investigation of spontaneous neural activity.

SSK14-06 Longitudinal Analysis of Brain Degeneration in MCI using a Biomechanical Framework

Wednesday, Nov. 30 11:20AM - 11:30AM Room: N226

Participants

Jeongchul Kim, Winston-Salem, NC (*Presenter*) Nothing to Disclose
Laura D. Baker, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Suzanne Craft, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Youngyoo Jung, PhD, Winston Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Christopher T. Whitlow, MD, PhD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to characterize the brain degeneration profiles for subjects with mild cognitive impairment (MCI) under different intensities of exercise intervention. Finite strain theory was applied to analyze not only brain volume changes, but also directional/shear deformations. We hypothesize that there will be directionally different brain degeneration patterns in MCI adults according to the exercise intervention.

METHOD AND MATERIALS

Longitudinal MR images for 35 adults with MCI were acquired as part of a randomized controlled trial investigating an exercise intervention (n=16 aerobic exercise, n=19 stretching control). Brain MRI was acquired at baseline and 6-months later after the exercise intervention on 3T-Siemens Skyra using a high-resolution 20 channel head/neck coil (Siemens Healthcare, Erlangen, Germany). High-resolution structural anatomic T1-weighted images of each subject were collected from which the deformation field during the 6 months period was estimated. Volumetric and directional/shear deformation parameters were derived from the image registration and all parameter maps were warped to standard MNI152_T1 space. Voxel wise statistical analysis was applied to see the effects of the type of exercise intervention.

RESULTS

For both aerobic and stretching exercise groups, volumetric increases were observed in most regions of the gray matter ($p < 0.05$ with FDR correction). However, right posterior corona radiata showed volumetric contraction in stretching control. Different volumetric increases were observed between groups around the genu of corpus callosum, right middle temporal gyrus and bilateral superior frontal gyri, showing higher volumetric expansions ($p < 0.005$, cluster size threshold = 608 voxels). Directional/shear deformation patterns also showed similar patterns with volume changes in most statistically significant brain regions.

CONCLUSION

Aerobic exercise intervention could preserve or possibly even improve brain volumes in MCI subjects compared to stretching control.

CLINICAL RELEVANCE/APPLICATION

The proposed biomechanical metrics appear to be sensitive biomarkers for evaluating interventions in subjects with MCI. These structural biomarkers could be used for classification of MCI and Alzheimer's disease via machine learning algorithms, which could improve the sensitivity and specificity of neurodegenerative disease prognosis and diagnosis.

SSK14-07 Disorganization of White Matter Framework in Bipolar Disorder: A Meta-analysis of Diffusion Tensor Imaging with Tract-based Spatial Statistics

Wednesday, Nov. 30 11:30AM - 11:40AM Room: N226

Participants

Lei Li, Chengdu, China (*Presenter*) Nothing to Disclose
Xinyu Hu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Qiyong Gong, MD, PhD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

White matter (WM) abnormalities have long been suspected in bipolar disorder (BPD). Increasing tract-based spatial statistics (TBSS) studies have detected abnormalities in fractional anisotropy (FA; a marker for white matter (WM) integrity) in BPD, but the available evidence has been inconsistent. We performed a quantitative meta-analysis of TBSS studies contrasting BPD patients with healthy control subjects (HCS). We also performed subgroup meta-analysis to compare BPD-I patients with HCS to elucidate the most consistent WM abnormalities in BPD-I type of this disorder.

METHOD AND MATERIALS

PubMed, ISI Web of Science, PsycINFO, Cochrane Library, and EMBASE databases were searched from January 1996 to January 2016 for all TBSS studies comparing FA between patients with BD and HCS. Coordinates were extracted from clusters of significant FA difference between BPD patients and HCS. Meta-analysis was performed using the anisotropic effect size signed differential mapping (AES-SDM) software. Meanwhile, a jackknife sensitivity analysis was carried out to test the replicability of the results. Furthermore, we used meta-regression methods to examine the potential moderating effects of demographics and clinical characteristics on the reported WM abnormalities.

RESULTS

A total of 21 datasets were enrolled in the current meta-analysis, which included 535 BPD patients and 601 HCS. FA reductions were identified in the genu and the body of corpus callosum (CC) in BPD patients relative to HCS. No regions of increased FA were revealed. A descriptive analysis of quartiles, a sensitivity analysis as well as subgroup analyses further confirmed these findings. Meta-regression analysis showed that samples with higher percentages of female BPD patients had more decreased FA in the body of the CC.

CONCLUSION

This study gave a thorough profile for the WM abnormalities in BPD and provided evidence that inter-hemisphere was the most convergent circuitry affected in BPD. The meta-regression results perhaps revealed the structural underpinning of the sex differences in epidemiological and clinical aspects of BPD.

CLINICAL RELEVANCE/APPLICATION

This study confirmed inter-hemisphere was the most convergent circuitry affected in BPD and suggested that structural

underpinning of gender differences in epidemiological and clinical aspects of BPD.

SSK15

Neuroradiology (Image Analysis and Quantitative Neuroradiology)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: N229



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

FDA Discussions may include off-label uses.

Participants

Greg Zaharchuk, MD, PhD, Stanford, CA (*Moderator*) Research Grant, General Electric Company; Consultant, General Electric Company;
Amy L. Kotsenas, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SSK15-01 **White Matter and Gray Matter Segmentation in 4D CT Images of Acute Ischemic Stroke Patients: A Feasibility Study**

Participants

Rashindra Manniesing, PhD, Nijmegen, Netherlands (*Presenter*) Research funded, Toshiba Corporation
Sil Van de Leemput, MSc, Nijmegen, Netherlands (*Abstract Co-Author*) Research funded, Toshiba Corporation
Mathias Prokop, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group
Speakers Bureau, Toshiba Corporation Speakers Bureau, Koninklijke Philips NV Research Grant, Toshiba Corporation
Bram Van Ginneken, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Stockholder, Thirona BV; Co-founder, Thirona BV; Research Grant, MeVis Medical Solutions AG; Research Grant, Delft Imaging Systems; Research Grant, Toshiba Corporation;

PURPOSE

White matter (WM) and gray matter (GM) respond differently to ischemia and thrombolytic treatment. Being able to differentiate WM/GM in CT enables tissue dependent perfusion analysis and automated detection of stroke related pathology. In this work we show the feasibility of segmenting WM/GM in 4DCT images of acute ischemic stroke patients.

METHOD AND MATERIALS

In total 18 stroke patients who received both a 4DCT and follow-up MR scan were included in this retrospective study. CT imaging was done on a 320-row scanner with 19 or 24 volumetric acquisitions after contrast injection resulting in 512x512x320 isotropic voxels of 0.5 mm. T1w imaging was done on a 1.5T MR scanner resulting in approximately 384x318x26 voxels of 0.6x0.6x5.5 mm. The MR image was segmented with FSL tools and served as reference standard to train and evaluate the method. The method starts with brain segmentation by atlas registration followed by a refinement using a geodesic active contour with dominating advection term steered by a gradient based speed function. Within the segmented brain, three groups of features are then extracted: intensity, contextual and temporal, including a multi-scale representation of the temporal average image weighted according to the exposures of the individual time points to maximize the signal-to-noise ratios. In total 120 features were then fed into a non-linear support vector machine with Gaussian radial basis kernel. A leave-one-patient out cross validation was carried out. Segmentation results were visually inspected for overall quality. Dice coefficient (DC) and 95th percentile Hausdorff distance (HD) were reported.

RESULTS

The segmentations were evaluated as good with the separation of WM/GM at the cortex good to excellent. GM segmentation at the cortex had generally less thickness variations compared to the reference standard. DC were 0.79 ± 0.06 and 0.77 ± 0.06 , 95% HD were 8.71 ± 3.22 and 7.11 ± 3.93 mm, for WM and GM, respectively.

CONCLUSION

WM and GM segmentation in 4DCT is feasible.

CLINICAL RELEVANCE/APPLICATION

WM and GM segmentation in 4DCT enables tissue dependent perfusion analysis and may increase sensitivity of detecting core and penumbra. Volume measurements of WM and GM normalized with the contralateral side may yield an important diagnostic parameter in the acute phase of ischemia.

SSK15-02 **Human-Machine Performance Comparison Study in Distinguishing Radiation Necrosis from Brain Tumor Recurrence on Routine MRI**

Wednesday, Nov. 30 10:40AM - 10:50AM Room: N229

Participants

Prateek Prasanna, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Ameya Nayate, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD, MBBS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Lisa Rogers, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Leo J. Wolansky, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Gagandeep Singh, MBBS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Marco C. Pinho, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Kimmo Hatanpaa, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Anant Madabhushi, PhD, Piscataway, NJ (*Abstract Co-Author*) Nothing to Disclose
Pallavi Tiwari, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

PURPOSE

An extremely challenging problem in neuro-oncology is distinguishing radiation necrosis (RN), a radiation related injury, from tumor recurrence (RT) on routine follow up MRI. To date no radiographic features have been reliably identified that can distinguish RN from RT. The purpose of this study is to investigate if computer extracted texture descriptors (CETDs) can mine subtle morphologic attributes on routine MRI (T1w, T2w, FLAIR), that may not be visually appreciable to trained experts, and help distinguish between RT and RN.

METHOD AND MATERIALS

3T MRI studies with T1w, T2w, FLAIR protocols in N=47 patients (18 RN, 29 RT) obtained 9-months post-surgery were analyzed. A set of 135 CETDs (i.e. Haralick, Laws energy, histogram of gradients) within lesion for each MRI protocol was extracted. CETDs were trained on N=32, and tested on N=15 using a random forest classifier. Independently, two board-certified neuro-radiologists with 2- and 4-years of experience, read the same MRI scans (T1w, T2w, FLAIR) to diagnose the presence of RN or RT on N=47 studies. For every study, the readers assigned a confidence score between 0.5 and 1 (in increments of 0.1), based on their confidence in making the diagnosis of RN or RT, with 0.5 = unclear and 1 = completely confident. The readers were blinded to the pathology reports at the time of MRI interpretation.

RESULTS

Analysis from CETDs and the interpretations of the brain MRI by the two neuroradiologists were compared to the pathologic findings which served as the gold standard. On the training set (N=32), the CETD classifier accuracy was 75%, as compared to 62% and 55% for experts 1 and 2. Similarly, on the test set (N = 15), the CETD classifier demonstrated an accuracy of 91% in identifying tumor recurrence cases, while the accuracies of experts 1 and 2 were 42% and 50%. Consensus with correct classification between the 2 experts was only seen in 18 of 47 studies.

CONCLUSION

Our results demonstrate that CETDs may capture subtle morphometric differences between RT and RN on routine MRI that are not readily appreciable to neuroradiologists. A multi-institutional, multi-reader study is warranted to validate the findings.

CLINICAL RELEVANCE/APPLICATION

Reliably distinguishing RT from RN using CETDs on routine MRI could allow for immediate and appropriate patient management, as well as prevent unnecessary anti-neoplastic interventions in patients with RN.

SSK15-03 Detectability of Restenosis after Carotid Artery Stenting Using Full Iterative Reconstruction at 320-detector CT Angiography

Wednesday, Nov. 30 10:50AM - 11:00AM Room: N229

Participants

Kazushi Yokomachi, RT, Hiroshima, Japan (*Presenter*) Nothing to Disclose
Fuminari Tatsugami, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Toru Higaki, PhD, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Chikako Fujioka, RT, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Masao Kiguchi, RT, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, Eisai Co, Ltd; Medical Advisor, General Electric Company; ; ; ;
Eiji Nishimaru, RT, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshinori Funama, PhD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

While restenosis after carotid artery stenting (CAS) for carotid artery stenosis can be assessed on CT angiograms (CTA), when images are reconstructed with conventional filtered back projection (FBP) or hybrid IR (AIDR 3D, Toshiba), blooming artifacts from the stent structure hamper their detection. The forward projected model-based iterative reconstruction solution (FIRST) is an algorithm that repeats both back and forward projections in the image-reconstruction process. It yields higher spatial resolution, lower image noise, and fewer artifacts. We studied the effect of FIRST on the image quality of CTA scans acquired after CAS and compared the detectability of restenosis on FIRST-, FBP-, and AIDR 3D images.

METHOD AND MATERIALS

We scanned a neck phantom created on a 3D printer using a 320-detector CT scanner (Aquilion One, Toshiba). We placed carotid WALLSTENT (8 * 21 mm, Boston Scientific, USA) or PRECISE stent (8 * 21 mm, Johnson&Johnson, USA) in the carotid artery part of the phantom and filled the carotid arteries with diluted contrast medium (approximately 450 HU). We created 0.4-, 0.6-, 0.8-, and 1.0 mm-thick restenosis along the stents (Figure). CT studies were repeated 5 times; the images were reconstructed with FBP, AIDR 3D (strength level: standard) and FIRST. Each image was reformatted cross-sectionally and the restenosis thickness was measured on all images.

RESULTS

With the carotid WALLSTENT, the size of the 0.8-mm restenosis model was 0.11 mm with FBP and significantly smaller than with AIDR 3D (0.53 mm) or FIRST (0.64 mm) ($p < 0.001$). No 0.6- or 0.4-mm restenosis were detected on FBP- and AIDR 3D images. With FIRST, the size of model restenosis measuring 0.6- or 0.4 mm was 0.54 ± 0.09 - and 0.40 ± 0.11 mm, respectively. With the PRECISE stent, the size of model restenosis measuring 0.6 mm was significantly smaller on AIDR 3D- than FIRST images (0.32 mm vs 0.55 mm; $p = 0.02$). Neither FBP nor AIDR 3D detected the 0.4 mm restenosis model; on FIRST images it was 0.3 ± 0.1 mm.

CONCLUSION

The detectability of restenosis after carotid artery stenting was better on FIRST- than FBP- or AIDR 3D images.

CLINICAL RELEVANCE/APPLICATION

FIRST is recommended for the precise evaluation of restenosis after carotid artery stenting.

SSK15-04 Awards

Texture Analysis on Contrast-Enhanced CT Images Helps Predict Local Failure to Chemoradiotherapy in Head and Neck Squamous Cell Carcinoma

Wednesday, Nov. 30 11:00AM - 11:10AM Room: N229

Trainee Research Prize - Fellow

Participants

Hirofumi Kuno, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Muhammad M. Qureshi, MBBS, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Baojun Li, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Margaret N. Chapman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Vanessa C. Andreu, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Minh T. Truong, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Osamu Sakai, MD, PhD, Boston, MA (*Abstract Co-Author*) Consultant, Guerbet SA

PURPOSE

The accurate prediction of prognosis and failure is crucial for optimizing treatment strategies for cancer patients. The purpose of this study is to assess the performance of texture analysis for the prediction of treatment failure in primary head and neck squamous cell carcinoma (HNSCC) treated with chemoradiotherapy.

METHOD AND MATERIALS

This IRB approved retrospective study included 66 patients (56men, 10 women; 31–80 years; median age, 59 years) diagnosed with primary HNSCC (32 oropharynx, 10 hypopharynx, 20 larynx and 4 oral cavity, including 25 HPV-positive and 25 HPV-negative) who underwent contrast-enhanced CT for staging between 2/2008-2/2015 followed by chemoradiotherapy. CT texture of the whole primary tumor was measured by using an in-house developed MATLAB-based texture analysis program. Receiver operating characteristic (ROC) analysis with the area under the ROC curve was used to identify the optimal threshold of any significant texture parameter. Multivariate cox proportional hazards models were used to examine the association between CT texture parameter and local failure adjusting for age, sex, primary tumor stage, primary tumor volume and HPV status.

RESULTS

Twenty-three patients developed local failure (follow-up periods; 2 to 28 months), and the remaining 43 showed local control (7 to 87 months). Multivariate analysis revealed that 2 histogram features (geometric mean [HR=7.76; $P=.006$], harmonic mean (HR=7.19; $P=.009$)) and 6 gray-level run-length features (SRE [HR=4.82; $P=.014$], LRE [HR=5.99; $P=.007$], GLN [HR=4.81; $P=.021$], RLN [HR=4.08; $P=.025$], HGRE [HR=3.96; $P=.049$], SRLGE [HR=4.23; $P=.044$]) remained significant predictor of outcome after adjusting for clinical variables. T-stage, tumor volume and HPV were not independent predictors in this model.

CONCLUSION

Independent of primary tumor CT texture analysis parameters are associated with local failure in patients with HNSCC who were treated with chemoradiotherapy. The results suggest that the CT texture analysis may serve as independent indicator of local failure regardless of HPV status. Further testing including larger sample size is needed to validate the performance of the predictive model.

CLINICAL RELEVANCE/APPLICATION

CT texture analysis could serve as a widely applicable pretreatment noninvasive biomarker for predicting local failure that could be used to help make treatment decisions in patients with HNSCC.

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

SSK15-05 Detecting Tumor Features of Head and Neck Cancers on CT Using Computerized Analysis

Wednesday, Nov. 30 11:10AM - 11:20AM Room: N229

Awards

Student Travel Stipend Award

Participants

Sean A. Woolen, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Lubomir M. Hadjiiski, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Kenny H. Cha, MSc, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Heang-Ping Chan, PhD, Ann Arbor, MI (*Abstract Co-Author*) Institutional research collaboration, General Electric Company
Francis P. Worden, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Paul Swiecicki, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Benjamin Wasserman, BA, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Ashok Srinivasan, MD, Canton, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

AT-101 is an oral chemotherapeutic agent that inhibits antiapoptotic Bcl proteins, induces pro-apoptotic proteins noxa and puma, and may be beneficial in laryngeal cancer patients treated with organ preservation therapy. The objective of our study was to investigate the feasibility of computer segmentation for determining pre-therapy tumor features that can be used as predictors of tumor response to AT-101.

METHOD AND MATERIALS

Retrospective analysis of pre-therapy CT neck scans was performed in 18 patients diagnosed with laryngeal cancer in this IRB approved study. Contouring of the tumors was performed by one board certified neuroradiologist, and tumor features were generated on an internally developed/validated computer aided detection (CAD) system. The system performs 3D segmentation on the basis of a level-set model using an approximate bounding box for the lesion of interest. Twenty seven radiomic features, including morphological and gray-level features, were extracted from the computer and hand-segmented lesions. Post-treatment responses were obtained after one cycle of AT-101 chemotherapy from laryngoscopic exam. A positive response was recorded when there was at least 50% reduction in tumor volume. Pearson correlations were done between the radiomic features versus lesion response and hand versus computer segmentation.

RESULTS

All 18 lesions examined were primary laryngeal cancers. Out of the 18 patients, there were 6 non-responders (33%) and 12 responders (67%). The computer-estimated tumor volume between the pre-treatment scans achieved a very strong correlation (intraclass correlation coefficient [ICC] = 0.97) with the estimates from manual segmentation. The automatic and manual estimate ICC for tumor features were very strong for contrast enhancement (ICC=0.91) and strong for tumor eccentricity, moment ratio, and axis ratio (ICC=0.76, 0.71, and 0.77). Out of all of the features, the contrast features showed the highest correlation to treatment response.

CONCLUSION

Our results indicate that the computerized segmentation system can reliably estimate tumor features and tumor size on CT scans relative to radiologists. Our next step is the utilization of this CAD system to evaluate potential predictors from the pre-therapy scan.

CLINICAL RELEVANCE/APPLICATION

The CAD system has the potential to aid radiologist in calculating treatment response and guide clinical decision making by identifying treatment response predictors.

SSK15-06 Multiple sclerosis Plaques Searched by Synthetic MRI

Wednesday, Nov. 30 11:20AM - 11:30AM Room: N229

Awards

Student Travel Stipend Award

Participants

Akifumi Hagiwara, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Masaaki Hori, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Christina Andica, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Mariko Yoshida, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Kamagata, Tyuuouku, Japan (*Abstract Co-Author*) Nothing to Disclose
Michimasa Suzuki, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kanao K. Kumamaru, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Misaki Nakazawa, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigeki Aoki, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Synthetic MRI enables creation of almost any contrast-weighted image from a single MRI quantification scan. Double inversion recovery (DIR) and phase-sensitive inversion recovery (PSIR) images, which are known to be better than T2-weighted or fluid-attenuated inversion recovery (FLAIR) images for detecting MS plaques, can also be created. The aim of this study was to assess whether synthetic MRI is suitable for detecting MS plaques.

METHOD AND MATERIALS

Twelve MS patients who underwent quantitative and conventional MRI were retrospectively analyzed in this study. 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 and saturation delay time for quantifying T1, T2, and PD. Synthetic T2-weighted, FLAIR, DIR, and PSIR images were produced after parameter quantification on SyMRI software (v. 8.0, SyntheticMR AB, Linköping, Sweden). The numbers of visible plaques were determined by a radiologist for a set of these four kinds of synthetic MR images and a set of conventional T1-weighted inversion recovery, T2-weighted, and FLAIR images. Acquisition time of synthetic MRI was 7 minutes and 12 seconds and that of conventional MRI was 6 minutes and 29 seconds in total. Lesion-to-white matter contrast and contrast-to-noise ratio (CNR) were calculated and compared between synthetic and conventional DIR images. Acquisition time was 6 minutes and 15 seconds for conventional 3D DIR images. For statistical analysis, we used the Wilcoxon signed-rank test to compare the numbers of lesions detected in the synthetic and conventional images and the contrast and CNR of synthetic and conventional DIR images.

RESULTS

Detected numbers of plaques were 157 in total by synthetic MR images and 139 in total by conventional MR images (P=0.014). Lesion-to-white matter contrast and CNR were better on synthetic DIR images than on conventional DIR images (P=0.001 and <0.001, respectively).

CONCLUSION

Synthetic MRI is better than conventional MRI for detecting and delineating MS plaques.

CLINICAL RELEVANCE/APPLICATION

Synthetic MRI, which creates almost any contrast-weighted image after a single quantification scan, enables detection of more MS plaques than conventional MRI in a comparable acquisition time.

SSK15-07 Segmentation of Small Cerebral Vessels on CT Perfusion Images of Patients with Suspected Acute Stroke

Wednesday, Nov. 30 11:30AM - 11:40AM Room: N229

Participants

Midas Meijs, MSc, Nijmegen, Netherlands (*Presenter*) Research funded, Toshiba Corporation
Mathias Prokop, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group
Speakers Bureau, Toshiba Corporation Speakers Bureau, Koninklijke Philips NV Research Grant, Toshiba Corporation
Frederick J. Meijer, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Bram Van Ginneken, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Stockholder, Thirona BV; Co-founder, Thirona BV; Research Grant, MeVis Medical Solutions AG; Research Grant, Delft Imaging Systems; Research Grant, Toshiba Corporation;
Rashindra Manniesing, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research funded, Toshiba Corporation

PURPOSE

Due to partial volume effects, accurate segmentation of small cerebral vessels on CT is a challenge. We present a novel technique that incorporates local intensity histogram information to segment the cerebral vasculature on CT perfusion (CTP) scans for suspected ischemic stroke.

METHOD AND MATERIALS

A pattern recognition approach based on global and local image features followed by a random forest classifier is proposed. The features consist of an automatically computed brain mask denoting intracranial tissue, the first volume of the CTP scan, the CTP scan temporal average weighted according to the individual exposures to maximize signal-to-noise ratio, the weighted temporal variance (WTV), and local histogram features of the WTV calculated in a neighborhood of 9x9x9 voxels around a centered voxel. The mean, standard deviation, entropy and mode of the histogram are extracted as local feature values. In total 26 patients that underwent CTP were included. The CTP was acquired on a 320-detector row scanner. Image size was 512x512x320 voxels by 19 time points with voxel sizes of approximately 0.5 mm. Training was done on 8 patients with manually annotated data. The remaining 18 patients were used as testing set. Segmentations were visually inspected for completeness and overall quality. 3D-patches including the M2/M3 segments of the middle cerebral artery were manually annotated for quantitative evaluation. The modified Hausdorff distance (MHD) (maximum of the median HDs) and the accuracy (true positive + true negative voxels divided by amount of voxels in a patch) of the segmentation were reported for the annotated patches.

RESULTS

Overall the method was capable of segmenting the complete cerebral vasculature with inclusion of very small distal vessels. Parts of one internal carotid were missed in one patient because of clipping artefacts. In 3 patients false positive voxels were observed in the skull base region near the internal carotid artery and cavernous sinus. The MHD was 0.51 ± 0.28 mm, which is similar to the voxel spacing, and the accuracy was 0.97 ± 0.01 .

CONCLUSION

Our approach provides high-quality segmentation of small cerebral vessels from CTP data.

CLINICAL RELEVANCE/APPLICATION

The high quality segmentation provided by our approach is an important step towards the automated localization and evaluation of vascular pathology in acute stroke patients.

SSK15-08 A Semi-automated Method for Expert Detection and Quantification of Carotid Artery Intraplaque Hemorrhage with 3D-MRI

Wednesday, Nov. 30 11:40AM - 11:50AM Room: N229

Participants

Tishan Maraj, MBBS, MSc, Toronto, ON (*Presenter*) Nothing to Disclose
Alan R. Moody, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Navneet Singh, MD, MPH, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Tina Binesh Marvasti, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
General Leung, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Pascal N. Tyrrell, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Mariam Afshin, PhD, MENG, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Carotid artery intraplaque hemorrhage (IPH) is identified by high intensity areas within the vessel wall compared with the sternocleidomastoid muscle (SCM) on 3-dimensional (3D) magnetic resonance imaging (MRI). Expert readers identify IPH as intensities >1.5 times the SCM, but detection may be subject to inter-reader variability, particularly when areas are small. We aimed to create a semi-automated image processing protocol that would consistently identify and quantify IPH on 3D MRI with the accuracy of an expert reader.

METHOD AND MATERIALS

3D-T1 weighted (T1w) gradient recalled echo (GRE) sequences from 15 carotid arteries with MRI-detected IPH were used in this REB approved retrospective study. Each sequence was used to create 16, 2mm thick axial reformats. Two expert readers independently rated the randomized images from 10 carotid arteries (n=160) for presence of IPH with a consensus decision for conflicting images. This was compared with the semi-automated detection of vessel wall high signal $\geq 1\text{mm}^2$ using thresholds from 1.2 to 2.2 times the SCM intensity, measured from a 20mm² region of interest (ROI) at the level of the carotid artery bifurcation. The optimal threshold was derived from a receiver operating characteristic (ROC) curve by the Youden Index (YI). For the remaining 5 carotid arteries, the semi-automated method used the optimal threshold to measure IPH area per axial image (n=80), which was compared with the manual measurements of an expert using intraclass correlation coefficient (ICC) statistics.

RESULTS

There was strong agreement between expert readers for the initial independent assessment ($\kappa = 0.90$, $p < 0.01$). The ROC curve

produced an area under the curve of 0.94 suggesting excellent diagnostic accuracy. The highest YI was 0.80, obtained at the 1.5 intensity ratio on the ROC curve. This corresponded to a sensitivity, specificity, positive predictive value, and negative predictive value of 80%, 100%, 100% and 83% respectively for regions of IPH $\geq 1\text{mm}^2$. The manual area measurements produced an ICC of 0.99 (95%CI 0.99 to 1.00) when compared with the 1.5 intensity ratio of the semi-automated method.

CONCLUSION

This semi-automated method for carotid artery IPH quantification has high accuracy compared with expert readers for areas $\geq 1\text{mm}^2$ on 3D-MRI.

CLINICAL RELEVANCE/APPLICATION

This semi-automated method can lead to improved consistency in detection and quantification of high signal intensity representing IPH.

SSK15-09 Performance of CAD system for Diagnosing Indeterminate Thyroid Nodules

Wednesday, Nov. 30 11:50AM - 12:00PM Room: N229

Participants

Jungmin Bae, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Eun Young Ko, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soo Yeon Hahn, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Hee Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Hee Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Yoon Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the capability of a breast ultrasound (US)-dedicated computer-assisted diagnosis (CAD) system as a supplemental tool for diagnosing indeterminate thyroid nodules.

METHOD AND MATERIALS

One hundred thirty-four patients with 139 nodules were enrolled in this prospective study between November 2015 and February 2016. US features and results of elastography were recorded according to the Korean Thyroid Imaging Reporting and Data System (K-TIRADS) in terms of size, composition, orientation, shape, margin, echogenicity, calcifications along with final assessment. After finishing the US examination, CAD system (breast US-dedicated CAD) was applied to the representative US images and the results were obtained as "benign" or "malignant". We evaluated the overall performance of CAD, and analyzed the performance of CAD system in diagnosing the thyroid nodules which were categorized as "indeterminate" (n=59) by radiologists. We also evaluated other US parameters and tools that can improve the performance of CAD system.

RESULTS

Among the 139 nodules, 91 nodules were benign and 48 nodules were malignant. Radiologists categorized the nodules as "benign" (n=37), "indeterminate" (n=59) and "malignant" (n=43). In diagnosing the indeterminate nodules (n = 59), CAD system showed high sensitivity (87.5%) and negative predictive value (95.5%), while specificity and positive predictive value were low (41.2%, 18.9%). By adding the results of elastography and the presence of calcification, specificity increased up to 94.1% and positive predictive value increased up to 57.1%, whereas sensitivity decreased to 50%.

CONCLUSION

CAD designed for breast mass showed high sensitivity and negative predictive value, but low specificity and positive predictive value in diagnosing the indeterminate thyroid nodules. Considering the presence of calcifications as well as applying the results of elastography could improve the specificity and positive predictive value of the CAD system.

CLINICAL RELEVANCE/APPLICATION

Development of thyroid-specific CAD system analyzing the US features including calcifications, and having elastography as one of the analyzing parameters is recommended for better performance.

SSK16

Physics (Cone Beam CT)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S403B



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

FDA Discussions may include off-label uses.

Participants

Sabee Y. Molloy, PhD, Irvine, CA (*Moderator*) Research Grant, Toshiba Corporation
Guang-Hong Chen, PhD, Madison, WI (*Moderator*) Research funded, General Electric Company Research funded, Siemens AG

Sub-Events

SSK16-01 Mask-Free Intravenous 3D Digital Subtraction Angiography (IV 3D-DSA) from a Single Sweep C-arm CBCT Acquisition

Awards

Student Travel Stipend Award

Participants

Yinsheng Li, BEng, Madison, WI (*Presenter*) Nothing to Disclose
Beverly A. Kienitz, MD, DDS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
David Niemann, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Azam S. Ahmed, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Charles M. Strother, MD, Madison, WI (*Abstract Co-Author*) Research Consultant, Siemens AG Research support, Siemens AG License agreement, Siemens AG
Guang-Hong Chen, PhD, Madison, WI (*Abstract Co-Author*) Research funded, General Electric Company Research funded, Siemens AG

PURPOSE

The current technology of intravenous 3D digital subtraction angiography (IV 3D-DSA) requires a pre-contrast mask scan and a contrast-enhanced (i.e. filled) scan, which prolongs the total data acquisition time, making the images more sensitive to involuntary patient motion and potentially increasing radiation dose. In this work, a new technique was developed to generate high quality IV 3D-DSA images from a single sweep C-arm cone beam CT (CBCT) data acquisition without the mask scan.

METHOD AND MATERIALS

A newly developed image reconstruction technique, Synchronized Multi-Artifact Reduction with Tomographic Reconstruction (SMART-RECON), enables four sub-image volumes to be generated from a single 200 degree filled scan. Each sub-image volume corresponds to a super short segment of the projection data, but without suffering from limited view angle artifacts. The first virtual nonenhanced sub-image volume is subtracted from the sub-image volume corresponding to peak contrast enhancement, generating the desired IV 3D-DSA images without the mask scan. The proposed method was applied retrospectively to filled standard-of-care (SOC) IV-DSA datasets of 15 human subjects with various neurovascular pathologies such as aneurysms; SOC images generated with both mask and filled scans were used to benchmark imaging performance.

RESULTS

Mask-free IV 3D-DSA images of the 15 human subjects were successfully generated with no noticeable limited view angle artifacts. Requiring just half the radiation dose, these images demonstrated arguably better image quality, as they were less prone to artifacts arising from inter-scan involuntary patient motions and mis-registration. The noise standard deviations measured in the mask-free SMART-RECON images are 3 ± 1 HU, compared with 13 ± 5 HU of SOC images. The CNR values of SMART-RECON and SOC images are 38 ± 10 and 9 ± 3 , respectively. The subjective conspicuity of neurovascular abnormalities such as aneurysms was improved in the SMART-RECON images.

CONCLUSION

High quality IV 3D-DSA can be generated from a single C-arm CBCT data acquisition to reduce overall image acquisition time, reduce artifacts associated with inadvertent patient motion, and reduce radiation dose by a factor of two.

CLINICAL RELEVANCE/APPLICATION

Intraoperative IV 3D DSA plays an important role in neurointerventions. The proposed method relaxed the need for two separate (mask+fill) scans, therefore reducing motion artifacts and radiation dose.

SSK16-02 Organ Dose and Radiation Risk Assessment for Orthognathic Patients in Large FOV Dental CBCT and Head MSCT Imaging

Wednesday, Nov. 30 10:40AM - 10:50AM Room: S403B

Participants

Andreas Stratis, Leuven, Belgium (*Presenter*) Nothing to Disclose
Xochitl Lopez-Rendon, MSc, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Guozhi Zhang, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Reinhilde Jacobs, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Ria Bogaerts, Herestraat 49, Belgium (*Abstract Co-Author*) Nothing to Disclose
Hilde Bosmans, PhD, Leuven, Belgium (*Abstract Co-Author*) Co-founder, Qaelum NV Research Grant, Siemens AG

PURPOSE

to estimate organ doses and the associated radiation-induced risks for a cohort of orthognathic patients, referred for a head CT either in a multi slice CT scanner (MSCT) or in a dental cone beam CT (CBCT) scanner for surgery planning purposes

METHOD AND MATERIALS

An EGSnrc-based-Monte-Carlo (MC) framework was used to calculate organ doses in the ICRP-female voxel phantom for a dedicated maxillofacial protocol in a MSCT (Somatom Definition Flash, Siemens, DE) and for full skull protocols in dental CBCT systems (Promax-3D-Max, Planmeca, FI and VGI-evo, Newtom, IT). The maxillofacial MSCT protocol is carried out at 120 kV, with a collimation of 64x0.6mm, a pitch of 0.8 and 3D tube-current-modulation (TCM) mode with a quality reference 125mAs (CareDose4D). Promax-3D-Max employs a 230x260 mm² FOV (diameter x height) along with a stitching technique and fixed current during rotation at 96 kV whereas VGI-evo (Newtom, IT) employs a 240x190 mm² FOV and rotational TCM at 110kV. An adult anthropomorphic phantom (SK 150, The Phantom Laboratory) was scanned to extract the TCM curves in Somatom Definition Flash and in Vgi-Evo. TCM was implemented in the MC-framework via dose-integral weighting factors. Doses were calculated for the aforementioned quality reference mAs in MSCT, for the entire range of available modes (mAs levels) of the specific protocol in Promax-3D-Max and for the Normal /regular dose mode in Vgi-evo.

RESULTS

The effective dose (ED) in Somatom Definition Flash was 1.13mSv. The dose to thyroid (245µSv), salivary glands (183µSv) and oral mucosa (181µSv) contributed most to the total risk. In Promax-3D-Max the ED ranges from 85µSv to 1.09 mSv depending on the operation mode (mAs-settings), whereas for VGI-evo the ED was 265µSv. Compared to MSCT, the dose delivered to most radiosensitive organs in dental CBCT, for normal dose operation modes, was three times lower. The absorbed dose to eye lenses was 13.5 mGy in MSCT, 1.85 to 24 mGy in Promax-3D-Max and 5.05 mGy in Vgi-evo.

CONCLUSION

Full-head dental CBCT scans deliver lower organ doses and are associated with lower EDs compared to MSCT scanners.

CLINICAL RELEVANCE/APPLICATION

For orthognathic surgery planning purposes, switching from MSCT imaging to CBCT imaging is justified, since head CBCT exams deliver lower radiation doses and are associated with lower risks.

SSK16-03 Comparative Assessment of High- and Low-Contrast Detectability Performance in Digital Mammography, Breast Tomosynthesis, and Dedicated Photon-Counting Breast Computed Tomography: A Phantom Study

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S403B

Participants

Veikko Ruth, MSc, Erlangen, Germany (*Presenter*) Nothing to Disclose
Christian Steiding, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, CT Imaging GmbH
Daniel Kolditz, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, CT Imaging GmbH
Ferdinand Lueck, DIPLPHYS, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, CT Imaging GmbH
Ann-Christin Roessler, MSc, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Willi A. Kalender, PhD, Erlangen, Germany (*Abstract Co-Author*) Founder, CT Imaging GmbH; CEO, CT Imaging GmbH

PURPOSE

Projection imaging such as digital mammography (DM) suffers from superimpositions, especially in dense breasts. Breast tomosynthesis (BT) and dedicated breast computed tomography (BCT) try to overcome this disadvantage. The study compared the performance of DM, BT, and BCT in detecting high- and low-contrast objects with and without superimposing structures as a function of average glandular dose (AGD).

METHOD AND MATERIALS

The performance of DM and BT using standard clinical systems and protocols was compared to a novel photon-counting BCT (pcBCT). Two breast-equivalent phantoms mimicking a compressed breast (for DM/BT) and a pendant breast (for pcBCT) were used. Both phantoms offer cubical (4 cm)³ cavities to be filled with up to 64 cubical (1 cm)³ breast equivalent inserts. Structures of varying size (130–530 µm calcifications (µCa), 1–8 mm lesions) and shape (spheres and fibrils) were embedded in 16 inserts. These 16 test structures were arranged randomly in one or two transverse planes of interest (POI). The positions of the POIs were varied in different distances to the phantom border and to each other. Superimpositions were simulated by placing organic structures above and below the POIs. Images were acquired with and without superimpositions using AGD levels from 1 to 10 mGy. Receiver operating characteristics were determined for five observers with respect to the detectability of the test structures.

RESULTS

The detection rates for test structures without superimpositions were similar in DM, BT and pcBCT for AGD below 5mGy: detection of 2 mm lesions in BT and pcBCT, 4 mm in DM; detection of 160 µm µCa pcBCT, 250 µm in DM and BT. When superimposing structures were present the detection rates remained constant in pcBCT. They were superior compared to DM and BT especially regarding low contrast objects: detection of 2 mm lesions in pcBCT, no lesion detection in DM and BT; detection of 160 µm µCa in pcBCT, 250 µm in BT, and 530 µm in DM.

CONCLUSION

BT showed higher performance than DM. pcBCT outperformed DM and BT due to superior detectability performance for calcifications and low-contrast objects owing to higher image contrast and the absence of superimpositions.

CLINICAL RELEVANCE/APPLICATION

pcBCT offers the opportunity to increase sensitivity and specificity in early detection of breast cancer and thus the potential to improve the diagnostic accuracy compared to DM and BT.

SSK16-04 **Participants Approaches and Results for Photon-Counting Spiral Breast CT**

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S403B

Daniel Kolditz, PhD, Erlangen, Germany (*Presenter*) Employee, CT Imaging GmbH
Christian Steiding, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, CT Imaging GmbH
Ferdinand Lueck, DIPLPHYS, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, CT Imaging GmbH
Veikko Ruth, MSc, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Willi A. Kalender, PhD, Erlangen, Germany (*Abstract Co-Author*) Founder, CT Imaging GmbH; CEO, CT Imaging GmbH

PURPOSE

To evaluate technical and patient dose indicators and to provide dosimetry approaches for high-resolution photon-counting spiral breast CT (pcBCT).

METHOD AND MATERIALS

Measurements were performed on a pcBCT (CT Imaging GmbH, Erlangen, Germany), using 60 kV, 3 mm Al filtration, 30 mm axial collimation and spiral scan mode offering 100 μm spatial resolution. As technical dose indicator, the weighted computed tomography dose index (CTDI_w) was measured according to IEC 60601-2-44 using a PMMA phantom 160 mm in diameter and 150 mm in length and a calibrated 100 mm long pencil ionization chamber (type 30009, PTW, Freiburg, Germany). From this, volume CTDI (CTDI_{vol}) and dose length product (DLP) were calculated. Additionally the CTDI free in air (CTDI_{air}) and air kerma in the isocenter were assessed. As patient dose indicators, the average glandular dose (AGD) and the effective dose (E) according to ICRP publication 103 were determined. For this, conversion factors of AGD per air kerma and E per air kerma were calculated for different breast phantoms using Monte Carlo software (ImpactMC, CT Imaging GmbH, Erlangen, Germany) taking the system geometry, x-ray spectrum, scan trajectory, breast size and patient body size into account. Using measured air kerma values, AGD and E for the scan protocol in question were calculated for the individual breast examined.

RESULTS

Measurements of technical dose indicators: CTDI_w was 10.6 mGy per 100 mAs, and CTDI_{air} was 20.5 mGy per 100 mAs. Simulations of patient dose indicators: AGD was 0.29 to 0.48 mGy and E was 0.039 to 0.059 mSv per 1 mGy air kerma, respectively, depending on breast size and composition. E.g., for a breast of 140 mm in diameter, 105 mm in length and 20% glandular tissue the investigation revealed: CTDI_{vol} of 6.8 mGy, DLP of 71.4 mGy * cm, AGD of 4.8 mGy and E of 0.61 mSv for our protocols.

CONCLUSION

Technical concepts established in clinical CT are suitable for dose assessment in pcBCT. Patient-specific dose can be estimated based on Monte Carlo simulations. AGD of about 5 mGy and E less than 1 mSv for bilateral examinations in pcBCT are low, acceptable and confirm photon-counting technology. Dose to all other organs not directly exposed appears negligible.

CLINICAL RELEVANCE/APPLICATION

Dedicated high-resolution photon-counting spiral breast CT potentially offers higher sensitivity and specificity for breast cancer detection without increasing dose levels significantly.

SSK16-05 **Cone Beam Breast CT for Breast Cancer Detection Comparing with Ultrasound, and Digital Mammography: A Prospective Study with 120 Asian Patients with Dense Breasts**

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S403B

Participants
Ni He, PhD, MD, Guangzhou, China (*Presenter*) Nothing to Disclose
Pan y. Wu, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
jiao li, BA, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

In this preliminary study, BCBCT was found to accurately identify malignant breast masses and calcifications in a diagnostic setting. CE-BCBCT provided additional information and improved cancer diagnosis in dense breasts compared to the use of BCBCT, US, or MG alone.

Background

Breast cone-beam computed tomography (BCBCT) is a flat-panel detector (FPD)-based X-ray imaging system that provides high-quality images of the breast. The purpose of this study was to investigate the ability to detect breast abnormalities using non-contrast BCBCT and contrast-enhanced BCBCT (BCBCT and CE-BCBCT) compared to ultrasound (US) and digital mammography (MG).

Evaluation

A prospective study was performed from May 2012 to August 2014. 120 patients with dense breast (270 lesions) underwent BCBCT and CE-BCBCT, all the patients underwent US and MG.

Discussion

Cancer diagnosis was confirmed pathologically in 102 patients (110 lesions). BCBCT identified 97 of 110 malignant lesions, whereas 93 malignant lesions were identified using MG and US. The areas under the receiver operating curves (AUCs) for breast cancer diagnosis were 0.861 (BCBCT), 0.856 (US), and 0.829 (MG). CE-BCBCT improved cancer diagnostic sensitivity by 20.3% (78.4-98.7%). The AUC values were 0.869 (CE-BCBCT), 0.846 (BCBCT), 0.834 (US), and 0.782 (MG).

SSK16-06 High-resolution Low-dose Breast CT Performance Tests on Surgical Specimens in Comparison with Digital Mammography and Breast Tomosynthesis

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S403B

Participants

Ann-Christin Roessler, MSc, Erlangen, Germany (*Presenter*) Nothing to Disclose
Evelyn Wenkel, MD, Erlangen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG
Christian Steiding, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, CT Imaging GmbH
Veikko Ruth, MSc, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Kolditz, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, CT Imaging GmbH
Willi A. Kalender, PhD, Erlangen, Germany (*Abstract Co-Author*) Founder, CT Imaging GmbH; CEO, CT Imaging GmbH

PURPOSE

Using dedicated breast computed tomography (bCT) for detection and diagnosis of breast cancer is a novel approach in breast imaging. Existing bCT systems showed comparable performance to digital mammography (DM) and breast tomosynthesis (BT) in detection of lesions especially if contrast media were applied but do not have sufficient resolution to detect microcalcifications (μCa) smaller than 300 μm . The purpose of the study was to compare a novel high-resolution low-dose bCT system to clinical DM and BT.

METHOD AND MATERIALS

30 surgical specimens were evaluated for this study. 14 of the specimens were lumpectomies, 16 total mastectomies. All women had a pre-operatively diagnosed breast cancer or DCIS. Specimens were investigated directly after surgery with DM, BT, bCT and pathology examination (ground truth). DM and BT were used with standard clinical settings, bCT with a tube voltage of 60 kV. Dose was kept below 5 mGy for bCT. 3 breast imaging experts examined the randomized data sets. Time for image viewing was recorded. Sensitivity and specificity for detection of lesions and calcifications were calculated.

RESULTS

Histology revealed 17 invasive cancers and 10 DCIS in the specimens (27 lesions in total). 16 of the specimens contained calcifications. 73 % of the specimens were rated as heterogeneously or extremely dense in DM. Mean time for image viewing was 77 s for DM, 122 s for BT and 131 s for bCT. Sensitivity for lesions was 41 % for DM, 52 % for BT and 70 % for bCT. Sensitivity for calcifications was 75 % for DM, 69 % for BT and 94 % for bCT. Specificity for lesions was 71 % for DM, 29 % for BT and 71 % for bCT. Specificity for calcifications was 67 % for all modalities.

CONCLUSION

For detection of lesions as well as calcifications, bCT showed superior sensitivity compared to DM and BT. Radiologists are not used to inspect bCT images in clinical routine, viewing times nevertheless were still comparable to those of BT. Sensitivity and specificity for lesion detection could potentially be increased further using contrast media.

CLINICAL RELEVANCE/APPLICATION

Dedicated high-resolution low-dose bCT proved to be superior to DM and BT especially for detection of calcifications and lesions in dense breasts.

SSK16-07 A Point-of-Care Cone-Beam CT System for Imaging of Intracranial Hemorrhage: Performance Characterization for Translation to Clinical Studies

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S403B

Participants

Jennifer Xu, Baltimore, MD (*Presenter*) Research Grant, Carestream Health, Inc
Alejandro Sisniega, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Carestream Health, Inc
Wojciech Zbijewski, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Carestream Health, Inc
Hao Dang, Baltimore, MD (*Abstract Co-Author*) Research Grant, Carestream Health, Inc
Joseph W. Stayman, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Elekta AB Research Grant, Varian Medical Systems, Inc
Xiaohui Wang, PhD, Rochester, NY (*Abstract Co-Author*) Employee, Carestream Health, Inc
David H. Foos, MS, Rochester, NY (*Abstract Co-Author*) Employee, Carestream Health, Inc
Nafi Aygun, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Vassiliss Koliatsos, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jeffrey H. Siewerdsen, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Carestream Health, Inc; Advisory Board, Siemens AG; Advisory Board, Carestream Health, Inc; License agreement, Carestream Health, Inc; License agreement, Elekta AB; ; ;

PURPOSE

To assess the imaging performance and suitability to clinical studies of a newly developed prototype cone-beam CT system for imaging intracranial hemorrhage (ICH) at the point of care.

METHOD AND MATERIALS

The prototype was designed for reliable detection of acute ICH (~2 mm diameter, 40-80 HU) in the ICU or other points of care for patients with brain injury. System design was guided by a task-based image quality model, yielding a mobile U-arm with 550 mm source-axis distance, 1000 mm source-detector distance, a 15 kW / 0.6 FS x-ray tube (IMD Monobloc), and a 0.14 mm pixel pitch / 43 x 43 cm² detector (Varian PaxScan 4343CB). Nominal imaging technique involved 720 projections over 360° in 28 s at 100 kVp and 216 mAs with 3x3 pixel binning and dual-gain detector readout. Artifact correction included a fast, GPU-based Monte Carlo scatter correction, Joseph-Spital beam hardening correction, and deconvolution of detector glare and lag effects. Image reconstruction was based on a penalized weighted least squares (PWLS) method with modified weights for artifact corrections.

RESULTS

The prototype has been deployed at our institution in preparation for clinical studies. Dose measured for the nominal scan protocol

(Farmer chamber in 16 cm CTDI phantom) yielded central D0 = 21 mGy, peripheral DP = 24 mGy, and CTDIW = 23 mGy (c.f., head scan protocols for a multi-detector CT CTDIvol = 45-55 mGy). Measurements in head phantoms presenting a spectrum of simulated ICH lesions demonstrated clear visualization down to 2 mm diameter at 50 HU contrast. Field of view was sufficient to cover the head without truncation from crown to mid-cervical spine. The assessment quantified the performance gains associated with detector readout (~10% increase in CNR at matched resolution for dual-gain readout), artifact correction (image uniformity improved by ~300 HU), and image reconstruction methods (contrast to noise > 6.9 at point spread function width ~1.2 mm).

CONCLUSION

The technical assessment indicates imaging performance and dose characteristics suitable to detection / monitoring of ICH at the point of care and provides important preclinical evidence in support of translation to clinical studies.

CLINICAL RELEVANCE/APPLICATION

A cone-beam CT system with image quality characteristics beyond that of existing mobile systems will enable detection and monitoring of acute ICH in applications such as the ICU, urgent care, concussion clinics, and field hospitals.

SSK16-08 **Mobile C-Arm Cone-Beam CT: A New Prototype Incorporating Model-Based Image Reconstruction and Soft-Tissue Contrast Resolution**

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S403B

Participants

Matthew W. Jacobson, Baltimore, MD (*Presenter*) Nothing to Disclose
Ali Uneri, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Tharindu De Silva, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph Goerres, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Sureerat Reaungamornrat, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Ketcha, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Stayman, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Elekta AB Research Grant, Varian Medical Systems, Inc
Gerhard Kleinszig, Salzburg, Austria (*Abstract Co-Author*) Employee, Siemens AG
Sebastian Vogt, PhD, Monument, CO (*Abstract Co-Author*) Employee, Siemens AG
Jeffrey H. Siewerdsen, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Carestream Health, Inc; Advisory Board, Siemens AG; Advisory Board, Carestream Health, Inc; License agreement, Carestream Health, Inc; License agreement, Elekta AB; ; ;

PURPOSE

Mobile C-arms are often limited to high-contrast visualization suitable to bone applications. This work reports the cone-beam CT (CBCT) imaging performance of a new mobile platform incorporating model-based image reconstruction to improve contrast resolution suitable to soft-tissue visualization.

METHOD AND MATERIALS

The system is based on a fluoroscopic C-arm (Cios Alpha, Siemens) with an external controller providing motorized gantry movement (orbital, angular, and linear) synchronized with x-ray exposure and detector readout. Nominal scan protocol involved a 300°, 452-view propeller orbit rotation. Image quality and dose were measured in phantoms presenting tissue-equivalent simulated lesions as a function of dose (80 kV, CTDIW = 2.25-11 mGy). CBCT volumes were reconstructed using FDK and Huber Penalized Likelihood (PL). The FDK filter and PL regularization strength were set to match the ESF width (0.75 mm) in the brain-equivalent insert. The PL algorithm used 20 iterations of the OS-SQS algorithm with 10 subsets. Noise was derived from the standard deviation in ROIs in soft-tissue regions of interest. Contrast and ESF widths were measured by fitting a Gaussian error function to radial samples of the low-contrast inserts.

RESULTS

For FDK reconstructions, the CNR in brain (to polyethylene background) was 1.8-3.0 over the dose range tested, whereas PL yielded CNR of 2.9-4.0 over the same dose range at matched spatial resolution. Reconstructions of an anthropomorphic head phantom demonstrated clear visualization of low-contrast inserts and bony anatomy throughout the cranial vault, including the skull base. Residual ring and streak artifacts were evident from residual errors in gain correction and geometric calibration.

CONCLUSION

The mobile C-arm offers increased x-ray power and the potential to overcome traditional limitations in soft-tissue visibility via model-based reconstruction. Contrast resolution appears sufficient for visualization of 80 HU lesions, with further gains via improved artifact correction. Realizing such capability in a manner consistent with surgical workflow (<2 min) leverages accelerated reconstruction methods.

CLINICAL RELEVANCE/APPLICATION

Mobile C-arms with image quality suitable to soft-tissue visualization could advance 3D imaging in neurosurgical, thoracic, and abdominal surgery for improved evaluation of the surgical product and detection of complications.

SSK16-09 **Does Rotational Tube Current Modulation have Significant Impact on Organ Doses in Dental CBCT to Impose its Implementation in Dose Calculating Software Tools?**

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S403B

Participants

Andreas Stratis, Leuven, Belgium (*Presenter*) Nothing to Disclose
Guozhi Zhang, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Joris Awouters, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Reinhilde Jacobs, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Ria Bogaerts, Herestraat 49, Belgium (*Abstract Co-Author*) Nothing to Disclose
Hilde Bosmans, PhD, Leuven, Belgium (*Abstract Co-Author*) Co-founder, Qaelum NV Research Grant, Siemens AG

PURPOSE

to compare organ doses and the associated radiation-induced risk for dental CBCT scanning with and without tube-current-modulation (TCM) with identical average tube loading (mAs).

METHOD AND MATERIALS

An EGSnrc-Monte-Carlo (MC) modelling system was used to simulate a VGi-evo (Newtom, Verona, IT) dental-CBCT-scanner with TCM. The scanner employs rotational TCM based on one antero-posterior and one lateral mA value defined from two scout exposures before the scan. Patient data and exposure parameters were retrieved from PACS for four cases; a 7 years old female undergoing a sinus jaw 8x5cm² Normal-resolution protocol; an 8 years old male undergoing an upper-jaw 5x5cm² Normal-resolution protocol; a 12 years old female undergoing a lower jaw 8x5cm² High-resolution and a full-jaw 12x8cm² normal-resolution-protocol. Age and gender-specific voxel models, based on head/neck CT image datasets, were designed (manually segmented) and were used in the simulations. TCM was simulated by applying projection-specific-weighting-factors when calculating the dose integral. The weighting-factors corresponded to the mA modulation at each projection. The constant-current scanning was modelled with a fixed weighting factor=1.

RESULTS

For the upper jaw protocol, TCM reduced the dose to oral mucosa (1.9mGy vs 2.1mGy), yet increased the dose to esophagus (80µGy vs 70µGy), to extra thoracic tissues (ET) (470µGy vs 400µGy) and to thyroid (70µGy vs 60µGy). In the lower jaw protocol TCM resulted in a lower dose to ET (1.5mGy vs 1.65mGy), to oral mucosa (2.9mGy vs 3.2mGy) and salivary glands (1mGy vs 1.1mGy), though the dose to the thyroid (710µGy vs 640µGy) and esophagus (1.1mGy vs 0.95mGy) increased. In full-jaw, except for the dose to RBM, all major radiosensitive organs received lower doses with TCM. In sinus protocols, there was a dose reduction to salivary glands with TCM (330µGy vs 400µGy), yet an increased dose to the brain (100µGy vs 80µGy). Organ dose differences didn't lead to significant changes in effective dose. All the above dose differences were beyond the overall statistical uncertainty (5%).

CONCLUSION

TCM results in different organ dose distributions and should be taken into account in software dosimetry tools.

CLINICAL RELEVANCE/APPLICATION

Accurate organ dose estimations for paediatric patients in dental CBCT imaging requires the implementation of TCM schemes in software tools and MC simulation frameworks

SSK17

Physics (CAD)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S404AB



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

Participants

Bram Van Ginneken, PhD, Nijmegen, Netherlands (*Moderator*) Stockholder, Thirona BV; Co-founder, Thirona BV; Research Grant, MeVis Medical Solutions AG; Research Grant, Delft Imaging Systems; Research Grant, Toshiba Corporation;
Heang-Ping Chan, PhD, Ann Arbor, MI (*Moderator*) Institutional research collaboration, General Electric Company

Sub-Events

SSK17-01 Automatic Lymph Node Cluster Segmentation Using Holistically-Nested Deep Convolutional Neural Networks and Structured Optimization in CT Images

Participants

Isabella Noguees, BA, Bethesda, MD (*Presenter*) Nothing to Disclose
Le Lu, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaosong Wang, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Holger R. Roth, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Gedas Bertasius, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Nathan S. Lay, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Yohannes Tsehay, BA, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Summers, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Royalties, iCAD, Inc; ;

PURPOSE

To perform lymph node cluster (LNC) segmentation and volume measurement in thoracoabdominal (TA) CT images. To overcome complexity of TA LNC segmentation caused by poor intensity and texture contrast between agglomerated lymph nodes and surrounding tissues.

METHOD AND MATERIALS

This study presents a novel approach to TA LNC segmentation that combines holistically-nested neural networks (HNNS) and structured optimization (SO). Two HNNS, built upon fully convolutional neural networks and deeply supervised networks, are trained to learn LNC appearance (HNN-A) or contour (HNN-C) probabilistic output maps from TA CT images. HNN first produces class label maps with the same resolution as the given input image. Next, HNN-A and HNN-C predictions are formulated into the unary and pairwise terms of conditional random fields (CRFs), which are subsequently solved using three SO methods: dense CRF (dCRF), graph cuts (GC), and the recently developed boundary neural fields (BNF). LNC volumes are then computed from the segmentation predictions. The method was evaluated on a (publicly available) dataset containing 84 abdominal (with 395 LNs) and 87 mediastinal (with 295 LNs) CT scans. 16,268 axial slices were extracted in the portal venous phase with slice thickness 1-1.25 mm. All enlarged LNs (those with short axis diameter ≥ 10 mm, volume range 0.24-31.74 cc, with mean 11.75 +/- 25.05 cc) were segmented by an expert radiologist.

RESULTS

BNF yields the highest quantitative results. Its mean Dice coefficient (DC) between segmented and ground truth LN volumes is 82.1+/-9.6%, compared to 73.0+/-17.6% for HNN-A alone, 69.0+/-22.0% for dCRF, and 67.3+/-16.8% for GC. BNF's LNC relative volume difference (RVD) is 13.7+/-13.1%, compared to 32.2+/-46.3% for HNN-A, 29.6+/-45.4% for dCRF, and 86.5+/-107.6% for GC. The p-values from a paired t-test comparing ground truth to segmented lymph node volumes are $p=0.87$ for BNF, $p=0.37$ for HNN-A alone, $p=0.10$ for dCRF, and $p<<0.01$ for GC.

CONCLUSION

BNF yields a state-of-the-art RVD result, which thus is promising for the development of LN imaging biomarkers based on volumetric measurements.

CLINICAL RELEVANCE/APPLICATION

Improved TA LNC segmentation and a more robust LN volume measurement will yield more accurate assessment of lymphadenopathy in oncology patients, and may lay the groundwork for improved RECIST measurements of LNs.

SSK17-02 Ensemble Deep Learning for the Improvement of the Performance of Computer-aided Detection of Polyps in CT Colonography

Wednesday, Nov. 30 10:40AM - 10:50AM Room: S404AB

Participants

Kensuke Umehara, Boston, MA (*Presenter*) Nothing to Disclose
Janne J. Nappi, PhD, Boston, MA (*Abstract Co-Author*) Royalties, Hologic, Inc.; Royalties, MEDIAN Technologies;
Toru Hironaka, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Daniele Regge, MD, Torino, Italy (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Takayuki Ishida, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Yoshida, PhD, Boston, MA (*Abstract Co-Author*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

PURPOSE

To develop and evaluate an ensemble deep learning (EDL) in the improvement of the detection performance of computer-aided detection (CADe) of polyps in CT colonography.

METHOD AND MATERIALS

A total of 154 CT colonography (CTC) cases were sampled from a large multi-center CTC screening trial. A deep convolutional neural network (DCNN) that had been pre-trained with millions of natural non-medical images was re-trained to identify polyps by use of virtual endoluminal (VE) images of the polyp candidates that were obtained by application of our existing CADe system to these CTC cases. Seven different types of rendering were generated for each of the VE images. An EDL was developed by first re-training seven DCNNs on the seven types of rendered VE images, and then combine them by a super-learner algorithm using a random forest classifier as the meta-classifier. The resulting EDL was reviewed the VE images of the polyp candidates to determine the final detected polyps. For evaluation, the 154 CTC cases were divided randomly into a training and a test dataset. The test set contained 107 biopsy-confirmed adenomas and carcinomas ≥ 6 mm in size: 69 were ≥ 10 mm and 38 were 6–9 mm in size. The performance of the EDL on the test dataset was evaluated by sensitivity analysis compared with that of the baseline CADe and a single DCNN with McNemar test.

RESULTS

At 4.3 FPs per patient, the per-polyp sensitivities of CADe, DL, and EDL were 84.1%, 91.6%, and 93.5%, respectively, for polyps ≥ 6 mm; and 84.1%, 97.1%, and 97.1%, respectively, for polyps ≥ 10 mm. The sensitivity difference between CADe and EDL was statistically significant (for polyps ≥ 6 mm, $p=0.002$; for polyps ≥ 10 mm, $p=0.03$). The CADe scheme yielded 93.5% of the polyps at 12.7 FP detections per patient on average. With the application of EDL, the number of FP detections was reduced to 4.3 per patient (66% reduction) at the same sensitivity.

CONCLUSION

EDL can significantly improve the performance of CADe of polyps in CTC.

CLINICAL RELEVANCE/APPLICATION

The EDL-based CAD could be used to provide a high detection accuracy of polyps in screening population.

SSK17-03 Detectability of Simulated Low-Contrast, Low-Attenuation (LCLA) Liver Lesions on CT: A Comparison of Two Alternate Forced Choice (2AFC) Human Observer Results with Channelized Hotelling Observer and Contrast-to-Noise Ratio for both FBP and ADMIRE

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S404AB

Participants

Arjun Maniyedath, MS, Shaker Heights, OH (*Abstract Co-Author*) Employee, Plexar Associates, Inc
Frank Dong, PhD, Solon, OH (*Presenter*) Equipment support, Siemens AG Software support, Siemens AG
Jordyn Bauer, Solon, OH (*Abstract Co-Author*) Nothing to Disclose
Andrew Primak, PhD, Malvern, PA (*Abstract Co-Author*) Employee, Siemens AG
Wadih Karim, RT, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Lucy D'Agostino McGowan, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
Nancy A. Obuchowski, PhD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Siemens AG; Research Consultant, QT Ultrasound Labs; Research Consultant, Elucid Bioimaging Inc
Mark E. Baker, MD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Bracco Group; Researcher, Siemens AG; Research support, Siemens AG
David Rohler, PhD, Shaker Heights, OH (*Abstract Co-Author*) Employee, Plexar Associates, Inc
Brian R. Herts, MD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

To compare the LCLA lesion detectability accuracy of Channelized Hotelling Model Observer (CHO), Contrast-to-Noise Ratio (CNR) and area-weighted CNR (CNR_a) against Human Observer detection accuracy (2AFC), for both filtered back-projection (FBP) and Advanced Modeled Iterative Reconstruction (ADMIRE).

METHOD AND MATERIALS

A custom designed abdominal phantom with liver insert (90 HU density) containing 3 copies each of 4 unique low-attenuation spherical lesions (15 mm x 6 HU, 10 mm x 12 HU, 10 mm x 18 HU, and 5 mm x 24 HU lesion contrasts) was scanned on a Siemens Somatom Force CT scanner at 6 exposure settings: 200, 160, 120, 80, 40 and 20 effective mAs without automated exposure control. A total of 100 repeat scans were done at each exposure level and images were reconstructed with both FBP and ADMIRE (strength A3). A 19 reader Naïve Human Observer (NHO) study in the form of a 2AFC experiment was performed on 577 pairs of lesion-present and lesion-absent images that were selected from one set of the four unique lesions, and the accuracy (AUC) values were computed for both reconstruction modes. A CHO (with internal noise) with 40 Gabor channels was used to evaluate pairs of 100 images, and the accuracy values (Area Under the Curve (AUC)) were computed. The internal noise for CHO was calibrated using the AUC result from data corresponding to FBP at 160 mAs from the NHO analysis. CNR and CNR_a and the corresponding scaled accuracy values were also computed for the select lesions. The NHO 2AFC results were compared with the accuracy from CHO, CNR and CNR_a and linear regression coefficients (R^2) were calculated.

RESULTS

CNR showed poor correlation with human observer results, with R^2 values of 0.28 and 0.39 for FBP and ADMIRE respectively, and 0.48 and 0.44 respectively for CNR_a. CHO showed strong correlation with humans with a R^2 value of 0.88 and 0.92 for FBP and ADMIRE respectively.

CONCLUSION

Our analysis showed good overall detectability correlation of CHO with human results for both ADMIRE and FBP at all exposure levels and for all lesions.

CLINICAL RELEVANCE/APPLICATION

Objective assessment of detectability performance in a controlled environment is important in order to determine the dose reduction

Objective assessment of detectability performance in a controlled environment is important in order to determine the dose reduction potential of novel iterative reconstruction methods. Validation of good correlation between CHO and human observers demonstrate that rigorous human observer studies can be replaced with simpler CHO studies.

SSK17-04 3D Computer-Aided Detection System for Lung Nodule: Comparison of Detection Performance between Filtered-Back Projection and Iterative Reconstruction Methods at Standard-, Reduced and Ultra-Low-Dose CT Levels

Wednesday, Nov. 30 11:00AM - 11:10AM Room: S404AB

Participants

Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd; Research Grant, FUJIFILM RI Pharma Co, Ltd; Research Grant, Guerbet SA;
Kota Aoyagi, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Hitoshi Yamagata, PhD, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Shigeo Kaminaga, Otawara-shi, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Naoki Sugihara, MEng, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Wakiko Tani, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Erina Suehiro, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshinori Sekitani, MS, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Negi, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuji Kishida, MD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisanobu Koyama, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuro Sugimura, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE

To determine the utility of iterative reconstruction (IR) method on a 3D computer-aided detection (CAD) system for pulmonary nodule at standard-, reduced- and ultra-low-dose CTs (SDCT, RDCT and ULDC) as compared with filtered-back projection method.

METHOD AND MATERIALS

Forty patients prospectively underwent chest CT examinations at MDCT scanners with SDCT (250mA), RDCT (50mA) and ULDC (10mA) protocols, and CT data were reconstructed into 1-mm-thick images with and without commercially available IR method (i.e. adaptive iterative dose reduction using 3D processing: AIDR 3D). Therefore, the following CT data set in each patient was reconstructed: SDCT with and without AIDR 3D, RDCT with and without AIDR 3D, and ULDC with and without AIDR 3D. Then, nodule detections were automatically performed by our proprietary CAD software. To determine the utility of IR method for improving nodule detection capability, sensitivity and false positive rate (/case) of the CAD system were also compared among all protocols by means of McNemar's test or signed rank test.

RESULTS

The gold standard consisted of 101 (48 solid and 53 sub-solid) nodules. Although there were no significant difference of false-positive rate among all protocols, sensitivities of RDCT and ULDC with AIDR 3D (RDCT: 72.3% , ULDC: 66.3% <2.9/case>) were significantly higher than that without AIDR 3D (RDCT: 56.4% <2.9/case>, p<0.0001; ULDC: 35.6% <2.9/case>, p<0.0001). Sensitivity of SDCT with and without AIDR 3D (with AIDR 3D: 73.3% <2.8/case>, without AIDR: 76.2% <2.6/case>) were significantly higher than that of RDCT without AIDR 3D (p<0.0001) and ULDC with and without AIDR 3D (p<0.0001), although there were no significant differences of sensitivity between SDCT with and without AIDR 3D and RDCT with AIDR 3D (p>0.05).

CONCLUSION

Iterative reconstruction method is useful for improving nodule detection performance on a 3D CAD system at reduced- and ultra-low-dose CTs as compared with filtered-back projection method. When applied AIDR 3D, 75% radiation dose can be reduced without decreasing detection performance on 3D CAD system.

CLINICAL RELEVANCE/APPLICATION

Iterative reconstruction method (i.e. AIDR 3D) is useful for improving nodule detection performance on a 3D CAD system at reduced- and ultra-low-dose CTs as compared with filtered-back projection method. In addition, when applied AIDR 3D, tube current would be better to be set equal to or more than 50mA in this setting.

SSK17-05 CAD Performance on a Large Cohort of National Lung Screening Trial Patients at Screening and Sub-screening Doses

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S404AB

Participants

Stefano Young, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Pechin Lo, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
John M. Hoffman, BS, Los Angeles, CA (*Presenter*) Nothing to Disclose
Hyung J. Kim, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
William Hsu, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Carlos Flores, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Grace Lee, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Matthew S. Brown, 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

Lung cancer screening is designed to be low-dose and high-throughput. CAD tools promise to assist radiologists in analyzing the

influx of screening exams. However, the effects of dose on CAD performance are not fully understood. In this work, we investigated the impact of reducing the dose further than the National Lung Screening Trial (NLST) dose protocols.

METHOD AND MATERIALS

The raw CT data files from 481 NLST patients were collected and input to a reduced-dose simulation software. The original NLST protocols called for 25 mAs for standard-size patients and 40 mAs for larger patients. We simulated reduced-dose scans corresponding to 50% and 25% of the original protocols. All cases were reconstructed at the scanner (Sensation 64, Siemens Healthcare) with 1 mm slice thickness and B50 kernel. The lungs were segmented in MeVisLab software, and then all images and segmentations were input to an in-house CAD algorithm. CAD results were compared to a reference standard generated by an experienced reader as part of the NLST. We computed subject-level sensitivities, false-positive rates, and analyzed the relative change in those metrics with dose. LungRADS categories were also assigned to each nodule based on nodule size and solidity, and a sub-analysis was performed by LungRADS category.

RESULTS

For larger category 4 nodules, median sensitivities were 100% at all three dose levels, and mean sensitivities were 72%, 63%, and 63% at original, 50%, and 25% dose respectively. Overall mean subject-level sensitivities were 38%, 37%, and 38% at original, 50%, and 25% dose due to the prevalence of smaller category 2 nodules. The mean false-positive rates were 3, 5, and 13 per case.

CONCLUSION

The results suggest some loss of CAD sensitivity with dose for larger nodules, although overall sensitivity appeared unaffected by dose. The false-positive rate increased substantially at 25% dose, illustrating the difficulty of adapting CAD to very challenging, high-noise screening exams.

CLINICAL RELEVANCE/APPLICATION

Care should be taken to adapt CAD algorithms for very challenging, high-noise lung screening exams.

SSK17-06 Computational Detection, Analysis, and Classification of Lytic, Sclerotic, and Mixed Spinal Metastases on PET/CT Imaging

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S404AB

Participants

Joseph E. Burns, MD, PhD, Orange, CA (*Abstract Co-Author*) Nothing to Disclose
Jianhua Yao, PhD, Bethesda, MD (*Abstract Co-Author*) Royalties, iCAD, Inc
Vic Sanoria, Orange, CA (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Summers, MD, PhD, Bethesda, MD (*Presenter*) Royalties, iCAD, Inc ;

PURPOSE

To develop a fully-automated system to detect, analyze, and classify spinal metastases on 18F-FDG PET/CT, integrating CT and PET features into lesion segmentation algorithms and classifiers

METHOD AND MATERIALS

The most common locale for spinal metastases, thoracic and lumbar vertebral bodies, is targeted. Modeling clinical evaluation, fused images are created. To utilize the higher dimensional operation capability of computers, two image sets are produced for each study by weighted integration of PET with CT data, with one set for lytic and one for sclerotic loci, for density amplification by PET activity. Spine segmentation/partitioning is performed, and watershed, graph cut, and level set algorithms are used to obtain initial detections. If a preliminary lytic and a sclerotic detection are spatially overlapping, they are merged and sent to a mixed lesion SVM classifier; otherwise, they are routed to lytic and sclerotic lesion classifiers, respectively. 10-fold cross validation was employed to evaluate classifier performance. The system was tested on PET/CTs of 53 patients (average age 53 (range 21-68), 28 F, 25 M). 35 patients had reported spinal metastases. 266 of 901 vertebrae demonstrated metastases. The numbers of lytic, sclerotic and mixed lesions were 205, 286, and 120, respectively

RESULTS

The sensitivities for detecting lytic, sclerotic and mixed lesions were 79.4% (95% CI [75.6%, 82.3%]), 80.8% (95% CI [76.7, 84.4]), and 80.2% (95% CI [74.2, 84.3]), respectively, with a false-positive (FP) rate of 2.1, 1.7 and 0.9 per patient. With only CT data used, performance sensitivity was 64.3%, 70.5%, and 48.6%, for lytic, sclerotic and mixed lesions respectively at a FP rate of 1.9, 1.9 and 1.0 per patient. Performance improvement with PET/CT fusion is statistically significant ($p < 0.01$). There were 32 FP in 18 control cases. Lesions ranged from 4 to 37 mm size, and were most common from T9 to T12. FP detections were most often due to bone islands. False negatives occurred with small lesions/insufficient activity on PET

CONCLUSION

A multi-classifier quantitative analysis system was created to detect, classify, and generate metrics for metastatic lesions of the vertebral bodies in the thoracic and lumbar spine on 18F-FDG PET/CT

CLINICAL RELEVANCE/APPLICATION

Quantitative characterization of metastatic lesions to the spine can assist ongoing efforts to develop new clinically relevant response criteria to guide patient therapy.

SSK17-07 Dynamic Texture Feature Analysis Using Dynamic Contrast-Enhanced CT Applied to Malignant Pleural Mesothelioma

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S404AB

Participants

Eyjolfur Gudmundsson, Chicago, IL (*Presenter*) Nothing to Disclose
Samuel G. Armato III, PhD, Chicago, IL (*Abstract Co-Author*) Consultant, Aduro Biotech, Inc

Zacariah Labby, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Christopher M. Straus, MD, Chicago, IL (*Abstract Co-Author*) Shareholder, HealthEngine, LLC; Shareholder, Cognisens, Inc
Feng Li, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Hedy L. Kindler, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Buerkley Rose, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this work was to investigate the utility of texture analysis of dynamic contrast-enhanced computed tomography (DCE-CT) scans in the assessment of tumor response for malignant pleural mesothelioma (MPM).

METHOD AND MATERIALS

Two DCE-CT scans were acquired at approximately 3-month intervals from a total of 16 MPM patients, of whom eight were on treatment and eight were on observation. The dynamic component of the scans involved the imaging of a 55-mm thick slice of thoracic anatomy at 25 time points immediately following the start of contrast injection. Visible tumor within the dynamically imaged anatomy of each patient was manually contoured. These contours were projected to other time points of the scan using deformable image registration and eroded by one voxel to limit the effect of misregistration and inadvertent inclusion of non-tumorous tissue. Twelve first-order texture features were calculated from the tumor voxels at each time point. The relative change in texture feature values from the start of contrast injection was calculated for all time points of each scan, as was the difference in these relative changes between the first and second scans. A Wilcoxon rank-sum test was used to test whether the median relative change in texture feature value and the median difference in relative change between the two scans were significantly different between the two patient cohorts.

RESULTS

The texture features interquartile range, mean HU value, median HU value, energy, and entropy each showed significant differences ($p < 0.05$) between the two patient cohorts at ten or more time points for the second DCE-CT scan. Differences in relative change between the two scans were statistically significant between patients on treatment and patients on observation at seven time points across all texture features.

CONCLUSION

Observed differences in median texture feature values between patients on treatment and patients on observation for the second scan of this study suggest that dynamic texture analysis is sensitive to MPM tumor response. This finding should be validated in future studies using a larger patient cohort and a more unified treatment regimen.

CLINICAL RELEVANCE/APPLICATION

Ultimately, this work could lead to more sophisticated methods to assess tumor response in MPM patients.

SSK17-08 Performance Evaluation of Machine-Learning-based Electronic Cleansing Schemes for Ultra-Low-Dose Dual-energy CT Colonography

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S404AB

Participants

Junko Ota, Boston, MA (*Presenter*) Nothing to Disclose
Rie Tachibana, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Janne J. Nappi, PhD, Boston, MA (*Abstract Co-Author*) Royalties, Hologic, Inc.; Royalties, MEDIAN Technologies;
Toru Hironaka, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Daniele Regge, MD, Torino, Italy (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Hiroyuki Yoshida, PhD, Boston, MA (*Abstract Co-Author*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

PURPOSE

To develop and evaluate accuracy of machine-learning electronic cleansing (ML-EC) schemes for non-cathartic ultra-low-dose dual-energy CT colonography (DE-CTC).

METHOD AND MATERIALS

Thirty-two patients were prepared for non-cathartic colorectal examinations by oral ingestion of 50 ml of iodinated contrast on the day before and two hours prior to DE-CT (SOMATOM Definition Flash) scans. The DE-CTC images were acquired at a current/voltage of 15 mAs/140 kVp and 40 mAs/80 kVp and reconstructed with sinogram-affirmed iterative image reconstruction. Our ML-EC performed a water-iodine material decomposition of the DE-CTC images and calculated virtual-monochromatic (VM) images at multiple energies for preparing radiomic image set, after which a machine-learning method [k-nearest neighbors (kNN), random forest (RF) and deep learning (DL)] was used to label the images into regions of lumen air, soft tissue, fecal tagging, and two types of partial-volume boundaries based on the features of these images. The EC was performed by removing materials other than soft tissues from the original CTC images. For pilot evaluation, 384 volumes of interest (VOIs) where current EC schemes generate typical EC artifacts (Type I: air-tagging boundary; Type II: three-material layer; Type III: three-material mixture) were extracted and labeled into a reference standard. The EC accuracy was evaluated by means of the mean overlap ratio (OR) between the reference standard labels and the labels generated by the ML-EC schemes.

RESULTS

In the DL-based ML-EC scheme, the mean \pm std of ORs for Types I, II, and III artifacts were 0.984 \pm 0.029, 0.932 \pm 0.046, and 0.958 \pm 0.021, respectively, which were higher than those of kNN-based ML-EC (0.975 \pm 0.035 [$p < .001$], 0.895 \pm 0.058 [$p < .001$], and 0.938 \pm 0.027 [$p < .001$], respectively), and RF-based ML-EC (0.982 \pm 0.032 [$p = .11$], 0.913 \pm 0.064 [$p < .001$], and 0.953 \pm 0.025 [$p < .001$], respectively). Visual assessment confirmed that the DL-based ML-EC generates less EC artifacts than do kNN- and RF-based ML-EC.

CONCLUSION

Our DL-based ML-EC scheme yields superior performance over kNN- and RF-based ML-EC schemes in identifying and minimizing subtraction artifacts on non-cathartic ultra-low-dose DE-CTC images.

CLINICAL RELEVANCE/APPLICATION

Current electronic cleansing methods for visualization of the colonic surface in CTC produce subtraction artifacts. The proposed method shows potential to minimize these artifacts and to facilitate non-cathartic examinations.

SSK17-09 Multivariate Modeling of Nodule Recognition in 3-D Chest CT using Gaze Tracking

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S404AB

Participants

Kingshuk Roychoudhury, Durham, NC (*Presenter*) Nothing to Disclose

Brian Harrawood, MS, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

Justus E. Roos, MD, Durham, NC (*Abstract Co-Author*) 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

Geoffrey D. Rubin, MD, Durham, NC (*Abstract Co-Author*) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company;

PURPOSE

Nodule detection in CT scans requires a large volume to be visually scanned for small objects. Recognition of potential nodules is a critical step towards detection. However the process of recognition is unknown, involving potential factors such as search strategy, size of the nodule and visible cross sectional area of the lung. Using gaze tracking data from chest CT reads, we developed a multivariate probabilistic model to elucidate the importance of these factors in the recognition process and the variation across readers with various levels of training.

METHOD AND MATERIALS

Gaze data was collected from 13 readers, ranging from 1st year residents to attending radiologists. Each reader examined 40 chest CTs, each embedded with 3-6 simulated nodules. Nodule recognition is modelled as a spatio-temporal Poisson process. The instantaneous probability of nodule recognition (IPR) was modelled as a linear combination of i) gaze distance from the nodule center at the moment of recognition (DG); ii) the visible cross-sectional (CS) size of the embedded nodules (nodule CS); iii) visible CS area of the lung (lung CS) using generalized Poisson regression. The linearity assumption was validated by considering a smooth (potentially non-linear) additive function of the variables.

RESULTS

The mean (SD) of 25th and 75th percentiles of DG were 1.71 (0.49) and 5.35 (1.30) cm respectively across readers. The IPR decreased approximately exponentially with increasing DG for all 13 readers ($P < 0.00001$), with a mean (SD) rate of decrease of 27.6% (8.8%) /cm across readers. The nodule CS effect was significant in 11/13 readers ($P < 0.005$) with a mean (SD) rate of increase in IPR of 8.6% (4.2%) /mm². The IPR decreased at a mean rate of 0.6% (0.2%) /cm² with increasing lung CS, with significant effects for 12/13 readers ($P < 0.001$).

CONCLUSION

Nodule recognition often occurs when the gaze is far from the target; the probability of recognition increases approximately exponentially with proximity. Factors like nodule size and lung cross section size also significantly impact recognition. Despite the variation in experience, the recognition process appears to be similar across readers.

CLINICAL RELEVANCE/APPLICATION

We have quantitatively characterized the process of nodule recognition during free search of 3-d chest CT scans. The insights from this characterization may lead to the development of CAD algorithms which work complementarily to the human recognition process.

SSK18

Radiation Oncology (Lung)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: S104A



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

Participants

Meng X. Welliver, MD, Columbus, OH (*Moderator*) Nothing to Disclose
Matthew M. Harkenrider, MD, Maywood, IL (*Moderator*) Nothing to Disclose

Sub-Events

SSK18-01 **A Comparison of Chemoradiotherapy Regimens used for Elderly Patients with Stage III Non-Small Cell Lung Cancer in the US**

Awards

Student Travel Stipend Award

Participants

Jeremy P. Harris, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Manali Patel, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Billy W. Loo JR, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research support, Varian Medical Systems, Inc; Research support, RaySearch Laboratories AB; Board Member, TibaRay, Inc
Heather Wakelee, MD, Stanford, CA (*Abstract Co-Author*) Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Eli Lilly and Company; Research Grant, Exelixis, Inc; Research Grant, Novartis AG; Research Grant, Pfizer Inc; Research Grant, Celgene Corporation; Research Grant, AstraZeneca PLC; Research Grant, Regeneron Pharmaceuticals, Inc; Research Grant, Clovis Oncology, Inc; Research Grant, Gilead Sciences, Inc; Research Grant, Xcovery; Research Grant, Bristol-Myers Squibb Company; Research Consultant, Peregrine Pharmaceuticals, Inc; Research Consultant, ACEA Biosciences, Inc; Research Consultant, Pfizer Inc; Research Consultant, Helsinn Healthcare SA;
Maximilian Diehn, MD, PhD, San Carlos, CA (*Abstract Co-Author*) Consultant, F. Hoffmann-La Roche Ltd; Consultant, QuanticeL Pharmaceuticals Inc; Research Grant, Varian Medical Systems, Inc

PURPOSE

The standard of care for patients with unresectable stage III non-small cell lung cancer (NSCLC) is definitive radiation with concurrent chemotherapy. For these patients, consolidation chemotherapy is frequently given, although several randomized trials have failed to show a benefit. We explored the association of consolidation chemotherapy with outcomes using a population-based comparative effectiveness approach.

METHOD AND MATERIALS

Surveillance, Epidemiology, and End Results (SEER)-Medicare was used to identify patients aged ≥ 65 , diagnosed 2002-2009, and treated with definitive radiation. We identified the various platinum-based doublet chemotherapy agents used. Chemoradiotherapy regimens were given as either sequential, concurrent only, concurrent with induction, or concurrent with consolidation. Outcomes were overall survival (OS) and cancer specific survival (CSS). Survival was estimated using the Kaplan-Meier method, with comparisons being made using log-rank tests, Cox proportional hazards models, and Royston-Parmar flexible parametric models.

RESULTS

2,006 patients were identified. Median OS was 18 months, with 1- and 2-year survival estimates of 68% (66-70%) and 39% (37-41%). The majority of patients (97%) received carboplatin-paclitaxel/docetaxel/gemcitabine/etoposide or cisplatin-etoposide. The use of consolidation chemotherapy was associated with improved OS and CSS compared to concurrent chemotherapy alone, with a multivariate adjusted OS HR of 0.82 ($p = 0.0098$) and CSS HR of 0.82 ($p = 0.03$). Propensity score adjusted analyses demonstrated similar results. In subset analyses, the benefit of consolidation chemotherapy was found only for patients treated with carboplatin-based doublets and not with cisplatin-etoposide.

CONCLUSION

For elderly patients in the US with NSCLC being treated with definitive concurrent chemoradiation, we found that patients receiving cisplatin during radiation do not appear to benefit from additional chemotherapy. However, for patients receiving carboplatin, consolidation chemotherapy appears to result in improved survival.

CLINICAL RELEVANCE/APPLICATION

For elderly patients with stage III non-small cell lung cancer treated with concurrent chemotherapy and radiation, additional consolidation chemotherapy should be given when carboplatin is used.

SSK18-02 **What are Recurrence Patterns in Patients with Malignant Pleural Mesothelioma Treated with IMRT after Lung-sparing Pleurectomy/Decortication?**

Wednesday, Nov. 30 10:40AM - 10:50AM Room: S104A

Participants

Micheal H. Raj, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Darragh Halpenny, MBCh, MRCPI, New York, NY (*Presenter*) Nothing to Disclose
Andreas Rimner, MD, New York, NY (*Abstract Co-Author*) Research Consultant, General Electric Company Research Consultant, Varian Medical Systems, Inc Research Grant, Varian Medical Systems, Inc
Michelle S. Ginsberg, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to assess patterns of recurrence in patients with malignant pleural mesothelioma (MPM) treated with hemithoracic pleural intensity-modulated radiation therapy (IMRT) after lung-sparing pleurectomy/decortication.

METHOD AND MATERIALS

The institutional review board approved this study. Consecutive patients with MPM treated with lung-sparing pleurectomy/decortication and IMRT between February 21, 2005 and December 1, 2015 were included. Only patients who had chest CTs pre and post IMRT were included and imaging was retrospectively reviewed by two radiologists in consensus. Features assessed included: presence or development of single or multiple pleural or parenchymal nodules or consolidation, focal or diffuse pleural thickening, pleural effusion, chest wall mass or peritoneal disease.

RESULTS

Fifty patients with MPM treated with lung-sparing pleurectomy/decortication and IMRT were included. The MPM subtypes on histology included: 41 epithelioid (82%), 2 sarcomatoid (4%), and 7 biphasic (14%). 25 patients (50%) had residual disease after surgery on the baseline CT prior to IMRT. 39 patients (78%) had recurrent disease on CT: 21 local, 13 distant and 5 local and distant. Of the 26 patients with local recurrence, the most common CT appearance of pleural recurrence were new/ increased focal mass or pleural thickening, nodular pleural thickening or multiple new pleural nodules. In the 25 patients without local recurrence, the most common appearance included stable or decreased pleural thickening or new/increased diffuse smooth pleural thickening. In the 18 patients with distal recurrence, the most common sites were in the lung parenchyma or peritoneum.

CONCLUSION

In patients with MPM treated with lung-sparing pleurectomy/decortication and IMRT local recurrence presented as new/increased focal pleural mass/thickening, diffuse nodular pleural thickening, or multiple pleural nodules. The most common sites for distant recurrence were lung parenchyma and peritoneum.

CLINICAL RELEVANCE/APPLICATION

Familiarity with the patterns of recurrence on CT in patients with MPM treated with IMRT is important in the follow up of these patients.

SSK18-03 Prognostic Potential of CBCT for Tracking Tumor Regression in Stage II-III Non-Small Cell Lung Cancer

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S104A

Awards

Student Travel Stipend Award

Participants

Kylie Kang, BS, Cleveland, OH (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): During external beam radiation therapy (EBRT) of lung cancer, cone beam computed tomography (CBCT) is routinely performed for image guidance. This study was conducted in order to determine the prognostic potential of CBCT for evaluating treatment outcome in terms of GTV reduction and to determine the difference of tumor reduction based on different histology. **Materials/Methods:** Forty-one NSCLC patients treated with definitive radiotherapy at one institution who received daily CBCT were randomly selected. Patients received mean EBRT of 60.7 Gy (range: 50-71.4 Gy) at 1.8 or 2 Gy per fraction. Initial mean gross tumor volume (GTV) was 197.3 cc (range: 3.4-1815.0 cc). Six sets of CBCT at an interval of one week were chosen, starting from the first fraction of treatment. The CBCTs were transferred to MIM Software (v.6.0) and single physician manually contoured the GTV on each slice. The change in GTV was recorded. Patient's clinical information was obtained from the institution electronic medical record. All statistical analysis was conducted on MedCalc (v.16.2). Univariate survival analysis was done using the Kaplan-Meier method with log-rank test. Median overall GTV reduction was used as a cutoff value (DGTVDGTV=45%). A univariate regression analysis was done to explore the correlation between histology and GTV reduction. **Results:** A consistent regression of GTVs was observed in 29 patients, while 12 patients experienced an increase of GTV at some point during their EBRT. Maximum reductions occurred during week 1 and 2 week of radiation, with mean % reductions of 13.5% and 12.6%, respectively. There was an overall GTV % reduction between weeks 1 to 6 in all 41 patients (median: 45%). The recurrence free survival (RFS) in our stratified group with DGTVDGTV=45% was 24.3 months (SE: 4.6) (p= 0.61). Overall survival (OS) for the group of patients with DGTVDGTV=45% (p= 0.21). There was a 6.6% greater overall GTV reduction in adenocarcinoma versus SCC on univariate regression analysis (p= 0.31). There was no statistical significance between histology and RFS (p=0.84) or OS (p=0.06). **Conclusion:** Large regression of GTV over the course of EBRT for stage II-III NSCLC patients was observed, however, no correlation was found with clinical outcome (RFS, OS). There was slightly higher GTV reduction in adenocarcinoma as compared to SCC, but no statistical significance. A future study with larger sample size involving multivariable analysis is warranted. **Variables** Mean/Median/CountSD/Range/%Median Age (y)6244-80Gender (#) Female/Male27/1465.9%/34.1Week 1 GTV (cc) Mean197.33.4-1815 Median68.93.4-1815Follow-Up (months) Median12.41.9-61.3

SSK18-05 Prognostic Value of Pretreatment PET Parameters in Stereotactic Ablative Radiotherapy (SABR) for Metastatic Non-Small Cell Lung Cancer

Wednesday, Nov. 30 11:10AM - 11:20AM Room: S104A

Awards

Trainee Research Prize - Resident

Participants

Alexander L. Chin, MD, MBA, Stanford, CA (*Presenter*) Nothing to Disclose

Kiran A. Kumar, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Henry Guo, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

Peter G. Maxim, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

Maximilian Diehn, MD, PhD, San Carlos, CA (*Abstract Co-Author*) Consultant, F. Hoffmann-La Roche Ltd; Consultant, Quanticele Pharmaceuticals Inc; Research Grant, Varian Medical Systems, Inc

Billy W. Loo JR, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research support, Varian Medical Systems, Inc; Research support, RaySearch Laboratories AB; Board Member, TibaRay, Inc
Michael Gensheimer, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Increasing interest exists in the use of stereotactic ablative radiotherapy (SABR) for treatment of patients with oligometastatic non-small cell lung cancer (NSCLC). Factors influencing outcomes after SABR for metastatic NSCLC are still unclear. We hypothesized that metabolic burden of disease on FDG PET at time of SABR can serve as a biomarker of survival outcome. **Materials/Methods:** Patients with metastatic NSCLC who received SABR, defined as total BED10 of =50 Gy delivered in =8 fractions, to one or more lesions were identified. All patients underwent FDG PET within 30 days prior to start of radiotherapy (RT). Patients with untreated brain metastases or who received either RT to the brain or non-SABR RT to any site within 2 weeks of SABR treatment were excluded from the analysis. Metabolic tumor volume (MTV) and total lesion glycolysis (TLG) were measured on pretreatment PET separately for treated and untreated lesions using a gradient-based method. Cox regression was used to assess the influence of imaging and clinical factors on overall survival (OS). **Results:** 59 treatment courses in 44 patients qualified for analysis, with median number of lesions treated of 1 (range 1 to 6) and median BED10 of 87.5 Gy (range 50.4 to 180 Gy). 66% (n=39) of treatment courses involved oligometastatic disease, defined as =5 total metastatic lesions. The most commonly treated sites were primary tumor (n=18), bone (n=17), and lung metastasis (n=14). With a median follow-up of 13.6 months, there were 4 local failures (7%). Median progression-free survival (PFS) and OS were 6.6 and 28.6 months, respectively. On univariate Cox regression, factors predictive of OS were MTV of untreated lesions (hazard ratio [HR] 1.024 for a 1 mL increase in MTV; p=0.003), TLG of untreated lesions (HR 1.003 for a 1 unit increase in TLG; p=0.008), MTV of all lesions (HR 1.012; p=0.02), and TLG of all lesions (HR 1.002; p=0.03). Three of the four factors (total MTV, untreated lesion MTV, and untreated lesion TLG) remained significant on multivariate regression controlling for age and performance status. MTV and TLG of treated lesions did not predict OS or PFS. Furthermore, the presence/absence of active untreated lesions was not a significant predictor of OS (p=0.755). **Conclusion:** In a cohort of metastatic NSCLC patients with primarily oligometastatic disease treated with SABR, metabolic tumor burden on FDG PET was predictive of overall survival after treatment. Pretreatment PET parameters may serve as a useful biomarker to select patients most suitable for aggressive local treatment with SABR.

SSK18-06 Long-term Outcomes of Stereotactic Body Radiotherapy for Stage I Non-small Cell Lung Cancer using Different Doses Depending on Tumor Size: Re-evaluation by Superposition-Comparable Dose Calculation Algorithms

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S104A

Participants

Fumiya Baba, MD, Nagoya, Japan (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): In stereotactic body radiotherapy (SBRT) for stage I non-small cell lung cancer (NSCLC), it was found that the outcomes of stage IB patients were worse than those of stage IA patients when treated with the same dose. We have performed SBRT since 2004 using different prescribed doses depending on tumor size. The clinical outcomes treated with our protocol are herein reported. In addition, radiation doses were re-evaluated by the algorithm comparable to the superposition method. **Materials/Methods:** Between February 2004 and November 2008, 124 patients with stage I NSCLC underwent SBRT; 87 had stage IA and 37 had stage IB disease. Total doses of 44, 48, and 52 Gy were administered to the isocenter for tumors with a longest diameter of 3 cm, respectively. All doses were delivered in 4 fractions twice a week. Pencil beam convolution with Batho power law correction (PBC-BPL) was used as the dose calculation algorithm. These plans were recalculated by anisotropic analytical algorithm (AAA) with the same monitor units. **Results:** The median follow-up period for living patients was 69 months (range: 24 to 124). For all 124 patients, overall survival (OS) was 55%, cause-specific survival (CSS) was 75%, progression-free survival (PFS) was 61%, and local control (LC) was 80%, at 5 years. The 5-year OS was 58% for 85 stage IA patients treated with 48 Gy and 49% for 37 stage IB patients treated with 52 Gy (p = 0.16). At 5 years, CSS was 76% versus 73% (p = 0.45), PFS was 60% versus 56% (p = 0.31), and LC was 83% versus 73% (p = 0.21). At 5 years, the cumulative incidence of grade 2 or 3 radiation pneumonitis (RP) was 15% for all patients; it was 9% in stage IA patients and 29% in stage IB patients (p=0.0086). Median doses to the isocenter recalculated using AAA were 47.58 Gy (range: 42.70-48.59) in 48 Gy prescription, and 51.54 Gy (range: 49.28-52.34) in 52 Gy prescription. Median PTV D95 doses of PBC-BPL plans were 45.79 Gy (range: 38.64-47.28) in 48 Gy prescription, and 49.35 Gy (range: 41.76-50.39) in 52 Gy prescription. Median recalculated PTV D95 doses of AAA plans were 42.00 Gy (range: 34.03-44.99), and 46.16 Gy (range: 40.64-48.71) in the two prescriptions, respectively. There were significant differences between PBC-BPL plans and AAA plans both in the isocenter dose and the PTV D95. **Conclusion:** In our protocol, there were no significant differences in OS, CSS, PFS and LC between stage IA and IB tumors despite the difference in tumor size. On the other hand, there was a significant difference in RP incidence. In the revised protocol, dose was prescribed at the PTV D95 using superposition-comparable dose calculation algorithms, taking these results into account.

SSK18-07 Image-Guided Hypofractionated Proton Therapy in the Management of Centrally Located Early Stage NSCLC

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S104A

Participants

Bradford Hoppe, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Stereotactic body radiotherapy (SBRT) has proven to be an excellent way to manage patients with small and peripheral early-stage non-small cell lung cancer (NSCLC). Unfortunately, concern exists regarding the management of early-stage centrally located NSCLC with SBRT because of reports of toxicity. We investigated outcomes from delivering hypofractionated proton therapy (PT) among patients with centrally located stage I NSCLC. **Materials/Methods:** From 2009 through 2015, 16 patients were treated for medically inoperable centrally located de novo (n=12) or relapsed (n=4) stage I NSCLC (IA, n=5; IB, n=11) with image-guided hypofractionated PT on an IRB-approved outcomes tracking protocol (median age, 69 years). Centrally located tumors were those within 2 cm of the proximal bronchial tree or heart. Patients underwent 4D CT simulation following fiducial marker placement and an iGTV was contoured per the 10 phases of the scan (median, 15.5 cc; range 6-56 cc). Initially, a 5-mm margin was added to make an ITV but was eliminated in 2014, followed by a 5-mm margin for the PTV (median, 78.5cc; range 32-211cc). Daily image-guidance was done using fiducial markers and double exposure of orthogonal kv imaging at the peaks of inspiration and expiration. Patients were all treated with 60 Gy(RBE) (6 Gy[RBE]/fraction x 10 fractions) utilizing pre-defined dose

constraints. Patients were evaluated by a physician and assessed for CTCAEv4 toxicities weekly during treatment, at 1 month after treatment, then every 3 months for 2 years, and then every 6 months until 5 years with a CT or PET/CT. Overall survival, progression-free survival, local control, regional control, and control of distant metastases were evaluated using the Kaplan-Meier method. Results: Median follow-up for the cohort was 44 months (range, 4-67). The 3-year progression-free survival and overall survival rates were 41% and 84%. The median progression-free and overall survival were 28 and 60 months. The 3-year local (ipsilateral lobe), regional, and distant control rates were 89%, 77%, and 74%. Four patients died with disease and 1 from complications of pneumonia 52 months after treatment. Seven patients developed a recurrence, including 5 distant, 3 regional, and 1 in the ipsilateral lobe at the edge of the treatment field. Five received salvage radiation for the recurrences using either SBRT (n=2) or standard fractionated proton therapy +/- chemo (n=3). Three have had no evidence of disease for >1.5 years. Within 6 months of treatment 6 patients (38%) experienced respiratory symptoms (cough, fatigue, shortness of breath) that resolved with antibiotics and/or a short course of steroids. One grade 3 toxicity occurred in a patient who developed a bronchial stricture (PTV, 211cc) requiring hospitalization and stent. Conclusion: Image-guided hypofractionated PT for centrally located stage I NSCLC provides promising local control and long-term survival with acceptable toxicity. Regional nodes and distant relapses remain a problem.

SSK18-08 The First Report to Evaluate Clinical Outcome of Dynamic Tumor-Tracking Stereotactic Body Radiotherapy for Early Stage Lung Cancer and Oligometastatic Lung Tumors Using a Gimbal-Mounted Linear Accelerator

Wednesday, Nov. 30 11:40AM - 11:50AM Room: S104A

Participants

Takamasa Mitsuyoshi, Kyoto, Japan (*Presenter*) Nothing to Disclose
Yukinori Matsuo, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Mitsuhiro Nakamura, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kenji Takayama, MD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaki Kokubo, MD, Kobe, Japan (*Abstract Co-Author*) Research Consultant, Mitsubishi Corporation
Takashi Mizowaki, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masahiro Hiraoka, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Recently, stereotactic body radiotherapy (SBRT) has developed as a new treatment modality for early stage lung cancer or oligometastatic lung tumor. When a lung tumor is treated with SBRT, the whole trajectory of a moving tumor is included in the irradiation field. It means healthy tissues are irradiated and leads to increase risks of toxicities. So, we hypothesized that dynamic tumor-tracking (DTT) SBRT using a gimbal-mounted linear accelerator could reduce irradiated volumes of healthy tissues and risks of toxicities without reducing tumor local control (LC) rate. This is the first reported study to evaluate clinical outcomes of DTT-SBRT using a gimbal-mounted linear accelerator. **Materials/Methods:** Eligibility criteria were as follows: (1) a single lung tumor with a diameter of 50 mm or less, (2) no metastasis, (3) respiratory tumor movement of 10 mm or more, (4) age of 20 years or above, (5) performance status (PS) of 0-2. Prior to the treatment, gold markers were placed under bronchoscopic guidance around the tumors as an internal surrogate for the tumor position. The tumors and markers were monitored with the kV imagers during irradiation in real-time. Out of 47 patients whom markers had been injected in, 29 patients (62%) were treated by DTT-SBRT successfully between September 2011 and April 2015 in Kyoto University Hospital or Institute of Biomedical Research and Innovation and had been enrolled in this study. The dose fraction schedule was 48 Gy/4 fr for clinical stage 1A lung cancer, and 56Gy Gy/4 fr for clinical stage 1B lung cancer and oligometastatic lung tumors. The prescribed dose was defined at the isocenter. The patients characteristics were as follows: median age, 78 years (range, 58-88); male/female: 22/7; PS 0/1/2: 9/16/4; primary lung cancer/oligometastatic lung tumor: 24/5; clinical stage T1a/T1b/T2a: 12/8/4 (UICC-7). Toxicity grading was scored using the Common Terminology Criteria for Adverse Events v.4.0. The survival rates were calculated using the Kaplan-Meier methods. **Results:** The median follow-up time was 23.4 months (range, 0.2-49.2). The 2-year overall survival (OS), progression free survival (PFS) and LC rate was 72%, 58% and 87%, respectively. Local recurrence developed in 4 patients and distant metastasis developed in 5 patients. At the time of analysis, 21 patients were alive and 8 patients had died. Out of living patients, 4 patients had recurrence. Out of dead patients, 4 patients died from progressive disease. Univariate analysis (log-rank test) could not help to identify the factor for worse OS or PFS. Grade 2 or worse toxicities were occurred in 2 patients (6.9%). One had Grade 2 radiation pneumonitis and the other had Grade 3 radiation pneumonitis. **Conclusion:** DTT-SBRT using a gimbal-mounted linear for patients with early stage lung cancer and oligometastatic lung tumors resulted in good LC with acceptable toxicities.

SSK18-09 Stereotactic Ablative Body Radiation (SABR) for Stage I Lung Cancer: A Retrospective Single Institution Report

Wednesday, Nov. 30 11:50AM - 12:00PM Room: S104A

Participants

Sarit Appel, ramat gan, Israel (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Stereotactic Ablative Radiation Therapy (SABR) is the new standard of care in medically inoperable stage I lung cancer and has been advocated for use as an alternative to surgery in patients with operable stage I lung cancer. Prior to beginning a pilot study for use of SBRT in operable stage I lung cancer, we reviewed and report local control, survival and toxicities of SABR in Stage I lung cancer in tertiary single institution since its introduction in 2009. **Materials/Methods:** A retrospective database analysis of stage I lung cancer treated with SBRT from 2009-2015. Database included: gender, age, histology, stage, radiation dose and fractionation and treatment dates. Survival status was confirmed from the national registry. Local failure was defined as increased FDG uptake on PET-CT scan within a 2 cm radius of the treated region. Survival and local control were dated from first day of radiation and censored at last visit or at event. Toxicity was graded according to common toxicity criteria adverse events (CTCAE) v. 4.03. Statistical methods used were Kaplan-Meier and Cox regression for survival analysis. **Results:** A total of 114 patients were treated for 122 stage I lung cancer lesions over the study period. Median follow up time was 27 months (range 8.2-69.5 months), median age was 76 (range 40-96). Stage IA was in 82% of the lesions, adenocarcinoma was in 45%, no biopsy was in 19.7%. The prescribed dose to encompass the PTV was 50 Gy/5fx in 68%, 54 Gy/3fx in 14.5% and 60Gy/8fx in 11.5%. The calculated BED was at least 100 Gy in 94.3% of treated lesions. Median survival was 46 months, estimated 3 years overall survival was 59% (95% CI 47-69%). For stage IA and IB, median survival was 51.3 and 41.4 months respectively (NS). Three years local control was 88% (95% CI 78-94%). On Cox regression, the survival and local control were not significantly affected by histology or fractionation. Toxicity was mild and included chest wall pain in 8.4% patients, rib fracture in 0.9%, grade 1-2 pneumonitis in 12%, grade 3 pneumonitis in 12% and grade 5 in 0.9%. Sixteen central lesions were treated with 8-10 fractions without occurrence of

airway necrosis or hemoptysis. Conclusion: SABR has been successfully implemented at our institution for the treatment of stage I lung cancer in inoperable patients with excellent local control, low toxicity and acceptable overall survival. A prospective study evaluating SBRT as an alternative to surgery in operable patients with stage I lung cancer will be proposed.

SSK19

Vascular Interventional (Chemoembolization and Radioembolization)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: E351



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

FDA Discussions may include off-label uses.

Participants

Juan C. Camacho, MD, Charleston, SC (*Moderator*) Nothing to Disclose
Ronald S. Arellano, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSK19-01 The Effect and Safety of Preoperative Hepatic and Regional Arterial Chemotherapy (PHRAC) for Stage II and III Colorectal Cancer-Multicenter Clinical Trial Results

Participants

Bo Zhou, Shanghai, China (*Presenter*) Nothing to Disclose
Zhiping Yan, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jianhua Wang, MD, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jianmin Xu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether preoperative hepatic and regional arterial chemotherapy is able to prevent liver metastasis and improve overall survival in patients receiving curative colorectal cancer resection.

METHOD AND MATERIALS

Patients in five medical centers with stage II or stage III colorectal cancer (CRC) were randomly assigned to receive preoperative hepatic and regional arterial chemotherapy (PHRAC group, n = 341) or surgery alone (control group, n = 347). The primary endpoint was disease-free survival (DFS), whereas secondary Outcomes include Cumulative incidence of liver metastasis (LM), overall survival (OS) and Safety. Clinical trial Number: NCT00643877.

RESULTS

There were no significant differences in baseline characteristics between PHRAC and Control groups. The 5y-DFS was 75% in PHRAC group vs 61% in control group (P<0.001). Three years liver metastasis (LM) was 7% in PHRAC group vs 15% in control (P<0.001). And 5-LM was 8% vs 18% (P<0.001). The 3y OS was 89% in PHRAC group and 79% in control, 5y OS was 81% vs 72%, HR 0.59 (95%CI 0.42-0.84,P=0.003). Subgroup analysis, 3y-DFS was 89% and 5y-DFS was 84% for patients with stage II CRC in PHRAC, while 3y-DFS was 80% and 5y-DFS was 74% in control, HR 0.64(95%CI 0.39-1.04,P=0.068). There was also no significant difference between the 2 groups in LM and OS for patients with stage II CRC. In stage III patients, 3y-DFS was 72% and 5y-DFS was 68% in PHRAC, while 3y-DFS was 62% and 5y-DFS was 51% in control, HR 0.62(95%CI 0.41-0.92,P=0.017). Three years LM was 9% and 5y-LM was 11% in PHRAC, while 3y-LM was 21% and 5y-LM was 25% in control, HR 0.37(95%CI 0.19-0.71,P=0.002). Three years OS was 86% and 5y-OS was 75% in PHRAC, while 3y-OS was 74% and 5y-OS was 64% in control, HR 0.57(95%CI 0.35-0.94,P=0.023). Toxicities, such as hepatic toxicity and leukocyte decreasing, were mild and could be cured with medicine.

CONCLUSION

Preoperative hepatic and regional arterial chemotherapy, in combination with surgical resection, could be able to reduce and delay the occurrence of liver metastasis and therefore improve survival rate in patients with stage III colorectal cancer.

CLINICAL RELEVANCE/APPLICATION

Preoperative hepatic and regional arterial chemotherapy, in combination with surgical resection, could be able to reduce and delay the occurrence of liver metastasis

SSK19-02 Initial Study of the Rheological Impact of a Balloon-occlusion Approach for Magnetic Resonance Navigation Liver Chemoembolization on 8 Pigs

Wednesday, Nov. 30 10:40AM - 10:50AM Room: E351

Participants

Alexandre Bigot, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Ning Li, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Maxime Gerard, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Francois Michaud, BSC, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Samuel Kadoury, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Gilles P. Soulez, MD, Montreal, QC (*Presenter*) Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Bracco Group Research Grant, Cook Group Incorporated Research Grant, Object Research Systems Inc
Sylvain Martel, Montreal, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic Resonance Navigation (MRN) is an interventional MRI technique which aims to navigate magnetic therapeutic beads using the imaging gradients of the scanner. Our targeted application is liver chemoembolization for hepatocellular carcinoma using an implantable port catheter system. We currently investigate a balloon-occlusion approach in order to greatly reduce the hepatic blood flow and the systolic-diastolic flow variation.

METHOD AND MATERIALS

We collected physiological and rheological data and evaluated the impact of a balloon catheter placed in the proper hepatic artery on eight pigs (mean weight \pm SD = 31.9 \pm 2.03 kg). Measurements were performed with an electromagnetic probe placed on the common hepatic artery for 4 pigs and with Doppler Ultrasound for 4 pigs. The experimental protocol was approved by the Institutional Animal Care and Use Committee of the Research Center of Centre Hospitalier de l'Universite de Montreal.

RESULTS

Average diameter of proper hepatic artery is 4.67 \pm 0.65 mm and average distance between the tip of the catheter and the first bifurcation is 17.6 \pm 8.48 mm. The average blood velocity in normal conditions is 40.5 \pm 26.5 cm/s and drops to 6.09 \pm 5.19 cm/s when the balloon is inflated. This represents a reduction of 84%. In addition, we found that the average systole-diastole range decreases from 48.2 \pm 31.8 cm/s to 11.5 \pm 12.5 cm/s with and without the inflated balloon respectively. These velocities under flow occlusion should be compatible with MRN of 250 μ m-diameter magnetic drug eluting beads with a magnetization of 60 emu/g and a propulsion gradient of 40 mT/m.

CONCLUSION

A balloon-occluded approach enables reduction the blood flow and elimination the pulsatile behavior of the blood in the liver. Future experiments will be focused on evaluating in vitro that the magnetic performance of the MRI and magnetic beads are sufficient to achieve balloon-occlusion MRN using a clinical MRI scanner.

CLINICAL RELEVANCE/APPLICATION

Magnetic Resonance Navigation has a great potential in the planning and treatment of HCC. Combining this technology with an implantable port catheter chamber could enable the development of less invasive chemoembolization treatments and therefore improve patient care.

SSK19-03 Does Stratified or Total Serum Bilirubin Predict Survival for Patients Undergoing Drug Eluting Bead Chemoembolization?

Wednesday, Nov. 30 10:50AM - 11:00AM Room: E351

Awards

Student Travel Stipend Award

Participants

Francis Kang, MD, Aurora, CO (*Presenter*) Nothing to Disclose

David T. Johnson, MD, PhD, Centennial, CO (*Abstract Co-Author*) Nothing to Disclose

Robert K. Ryu, MD, Chicago, IL (*Abstract Co-Author*) Consultant, Cook Group Incorporated Stockholder, EndoVention Inc Consultant, IORAD

PURPOSE

Increased total serum bilirubin has been commonly cited as an independent risk factor that affects overall survival in patients undergoing drug eluting bead transarterial chemoembolization (DEB-TACE) for hepatocellular carcinoma (HCC). This study aims to determine and compare overall survival rates based on stratification of total bilirubin levels in patients undergoing DEB-TACE for HCC.

METHOD AND MATERIALS

A retrospective cohort analysis was performed on all HCC patients who underwent DEB-TACE for HCC from November 2008-March 2015. The overall survival was stratified by total serum bilirubin groups (< 2.0, 2.0-2.4, 2.5-2.9, 3.0-3.4, 3.5-3.9, and > 3.9). The survival analysis was carried out comparing each group to a control group (total bilirubin < 2.0). Multivariable linear regression using a Cox model was used to evaluate the effect of various prognostic factors on overall survival. Survival distribution across all groups was compared using a Wilcoxon test.

RESULTS

407 patients underwent DEB-TACE for HCC in the time period assessed. The median overall survivals for the six total bilirubin groups were 48, 47, 81, 47, 32, and 77 months respectively. Survival distributions were compared amongst all groups using the Wilcoxon test; there was no significant difference (P = 0.527). The survival analysis showed an increase of 7.7%, decrease of 3.9%, increase of 48%, 54%, and decrease of 38% in mortality risk for total bilirubin groups 2.0-2.4, 2.5-2.9, 3.0-3.4, 3.5-3.9, and > 3.9 respectively. However, the results were not statistically significant (P > 0.05). The only prognostic factors which were independent predictors of overall survival ECOG performance status (HR 1.38, 95% CI 1.10-1.72, P = 0.005), AFP (HR 1.55, 95% CI 1.30-1.84, P < 0.000001), length of hospital stay after DEB-TACE (HR 1.24, 95% CI 1.10-1.41, P = 0.0007), and segmental or lobar treatment (HR 1.75, 95% CI 1.08-2.85, P = 0.023).

CONCLUSION

In this cohort, bilirubin was not predictive of poor outcome. In fact, there was a trend to increased survival in patients with the highest bilirubin. In this population, the total serum bilirubin alone was insufficient to predict survival or candidacy of patients with HCC for DEB-TACE.

CLINICAL RELEVANCE/APPLICATION

Elevated total bilirubin should not be a contraindication for patients undergoing DEB-TACE for HCC.

SSK19-04 Liver Transplant Outcomes after Locoregional Therapy for Hepatocellular Carcinoma: A Large Single-Center Experience

Wednesday, Nov. 30 11:00AM - 11:10AM Room: E351

Awards

Student Travel Stipend Award

Participants

Tyler J. Fraum, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Neeta Vachharajani, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Aaron Gould, MD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Min Xu, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Nael E. Saad, MBBCh, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Veran Medical Technologies, Inc; Proctor, Sirtex Medical Ltd
Kathryn J. Fowler, MD, Chesterfield, MO (*Abstract Co-Author*) Nothing to Disclose
William Chapman, MD, Saint Louis, MO (*Abstract Co-Author*) Founder, Pathfinder Therapeutics, Inc

PURPOSE

Locoregional therapy (LRT), such as transarterial chemoembolization (TACE), is a mainstay of managing hepatocellular carcinoma (HCC) in patients with cirrhosis. In such cases, LRT serves as a bridge to liver transplant (LT) by either maintaining tumor burden at acceptable levels or down-staging extensive disease to within the Milan criteria. The aim of this study was to evaluate the long-term survival of patients undergoing LT following LRT for HCC with respect to pre-transplant tumor burden and LRT-related variables.

METHOD AND MATERIALS

From 2000-2014, 258 adult patients with HCC pre-operatively treated with LRT underwent LT at our institution. For this retrospective analysis, we collected demographic information, LRT details, and post-LT clinical outcomes from our transplant database. These data were stratified according to whether each patient's HCC disease burden prior to LRT fell within the Milan criteria (WMC) or beyond the Milan criteria (BMC). Kaplan-Meier curves were generated for both groups for overall survival (OS), disease-free survival (DFS), and disease-specific survival (DSS). The log-rank test was used to evaluate for differences up to 10 years post-LT.

RESULTS

A total of 258 patients with 417 HCCs underwent 431 LRTs prior to LT. At presentation, 201 patients (78%) were classified as WMC. These patients underwent fewer LRTs prior to LT than BMC patients (1.5 v. 2.3, $p < 0.001$). The interval between first LRT and LT was longer for BMC patients (276 v. 171 days, $p < 0.001$). A higher percentage of BMC patients had imaging evidence of post-LRT disease progression (28 v. 14%, $p = 0.01$) at some point prior to LT. 257 patients (99.6%) satisfied Milan criteria by the time of LT. There was no significant difference between WMC and BMC patients with respect to OS ($p = 0.20$), DSS ($p = 0.42$), or DFS ($p = 0.13$).

CONCLUSION

BMC patients required more LRTs and were more likely to progress following LRT than WMC patients. As a result, BMC patients generally waited longer for LT. Once BMC patients were sufficiently down-staged and underwent LT, there were no significant survival differences between the WMC and BMC groups. To our knowledge, this analysis constitutes the largest single-center outcomes study of HCC patients treated with LRT before LT.

CLINICAL RELEVANCE/APPLICATION

Patients presenting with HCC exceeding the Milan criteria require longer and/or more extensive pre-transplant therapy but have similar post-transplant outcomes.

SSK19-05 Prediction of Early Response to Transpulmonary Chemoembolization and Transarterial Chemoperfusion in the Interventional Treatment of Unresectable Primary and Secondary Lung Cancer by Using Diffusion-Weighted MR Imaging: Preliminary Experience

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E351

Awards

Student Travel Stipend Award

Participants

Iliana Bednarova, MD, Udine, Italy (*Presenter*) Nothing to Disclose
Andrei Roman, Cluj-Napoca, Romania (*Abstract Co-Author*) Nothing to Disclose
Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Chiara Zuiani, MD, Udine, Italy (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether the change of apparent diffusion coefficient (ADC) value after transpulmonary chemoembolization (TPCE) or transarterial chemoperfusion (TACP) in a palliative intention could predict the early response in unresectable lung cancer and lung metastases.

METHOD AND MATERIALS

- From January 2012 to February 2016, 295 patients (138 males/157 females) were treated with TPCE or TACP session in 4-week intervals. Finally, 11 patients (mean age: 58.8; age range 24-75) with primary lung tumor (bronchial carcinoma, n=4) and lung metastases from different primaries (breast cancer, n=2; thyroid cancer, n=1; renal cellular cancer, n=1; colorectal carcinoma, n=1; esophageal cancer, n=1; carcinoid, n=1) underwent chest MR imaging (1.5 Tesla) including DWI before and after the first treatment with TPCE or TACP.- DWI and ADC maps were acquired using b-values of 0 and 800 s/mm² and the tumor's mean ADC value was calculated and compared in a 4-weeks interval.- The grouping reference was based on serial CT scans according to Response Evaluation Criteria in Solid Tumors (RECIST, version 1.1).

RESULTS

- All patients tolerated well the treatment and had no major complications.- According to the follow-up imaging data 3 patients presented a partial response (PR) and 8 patients a stable disease (SD). No patient belonged to complete response or progressive disease group. - The pretherapy ADC values had no significant difference between the PR group [(0.97±0.18) x 10⁽⁻³⁾ mm⁽²⁾/s] and SD group [(0.88±0.27) x 10⁽⁻³⁾ mm⁽²⁾/s] ($p > 0.05$). The change of ADC value was statistically significantly higher in PR group

$[(0.63 \pm 0.17) \times 10^{-3} \text{ mm}^2/\text{s}]$ compared with that in SD group $[(0.19 \pm 0.15) \times 10^{-3} \text{ mm}^2/\text{s}]$ ($p < 0.05$).

CONCLUSION

- From our preliminary results, the changes in ADC value were significant between the PR and SD group. - Noninvasive DWI could be potentially used to early predict and monitor unresectable primary and secondary lung cancer response to transpulmonary chemoembolization and transarterial chemoperfusion.

CLINICAL RELEVANCE/APPLICATION

The change of ADC value might have the potential to monitor and predict the treatment response of transpulmonary chemoembolization and transarterial chemoperfusion in patients with unresectable primary and secondary lung cancer.

SSK19-06 Prospective Trial Using Internal Pair-production Positron-emission Tomography (PET) after Radioembolization to Determine the Optimal Yttrium-90 (90Y) Dose for Objective Response of Hepatic Tumors

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E351

Awards

Student Travel Stipend Award

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
Wayne L. Monsky, MD, PhD, Sacramento, CA (*Abstract Co-Author*) Research Consultant, NexGen Medical Systems, Inc
Sharon W. Kwan, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Ann E. Wilson, MS, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
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 provide a quantitative assessment of radiation dose delivered to intrahepatic tumors after radioembolization. This study prospectively assessed the required threshold dose for effective radioembolization of liver tumors.

METHOD AND MATERIALS

A single-arm prospective trial was performed at a single institution under IRB approval. Thirty-five patients with unresectable hepatocellular carcinoma (HCC) or non-HCC intrahepatic malignancies were recruited. Inclusion criteria were: ECOG performance status 0–2, Childs-Pugh A or B, and receiving first 90Y radioembolization treatment as part of routine clinical care. Time-of-flight PET imaging without additional tracer administration was performed the same day after 90Y treatment. Volumetric analysis of the tumors was performed using a proprietary software and radiation dose calculated for each tumor. Radiographic best response was assessed on follow-up imaging.

RESULTS

A total of 52 hepatic tumors (38 HCC, 14 non-HCC) were treated with median follow-up of 684 days. Median tumor size was 5.5 cm (range 2.8–17.9). Most treatments were performed via lobar hepatic artery infusion (76%) using glass microspheres (94%). HCC treatments showed 84% objective response (OR), 11% stable disease (SD), and 5% progressive disease (PD) based on best mRECIST response. Responders had a higher mean 90Y dose to tumor than non-responders (261Gy vs 104Gy, $p < 0.01$). All non-responders had tumor dose < 200 Gy. No statistical difference was found between responders and non-responders for patient age, tumor volume, multifocal or extrahepatic disease, portal vein invasion, or injected 90Y activity. Treatment of non-HCC tumors showed 14% OR, 29% SD, and 57% PD based on best response RECIST 1.1. There was no significant difference in mean dose between responders and non-responders. No difference was found between the two groups for multifocal disease or injected 90Y activity.

CONCLUSION

HCC responders had a statistically greater mean tumor dose of 261Gy compared to 104Gy in non-responders. Delivered tumor dose significantly impacts treatment response in HCC, and can be assessed by PET.

CLINICAL RELEVANCE/APPLICATION

90Y-PET tumor dosimetry permits immediate assessment of HCC treatment adequacy after radioembolization, and may predict tumor response.

SSK19-07 Same Day Y90 Radioembolization: An Effective Treatment Model

Wednesday, Nov. 30 11:30AM - 11:40AM Room: E351

Participants

Ahmed Gabr, MD, MBCh, Chicago, IL (*Presenter*) Nothing to Disclose
Joseph R. Kallini, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Vanessa L. Gates, MS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ryan Hickey, MD, Chicago, IL (*Abstract Co-Author*) Advisor, BTG International Ltd
Nadine Abouchaleh, BA, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Kush R. Desai, MD, Chicago, IL (*Abstract Co-Author*) Speakers Bureau, Cook Group Incorporated; Consultant, Cook Group Incorporated
Bartley G. Thornburg, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Robert J. Lewandowski, MD, Chicago, IL (*Abstract Co-Author*) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc
Riad Salem, MD, MBA, Chicago, IL (*Abstract Co-Author*) Research Consultant, BTG International Ltd Research Grant, BTG

PURPOSE

To assess the feasibility of conducting pretreatment mesenteric angiography, coil embolization, technetium-99m macroaggregated albumin (99mTc-MAA) scanning, and yttrium-90 (Y90) radioembolization treatment in a single, same-day, combined outpatient encounter.

METHOD AND MATERIALS

78 patients from 2008 to 2015 were managed in a single outpatient encounter under the guidance of interventional radiology and nuclear medicine. Pretreatment planning was performed by reviewing baseline imaging and tumoral region of interest (ROI) was estimated by 3-D software; pre-treatment Y90 glass microsphere dosimetry was performed assuming a lung shunt of 10% for hepatocellular carcinoma (HCC) and 5% for liver metastases. Subsequently, mesenteric angiography and 99mTc-MAA scanning were performed followed by Y90 treatment in one outpatient encounter. Total in-room procedure time was recorded.

RESULTS

All patients underwent same-day pretreatment angiography, 99mTc-MAA and Y90 radioembolization. 16 patients received multiple segmental treatments to both lobes, 44 received right lobe treatment, and 18 received left lobe treatment. Median dose was 106 Gy. Median number of glass Y90 vials needed for complete treatment was 2 (1-6 vials). Median in-room time was 160 minutes (75-250 minutes). 18% (14/78) of patients were local residents, 55% (43/78) traveled from outside city limits, 18% (14/78) were from out-of-state, and 9% (7/78) were international. 77% (61/78) of patients treated presented with HCC, 22% (17/78) with liver metastases. Median lung dose was 3.5 Gy.

CONCLUSION

This study demonstrates the feasibility of same-day Y90 evaluation and treatment while maintaining the principles of safe and effective Y90 infusion including tumoricidal dosimetry, mitigation of non-target flow, and minimization of lung dose.

CLINICAL RELEVANCE/APPLICATION

We propose that same-day treatment paradigm to be considered for patients receiving radioembolization in selected cases. Indications include distant residence, elderly patients, contrast allergy, renal impairment, small/limited disease and absence of portal vein invasion. Convenience for patients is an important consideration as this approach is adopted in the future. Finally, we believe a room time averaging just over 2.5 hours makes this approach feasible and should translate into significant cost and time savings.

SSK19-08 Early Response Detected by DWI Predicts Survival of Patients Undergoing Y90-Radioembolisation for Hepatic Metastases

Wednesday, Nov. 30 11:40AM - 11:50AM Room: E351

Participants

Alexandra Barabasch, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
Alexander Ciritsis, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander Heinzl, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils A. Kraemer, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Y90-Radioembolisation (RE) is a valuable treatment option for otherwise therapy-refractory liver malignancies. DWI has been shown to be helpful to assess response of liver metastases as early as 4 to 6 weeks after lobar treatment. Aim of this study was to evaluate whether change of lesion ADC early after treatment (within 6 weeks) can help predict patients' overall survival.

METHOD AND MATERIALS

Between May 2010 and April 2014, 41 consecutive patients (28 female, mean age 60 ± 10 years) underwent DW-MRI with $b = 0, 50, \text{ and } 800$ at 1.5T within 6 weeks before and 6 weeks after lobar RE to treat secondary progressive liver metastases from solid cancers (21 colorectal, 16 breast, 4 other). Three target lesions per patient were assessed according to RECIST, and change of minimal ADC (ADC_{min}) was measured, with an increase of ADC_{min} by at least 30% regarded as indicating response. Patient survival was assessed by long-term follow-up. Comparison analysis was performed by the logrank test.

RESULTS

38/41 patients were followed until their death. Two patients (one with colorectal, the other with breast cancer) treated 1765 and 761 weeks ago, are still alive. One patient was lost after 13 weeks of follow-up. Overall median survival was 69 ± 67 weeks. An ADC increase by 30% or more (i.e., response) was observed in 27/41 patients (66%). Median survival in this "DWI-responder" group was 86 ± 74 weeks, compared to 35 ± 43 weeks in the "DWI-non-responder" group ($p < 0.05$). Based on RECIST analysis, metastases in 4/41 (10%) patients were categorized as progressive (PD), in another 4/41 as partial response (PR), and in 33/41 (80%) as stable (SD). Median survival was 64 ± 57 weeks in the PD-group, 67 ± 68 weeks in the SD group, and 87 ± 87 weeks in PR-group ($p > 0.05$).

CONCLUSION

Patients who, at 4 to 6 weeks after Y-90-RE treatment, exhibit response on DWI, can expect significantly longer overall survival than patients without such response. No such correlation was observed for tumor size changes according to RECIST.

CLINICAL RELEVANCE/APPLICATION

DW-MRI can be used to predict overall survival after RE of patients with liver metastases.

SSK19-09 Dynamic 4D-CT Angiography of the Abdomen for Guiding TACE: Impact on Reduction of Contrast Material, Operator Radiation Exposure, Catheter Consumption and Diagnostic Confidence

Wednesday, Nov. 30 11:50AM - 12:00PM Room: E351

Awards

Student Travel Stipend Award

Participants

Moritz H. Albrecht, MD, Charleston, SC (*Presenter*) Nothing to Disclose

Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

Julian L. Wichmann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

Stefan Zangos, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; Consultant, Guerbet SA; ; ;

Carlo N. De Cecco, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

Thomas Lehnert, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

Sebastian Fischer, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

Andreas Bucher, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

Martin Beeres, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

Ralf W. Bauer, MD, Frankfurt, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens Healthcare GmbH; Speakers Bureau, Bayer Healthcare; Speakers Bureau, GE Healthcare

Christian Tesche, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the impact of 4D computed tomography angiography (4D-CTA) prior to transarterial chemoembolization (TACE) regarding administered contrast media, operator radiation exposure, catheter consumption, and diagnostic confidence.

METHOD AND MATERIALS

4D-CTA examinations prior to initial TACE of 29 patients (20 men; mean age, 65.7±11.5 years) with malignant liver tumors were analyzed. Multiplanar-reformat (MPR), volume-rendering-technique (VRT) and maximum-intensity-projection (MIP) series were reconstructed enabling a direct selective catheterization of the tumor-supplying artery without prior conventional digital subtraction angiography (DSA) of the abdominal aorta, coeliac trunk, superior mesenteric artery, and indirect portography. Twenty-nine patients who underwent traditional TACE served as the control group. The amount of administered contrast media, operator radiation exposure, and catheter consumption was compared between the different TACE workflows. Diagnostic confidence in the exclusion of portal vein thrombosis was assessed by two radiologists using 5-point Likert scales.

RESULTS

4D-CTA TACE resulted in a significant overall contrast media reduction of 12.8 ml (-13.8 %, $p<0.001$) and 61.0 ml less contrast were administered intra-arterially (-66.3%, $p<0.001$) compared to traditional TACE. Scattered radiation could be reduced by 50.5% for 4D-CTA compared to standard TACE ($p<0.001$). 4D-CTA TACE was performed using 0.7 less catheters on average ($p=0.063$). Diagnostic confidence in the exclusion of portal vein thrombosis could be significantly increased using 4D-CTA compared to traditional DSA images (scores, 3.9 and 2.4, respectively; $p<0.001$).

CONCLUSION

4D-CTA enables TACE with substantially reduced amount of contrast material, decreases operator radiation exposure, and increases diagnostic confidence in the exclusion of portal vein thrombosis.

CLINICAL RELEVANCE/APPLICATION

4D-CTA prior to TACE can reduce the intra-arterial amount of utilized contrast material by two-thirds. Thus, this technique may decrease the risk of CIN and enable TACE for patients with renal impairment, while 4D-CTA portography allows for a higher diagnostic confidence than conventional DSA images.

SSK20

Vascular Interventional (CTA)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: N227B



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

Participants

Dominik Fleischmann, MD, Palo Alto, CA (*Moderator*) Research support, Siemens AG;
Daniel L. Cooke, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events

SSK20-01 Carotid Tortuosity Index is Associated with the Need for Early Aortic Root Replacement in Patients with Loeys-Dietz Syndrome

Participants

Linda C. Chu, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Reham R. Haroun, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Robert Beaulieu, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
James H. Black III, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Harry Dietz, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Elliot K. Fishman, MD, Baltimore, MD (*Abstract Co-Author*) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company;

PURPOSE

Loeys-Dietz syndrome (LDS) is an autosomal dominant connective tissue disorder characterized by aortic root aneurysm, dissection, arterial tortuosity, and characteristic craniofacial manifestations. Purposes of this study are to quantify carotid arterial tortuosity in patients with LDS and to determine if increased carotid arterial tortuosity is associated with the need for early aortic root replacement.

METHOD AND MATERIALS

This is an IRB approved retrospective study. Patients with LDS who underwent baseline CTA of the neck, chest, abdomen, and pelvis between January 2005 and December 2013 were identified from a prospectively maintained database. CTA were post-processed on 3D workstation with vessel trace function (InSpace, Siemens) to measure centerline vessel length of bilateral carotid artery length, beginning from bilateral common carotid artery origins to the termination of bilateral cervical internal carotid arteries at the petrous bone. Straight distance length was measured on the coronal plane using the same anatomic landmarks. Carotid artery tortuosity index (CATI) was calculated by ratio of centerline right and left carotid artery length divided by straight distance length. The age of patients when they underwent aortic root replacement was determined from the medical records. Relationship between CATI and freedom from aortic root replacement was evaluated with Kaplan-Meier plot. Receiver operating characteristic (ROC) curve analysis was performed for CATI and aortic root replacement by age 10.

RESULTS

54 LDS patients (22 men, 32 women) underwent baseline CTA. Mean CATI was 1.49 ± 0.31 . 35 of the 54 patients underwent aortic root replacement. Mean age of aortic root replacement was 17.9 ± 14.2 years. Using CATI threshold of 1.50, Kaplan-Meier plot showed significant difference in freedom from aortic root replacement (log-rank test $p < 0.001$). ROC area under the curve between CATI and need for aortic root replacement by age 10 was 0.891, $p < 0.001$.

CONCLUSION

Carotid artery tortuosity can be quantified with carotid artery tortuosity index in patients with LDS. Increased CATI is associated with the need for early aortic root replacement in patients with LDS.

CLINICAL RELEVANCE/APPLICATION

Carotid artery tortuosity index can be used as an imaging biomarker to risk stratify LDS patients who may require early aortic root replacement.

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

SSK20-02 Impact of Multidetector CT-Angiography on the Emergency Management of Severe Hemoptysis

Wednesday, Nov. 30 10:40AM - 10:50AM Room: N227B

Participants

Zhiwei Wang, MD, Beijing, China (*Presenter*) Nothing to Disclose
Zheng Yu Jin, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Multidetector CT-angiography (MDCTA) is commonly used in patients with severe hemoptysis requiring admission to emergency room. The purpose of our study was to retrospectively assess the characteristics of bronchial artery (BA) using MDCTA and evaluate the role of MDCTA for management of severe hemoptysis requiring admission to emergency room.

METHOD AND MATERIALS

We retrospectively studied 117 patients with severe hemoptysis (either ≥ 300 mL of expectorated blood over a 24 hour period or bleeding at a rate ≥ 100 mL/hour) requiring admission to emergency room from Jan 1, 2013 to Dec 31, 2015 in our hospital. 108 patients underwent MDCTA scan examinations. Patients' clinical characteristics, imaging of MDCTA, treatment modalities, morbidity, and follow-up data were analyzed.

RESULTS

The group of 108 patients included 71 men and 37 women, with a mean age of 55.3 years. Etiology was mainly bronchiectasis (44%), tuberculosis sequelae (26%) and tumor (18%). MDCTA enabled visualization 197 traceable BAs and also suggested the involvement of 35 nonbronchial systemic arteries. The mean diameter of BAs which was measured at the level of the bronchial bifurcation in the mediastinum was 2.8mm. 52 patients (Group 1) recover after only conservative treatment and 56 patients (Group 2) persistent hemoptysis that was resistant to conservative treatment received BAE. The mean diameter of BAs (2.9mm) in Group 2 was not significant larger than that (2.7mm) in Group 1 ($p > 0.05$). MDCTA detected all origin sites of BAs and 20 nonbronchial systemic arteries for patients in Group 2, so BAs and nonbronchial systemic arteries angiography during BAE were successful for these patients. Systemic artery-pulmonary artery fistulas were found in 54 patients during angiography. The technical success rate of embolization was 95% (53/56). Clinical success rate within one months after BAE was achieved in 50 (94%) of 53 patients who underwent embolization.

CONCLUSION

MDCTA provides useful information for identifying the anatomical characteristics of bleeding-related BAs and nonbronchial systemic arteries in patients with severe haemoptysis. However, MDCTA could not select which patient needed BAE by measurement diameter of BAs.

CLINICAL RELEVANCE/APPLICATION

MDCTA should be the first-line procedure performed in emergency clinical setting to make it easier to perform BAE, but MDCTA could not predict the treatment choice for patients with severe haemoptysis.

SSK20-03 Dynamic Imaging by ECG-gated CTA for Assessing Landing Zone in Aortic Aneurysm and Type B Dissection

Wednesday, Nov. 30 10:50AM - 11:00AM Room: N227B

Participants
sanjeev kumar, MBBS,MD, DELHI, India (*Presenter*) Nothing to Disclose

PURPOSE

To assess dynamic changes in proximal landing zones (PLZ) in aortic aneurysm or type B dissection patients and to correlate these changes with age and atherosclerotic changes.

METHOD AND MATERIALS

56 patients underwent retrospective gated CTA (Definition, Siemens). Group 1 (n= 28) included patients with aortic aneurysm or type B dissection, Group 2 (n= 28) included patients undergoing gated-CTA for other indications. Measurements were made at PLZ in Group 1 and 1 cm proximal to innominate artery, mid arch, 1 cm distal to left subclavian artery in Group 2. Aortic pulsatility (AP) was calculated as percent change between systolic and diastolic diameters. Two measurements were made in each phase corresponding to largest and smallest dimensions. These were averaged. Vessel wall characteristics (thickening, calcification) and patient age were recorded.

RESULTS

Mean diameter change in Group 1 and Group 2 were 4.8 and 6.2 % respectively (maximum 23%). No significant difference in aortic pulsatility (AP) was seen between dissection and aneurysm, and in different locations in aorta. AP was decreased with advancing age with statistically significant negative correlation. There was significant difference in AP with increasing atherosclerotic

CONCLUSION

ECG-gated CTA is useful to assess aortic pulsatility (AP). Young age and absence of atherosclerosis correlate with high AP. Measurement of AP will optimize device selection for Endovascular Repair (EVR).

CLINICAL RELEVANCE/APPLICATION

Aorta exhibits diameter changes (aortic pulsatility or AP) during different phases of cardiac cycle. Age and atherosclerotic changes may influence AP. These may have implications for appropriate device selection for endovascular repair (EVR).

SSK20-04 Iterative Reconstruction in a Single Source Dual-Energy CT Angiography: Feasibility Study on Application of Low and Ultra-Low Columes Contrast Medium at Aortic CTA

Wednesday, Nov. 30 11:00AM - 11:10AM Room: N227B

Participants
Ping Hou, MD, Zhengzhou, China (*Presenter*) Nothing to Disclose
Xiang-Nan Feng, MS, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Jianbo Gao, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jie Liu, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yaojun Jiang, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the feasibility of using contrast medium (CM) of low and ultra-low volumes and injection rates at aortic CT angiography (CTA) through the joint application of single source dual-energy CT and ASIR

METHOD AND MATERIALS

One hundred and twenty patients underwent aortic CTA were equally divided into three groups. Conventional 120 kVp scan with CM volume 70 ml and injection rate 5ml/s was performed on group A (n = 40). Groups B (n = 40) and C (n = 40) underwent spectral CT scan in gemstone spectral imaging mode with CM volumes 0.6ml/kg and 0.4ml/kg, respectively. For both groups B and C, CM injection rates were adaptively determined by CM volume/(delay time + exposure time). 40% and 50% ASIR algorithms were applied for groups B and C, respectively. A 5-point grading scheme was utilized by two independent experts to subjectively evaluate the image quality, and CT values and Contrast-to-noise (CNR) ratios were recorded as objective measures. Radiation doses were acquired and compared. Diagnostic accuracy for vascular lumen and display rates of aortic dissection tears were also evaluated.

RESULTS

Experts exhibited good agreement on their aortic image quality scores ($k=0.627$). Groups B and C had equivalent subjective image quality scores and CT values as group A. Group B had significantly higher CNRs than group A and group C in all aortic regions of interest ($p < 0.001$). Group C had higher ($p < 0.05$) or equivalent ($p > 0.05$) CNRs, compared with the conventional group A. The low CM volume group B (volume: 41.9 ± 6.3 ml, injection rate: 3.5 ± 0.4 ml/s) had 42.8% and 31.6% reductions on CM volume and injection rate, respectively, compared with the conventional group A. While group C (volume: 28.5 ± 4.7 ml, injection rate: 2.4 ± 0.3 ml/s) further resulted in 16.2% and 19% less CM volume and injection rate than group B ($p < 0.001$). CTA diagnostic accuracy for vascular lumen was 100% for each group, and the display rates of aortic dissection tears were close among three groups (93.7% , 91.2% and 93.3%, respectively).

CONCLUSION

With the aid of ASIR and spectral CT for aortic CTA, it is feasible to adopt low and ultra-low CM volumes and injection rates to obtain good quality monochromatic images

CLINICAL RELEVANCE/APPLICATION

Monochromatic images of low keV in spectral aortic CTA can minimize the amount of contrast agent and injection rate but without sacrifice image quality.

SSK20-05 Image Quality and Radiation Dose of Hybrid ECG-gated CT versus Non-ECG-Gated CT of the Aorta: Prospective Study using the Wide-detector CT Scanner

Wednesday, Nov. 30 11:10AM - 11:20AM Room: N227B

Participants

Yeon Joo Jeong, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Ji Won Lee, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose

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

PURPOSE

To compare hybrid ECG-gated and non-gated CT angiography of the aorta with regard to image quality and radiation dose.

METHOD AND MATERIALS

Eighty consecutive patients prospectively randomized into two groups (Group 1, hybrid ECG-gated CT group; Group 2, non-gated CT group) underwent the wide-detector array aortic CT angiography (Revolution CT, GE healthcare), due to several pathologies of the aorta. Mean heart rate (HR) was measured during scan acquisition. Motion artifact (MA) was assessed using a four-point scale. Mean enhancement was calculated by average the density at five different levels of aorta. Contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR) and the dose-length-product (DLP) of each examination was evaluated.

RESULTS

There was no significant difference between the two groups in regard to body mass index and mean HR. Scan duration was shorter in group 1 (15.2 ± 0.4 s) compared with group 2 ($p < 0.001$, 17.4 ± 1.1 s), although scan range was similar. Hybrid ECG-gating showed statistically significant advantages over non-gated CT angiography, with regard to MA at the cardiac chamber, aortic valve, origin of the coronary arteries, main coronary arteries and the aortic wall. Coronary arteries can be assessed in about 85% of patient in group 1. However, mean enhancement, CNR and SNR was not significantly different between the two groups. DLP of group 1 (264.7 ± 52.6 mGy·cm) did not differ significantly ($p = 0.051$) from that of group 2 (246.7 ± 98.9 mGy·cm).

CONCLUSION

Hybrid ECG-gated CT angiography of the entire aorta reduces MA and scan duration with the same CNR and SNR, compared to non-gated CT angiography at the same radiation dose.

CLINICAL RELEVANCE/APPLICATION

Hybrid ECG-gated CT of the aorta provides improved image quality of the aortic root, where pulsating artifacts are common and likely to mimic dissection. Furthermore, this technique may be useful to in the diagnosis of unsuspected cardiac abnormalities without additional radiation exposure.

SSK20-06 320-Slice CT Renal Perfusion Imaging in Patients with Aortic Dissection: A Preliminary Study

Wednesday, Nov. 30 11:20AM - 11:30AM Room: N227B

Participants

Dongting Liu, Beijing, China (*Presenter*) Nothing to Disclose

Zhanming Fan, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the clinical value of renal perfusion imaging in patients with aortic dissection (AD) using 320-slice computed tomography (CT), and to determine the relationship between renal CT perfusion imaging and various factors of aortic dissection.

METHOD AND MATERIALS

43 patients with AD confirmed by ultrasound diagnosis who underwent 320-slice CT renal perfusion before operation were prospectively enrolled in this study. Blood flow (BF) values of bilateral renal perfusion were measured and analyzed. CT perfusion imaging signs of AD in relation to the type of AD, number of entry tears and the false lumen thrombus were observed.

RESULTS

The BF value of patients with type A AD was significantly lower than those of patients with type B dissection ($P < 0.05$). No significant difference was found in the BF between different number of intimal tears ($P > 0.05$). The BF value was significantly higher in cases with the false lumen without thrombus and renal arteries arising from the true lumen than that of with thrombus ($P < 0.05$). The BF values measured between the true lumen, false lumen and overriding groups were different significantly ($p < 0.05$). The larger the size of intimal entry tears, the greater the BF values ($P < 0.05$).

CONCLUSION

This study shows a direct correlation between renal CT perfusion changes and AD, with size, number and location of intimal tears, false lumen thrombosis significantly affecting the perfusion values.

CLINICAL RELEVANCE/APPLICATION

Aortic dissection (AD) is the most frequent cause of aortic emergency. This study shows that CT has brought us an unprecedented improvement in renal perfusion and provided important information about whole kidney blood perfusion in aortic dissection patients. It can guide intraoperative and postoperative treatments, which has important clinical significance.

SSK20-07 Image Quality Evaluation between 4D CTA and Standard CTA of the Lower Leg Patients with Peripheral Arterial Occlusive Disease

Wednesday, Nov. 30 11:30AM - 11:40AM Room: N227B

Participants

Da-Ming Zhang, MD, Beijing, China (*Presenter*) Nothing to Disclose
Huadan Xue, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zheng Yu Jin, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yan-Ting Xie, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xuan Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to assess the image quality of dynamic computed tomographic angiography (dyn-CTA) in patients with lower leg ischemia.

METHOD AND MATERIALS

A population of 20 patients with known peripheral arterial occlusive disease was examined with a combined CTA protocol consisting of a standard CTA (s-CTA) of the lower leg runoff from the diaphragm to the toes and dynamic CTA (dyn-CTA) of the calves (scan range, 45 cm; 8 phases; 3.5 seconds per phase; 70 kVp; 80 mAs; contrast volume, 30 mL, saline water, 50ml, 4.0 mL/s). The premonitory position was 15cm above the superior border of the scan range of the dyn-CTA, and the scan was manually started as soon as the arteries were enhanced at the premonitory position. The scan protocol of s-CTA was intravenous administration of 50 mL of Iopromide (370 mgI/ml, 30ml with flow rate of 3ml/s, 20ml with flow rate of 2.5ml/s) followed with 40ml saline water (2.5ml/s), pitch 2.2, the premonitory position was in the middle of the lower legs and the scan was manually started as soon as the arteries were enhanced at the premonitory position. There were 3-5 minutes before the s-CTA started to make sure the contrast medium was washed out of the calves. The CT scanner was the third-generation dual-source CT system. For each of seven lower leg artery segments, arterial contrast and diagnostic confidence for stenosis assessment (3-point scale) were tested for s-CTA and dyn-CTA.

RESULTS

Compared with s-CTA, dyn-CTA resulted in significantly higher arterial contrast enhancement (95% vs 67% optimal contrast) and higher diagnostic confidence (96% vs 70% fully confident, respectively). The score of stenosis was 1.50 ± 0.85 and 2.08 ± 0.94 for dyn-CTA and s-CTA. DLP was $396.8 \text{ mGy} \cdot \text{cm}$.

CONCLUSION

Compared with s-CTA, dyn-CTA provides improved arterial contrast enhancement, higher diagnostic confidence.

CLINICAL RELEVANCE/APPLICATION

Dyn-CTA of the calves using 70kVp tube voltage can improve the contrast enhancement of the lower legs and the diagnosis confidence with low radiation dose.

SSK20-08 Diagnostic Image Quality the Voxel-Wise Bone and Plaque Subtracted Datasets Calculated From Dynamic CT Angiography Datasets of the Lower Limb

Wednesday, Nov. 30 11:40AM - 11:50AM Room: N227B

Participants

Nils Vogler, MD, Mannheim, Germany (*Presenter*) Nothing to Disclose
Sonja Sudarski, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Mathias Meyer, Mannheim, Germany (*Abstract Co-Author*) Speaker, Siemens AG Speaker, Bracco Group
Holger Haubenreisser, Mannheim, Germany (*Abstract Co-Author*) Speaker, Siemens AG Speaker, Bayer AG
Stefan O. Schoenberg, MD, PhD, Mannheim, Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Thomas Henzler, MD, Mannheim, Germany (*Abstract Co-Author*) Research support, Siemens AG; Speaker, Siemens AG

PURPOSE

Static CT angiography of the lower limb (sCTA) in combination with dynamic CT angiography of the calf (dCTA) is increasingly used as an imaging technique in patients with known or suspected peripheral artery disease. Although sCTA and dCTA are rather robust extensive calcification impairs image quality especially at the calf. The aim of this study was to evaluate the diagnostic image quality of voxel-wise bone and plaque subtracted datasets calculated from dCTA datasets in comparison to sCTA and the best arterial non-subtracted phase selected from the dCTA dataset.

METHOD AND MATERIALS

15 patients that underwent sCTA and dCTA were retrospectively included in this study. The dCTA consisted of 14 single acquisitions that were corrected for motion and image noise subsequently after the image acquisition. Out of these 14 contrast phases the phase with the highest arterial enhancement (best arterial phase) was selected. Subsequently the first non-contrast enhanced phase was subtracted from the corresponding best arterial phase generating voxel-wise bone and plaque subtracted datasets (see figure). These voxel-wise bone and plaque subtracted best arterial datasets (Dataset 3) were compared to both, the sCTA (Dataset 1) and the best arterial non-subtracted phase from the 14 single dCTA phases (Dataset 2). All 3 datasets were evaluated by 2 independent readers regarding the degree of stenosis, diagnostic confidence and overall image quality using a 5-point Likert scale.

RESULTS

Dataset 3 showed significantly higher overall image quality and diagnostic confidence than Dataset 1 and Dataset 2. Overall image quality was rated good/excellent in 10%, 27% and 90% and nondiagnostic/poor in 63%, 17%, 3% of the Datasets 1, Datasets 2 and Datasets 3 respectively. Diagnostic confidence was rated good/excellent in 20%, 41% and 83% and nondiagnostic/poor in 52%, 18%, 2% of the Datasets 1, Datasets 2 and Datasets 3 respectively.

CONCLUSION

Voxel-wise bone and plaque subtracted datasets calculated from dCTA increase overall image quality and diagnostic confidence compared to sCTA of the calf or non-subtracted dCTA of the calf.

CLINICAL RELEVANCE/APPLICATION

Voxel wise bone and plaque subtracted CTA datasets calculated from motion and noise corrected dCTA datasets improve diagnostic image quality and readers confidence of the calf, which is of paramount importance in patients with heavily calcified vessels.

SSK20-09 Diagnostic Performance of 4D-CT Uterine Angiography Using 320-Detector Row CT in Diagnosis of Uterine Vascular Malformations

Wednesday, Nov. 30 11:50AM - 12:00PM Room: N227B

Awards

Student Travel Stipend Award

Participants

Ahmed M. Elsharkawy, MBBCh, MSc, Tanta, Egypt (*Presenter*) Nothing to Disclose
Mohamed Moharram, Tanta, Egypt (*Abstract Co-Author*) Nothing to Disclose
Hytham Haroon, Tanta, Egypt (*Abstract Co-Author*) Nothing to Disclose
Amr Mubarak, Tanta, Egypt (*Abstract Co-Author*) Nothing to Disclose
Alaa Khalil, Tanta, Egypt (*Abstract Co-Author*) Nothing to Disclose
Lina T. Hablas, MBBCh, Tanta, Egypt (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To clarify the diagnostic performance of dynamic volume 320-detector row computed tomography (CT) uterine angiography to identify the feeding arteries, draining veins and the nature of vascular malformations of uterine arteriovenous malformation (AVM) before embolisation.

METHOD AND MATERIALS

Eighteen patients who underwent 320-detector row 4D CT pelvic angiographic examination using 16.0 cm coverage /gantry rotation. □ 100 cc Contrast media were injected at a rate of 5.0cc/sec then 40cc saline administration. □ The scan was started automatically 12 seconds after contrast injection. Intermittent scanning mode with 3 seconds interval was obtained. After the end of venous phase the scan is terminated manually. Maximum intensity projections (MIP) and 3D volume rendered images was obtained. Lastly, dynamic movies were made using all phases denoting contrast passage in pelvic arteries, veins and AVM nidus.

RESULTS

Among 18 patients , 9 patients had vascular supply of the AVM nidus from right uterine artery , 6 from left uterine artery and 3 patient from both arteries. Two patients had anastomosis between right uterine and right ovarian arteries. 4 patients had intrauterine aneurysm accompanying the AVM. 11 patients had venous drainage into the right ovarian venous plexus and 5 patients to the left ovarian veins and 2 patients to both ovarian veins. Overall sensitivity, specificity, were 88% and 83%, respectively. The mean total radiation dose is about 15 mSv.

CONCLUSION

4D-CTA is a non-invasive imaging technique that helps in the assessment of uterine vascular malformations, with high spatial and temporal resolution and so helps in selection of appropriate treatment strategy for such lesions.

CLINICAL RELEVANCE/APPLICATION

In cases of uterine AVM, this technique helps in treatment selection of different interventional procedures by detection of the vascular supply and venous drainage of the nidus.

MSRT43

ASRT@RSNA 2016: CT Angiography: A Technologist's Perspective

Wednesday, Nov. 30 10:40AM - 11:40AM Room: N230B



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

Participants

John Leal, Claremont, CA, (jeleal@charter.net) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Gain understanding of the role a Technologist play in the CTA imaging examination. 2) Define strategies for dealing with clinical imaging situations focusing on the diagnostic question. 3) Balancing our responsibilities between diagnostic question, radiation dose, clinical information and exam requests. 4) Understand the process of protocol development for CT Angiography. 5) Recognizing and avoiding pitfalls.

ABSTRACT

Today's CT Technologists are challenged with the rapidly changing environment in Computed Tomography Angiographic imaging. Focusing on the role the Technologist plays in the acquisition of complicated imaging exams, from preparation to post processing; this discussion explores the skill set and technical considerations required in the production of exceptional diagnostic images.

Using the RSNA CTP Software for Clinical Trials and Research (Hands-on)

Wednesday, Nov. 30 12:30PM - 2:00PM Room: S401AB

INAMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**Participants**

Bradley J. Erickson, MD, PhD, Rochester, MN, (bje@Mayo.edu) (*Presenter*) Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC; Stockholder, FlowSigma
Kirk E. Smith, BS, Little Rock, AR, (ksmith@uams.edu) (*Presenter*) Nothing to Disclose
Tracy S. Nolan, BEng, Little Rock, AR, (tnolan@uams.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand what CTP software can do. 2) Understand how to install and configure CTP to do basic tasks. 3) Meet others in the CTP user community.

ABSTRACT

Over the past year, CTP has undergone a change in its support model. In the past, RSNA directly supported a person to maintain and enhance CTP. The feeling now is that CTP is mature and so RSNA has decided to release it as open source and to let the community take it over. We hope that this will be a positive step forward for CTP and the community that requires this functionality. This meeting will include time for community members to meet each other and discuss initiatives going forward.

Getting Stuff Done: A Hands-on Technology Workshop to Enhance Personal Productivity (Hands-on)

Wednesday, Nov. 30 12:30PM - 2:00PM Room: S401CD

INAMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**Participants**

Matthew B. Morgan, MD, Sandy, UT (*Presenter*) Consultant, Reed Elsevier
Puneet Bhargava, MD, Shoreline, WA, (bhargp@uw.edu) (*Presenter*) Editor, Reed Elsevier
Amanda Lackey, MD, Columbus, OH (*Presenter*) Editor, Reed Elsevier
Dushyant V. Sahani, MD, Boston, MA (*Presenter*) Research support, General Electric Company; Medical Advisory Board, Allena Pharmaceuticals, Inc

LEARNING OBJECTIVES

- 1) Introduce the concept of "Getting Things Done" .
- 2) Learn the concepts of Inbox Zero and other email management techniques.
- 3) Using tools such as note-taking applications, citation and password managers.

ABSTRACT**Honored Educators**

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Puneet Bhargava, MD - 2015 Honored Educator
Dushyant V. Sahani, MD - 2012 Honored Educator
Dushyant V. Sahani, MD - 2015 Honored Educator
Dushyant V. Sahani, MD - 2016 Honored Educator

RCC43

Want to Learn More About Imaging Informatics? Education, Resources and Certifications

Wednesday, Nov. 30 12:30PM - 2:00PM Room: S501ABC



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

Participants

Christopher J. Roth, MD, Raleigh, NC, (Christopher.roth@duke.edu) (*Moderator*) Nothing to Disclose

Active Handout: Christopher John Roth

http://abstract.rsna.org/uploads/2016/16005066/RCC43_2016_RSNA_Learning_and_Society_Certifications_for_Handout.pdf

Sub-Events

RCC43A Landscape of Online Resources for Informatics Self-Study

Participants

Marc D. Kohli, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify online sources of content for didactic informatics self-study. 2) Identify online resources for hands-on study of database and programming concepts.

ABSTRACT

RCC43B Formal Opportunities and Resources for Imaging Informatics Training

Participants

Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

RCC43C Imaging and Nonimaging Informatics Society Certifications: What is Out There and Is It Valuable?

Participants

Christopher J. Roth, MD, Raleigh, NC, (Christopher.roth@duke.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Summarize the forces driving physician adoption and leadership in local and national informatics initiatives. 2) Compare the opportunities toward pursuing: American Board of Imaging Informatics Certified Imaging Informatics Professional (ABII CIIP) certification, and, American Board of Preventative Medicine Clinical Informatics (ABPM CI) ABMS board certification, Healthcare Information and Management Systems Society Certified Professional in Health Information & Management System (HIMSS CPHIMS).

RCC43D Overview of Imaging Informatics with Technologists and Administrators

Participants

Scott R. Steingall, BS,ARRT, Malvern, PA, (scott.steingall@siemens.com) (*Presenter*) Employee, Siemens AG

LEARNING OBJECTIVES

1) Identify the informatics education requirements within the current educational process for imaging technologists and administrators. 2) Describe the need to include more informatics based education for the imaging technologists and administrators. 3) Compare the current informatics offerings from the American Society of Radiologic Technologists (ASRT), The Association for Medical Imaging Management (AHRA), and the Radiology Business Management Association (RBMA).

ABSTRACT

MSRT44

ASRT@RSNA 2016: The Argument for Screening Mammography (and Against the United States Preventive Services Task Force Recommendations)

Wednesday, Nov. 30 1:00PM - 2:00PM Room: N230B



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

Participants

Michael N. Linver, MD, Albuquerque, NM, (mammomike@aol.com) (*Presenter*) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc

LEARNING OBJECTIVES

1) Discriminate between the subjective negative conclusions of the USPSTF and the true objective data supporting annual screening mammography beginning at 40. 2) Argue successfully in favor of screening mammography when confronted by mammography nihilists. 3) Create useful information for patients regarding the life-saving value of yearly mammography beginning at 40.

ABSTRACT

Early in 2016, the USPSTF reaffirmed their recommendations against screening mammography in women 40-49 and over 73, and recommended screening every 2 years for women 50-73. If fully implemented, as many as 100,000 more women would die prematurely from breast cancer over the next 10 years. The true facts the Task Force twisted or ignored about the real value of yearly screening beginning at 40 will be elucidated. The mythical "harms" of mammography purported by the Task Force will be revealed as overly exaggerated or nonexistent. Talking points radiologists can use in discussing screening guidelines with their patients and clinicians will be reviewed.

MSCU41

Case-based Review of US (An Interactive Session)

Wednesday, Nov. 30 1:30PM - 3:00PM Room: S406A

US

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

FDA

Discussions may include off-label uses.

Participants

Deborah J. Rubens, MD, Rochester, NY, (Deborah_rubens@urmc.rochester.edu) (*Director*) Nothing to Disclose

Sub-Events

MSCU41A **Discordance of CEUS with CT and MR: Why Does It Happen and How Does It Help?**

Participants

Stephanie R. Wilson, MD, Calgary, AB, (stephanie.wilson@ahs.ca) (*Presenter*) Equipment support, Siemens AG; Equipment support, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Understand the fundamental differences between contrast enhanced imaging with US, CT and MR scan, to appreciate the advantages afforded by real time Ultrasound. 2) Recognize advantages of using a purely intravascular contrast agent for CEUS.

ABSTRACT

MSCU41B **Small Body Parts Ultrasound**

Participants

Jason M. Wagner, MD, Oklahoma City, OK, (jason-wagner@ouhsc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Classify thyroid nodules into risk categories using sonographic and clinical features. 2) Differentiate subcutaneous lipomas from other superficial masses. 3) Apply color and spectral Doppler findings to evaluate for testicular torsion.

ABSTRACT

MSCU41C **OB and GYN Ultrasound**

Participants

Mindy M. Horrow, MD, Philadelphia, PA (*Presenter*) Spouse, Employee, Merck & Co, Inc

LEARNING OBJECTIVES

1) Describe criteria for a failed first trimester pregnancy. 2) List sonographic findings to distinguish adenomyosis from fibroids. 3) Categorize findings of unusual ectopic pregnancies partially or completely within the uterus. 4) Review classic signs that indicate a tubal origin of an adnexal mass.

ABSTRACT

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Mindy M. Horrow, MD - 2013 Honored Educator
Mindy M. Horrow, MD - 2016 Honored Educator

MSES43

Essentials of Pediatric Imaging

Wednesday, Nov. 30 1:30PM - 3:00PM Room: S100AB

PD

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

Participants

Sub-Events

MSES43A Controversies in Imaging Appendicitis

Participants

Alex Towbin, MD, Cincinnati, OH, (alexander.towbin@cchmc.org) (*Presenter*) Author, Reed Elsevier; Grant, Guerbet SA; Grant, Siemens AG;

LEARNING OBJECTIVES

1) Describe the clinical and imaging findings of appendicitis in children. 2) Describe the value of measurements of the appendix in making a diagnosis of appendicitis. 3) Describe the utility of structured reporting in the setting of appendicitis.

ABSTRACT

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Alex Towbin, MD - 2014 Honored Educator

MSES43B Imaging Children with Respiratory Distress

Participants

Edward Y. Lee, MD, MPH, Boston, MA, (Edward.Lee@childrens.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss underlying causes of respiratory distress in children. 2) Review imaging modalities and techniques for evaluating respiratory distress in children. 3) Learn characteristic imaging findings of disorders causing respiratory distress in children.

MSES43C Imaging Child Abuse

Participants

Gael J. Lonergan, MD, Austin, TX, (lonergangmd@ausrad.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The attendee will be able to recognize radiographic findings highly suspicious for child abuse. 2) The attendee will understand the imaging protocols for suspected child abuse. 3) The attendee will know the forensic significance of common inflicted childhood injuries.

Active Handout:Gael J. Lonergan

http://abstract.rsna.org/uploads/2016/16000898/MSES43C_RSNA_Lonergan_Abuse_Handout.pdf

MSES43D Congenital Urinary Tract Malformations

Participants

Ethan A. Smith, MD, Saline, MI, (ethans@med.umich.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand basic embryologic development of the kidney and how abnormalities of development lead to common congenital urinary tract abnormalities. 2) To be familiar with different imaging modalities used for the work up of congenital urinary tract malformations and to be able to recommend the appropriate "next step" for imaging of common conditions.

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/>

MSSR43

RSNA/ESR Hybrid Imaging Symposium: Hybrid Imaging in the Male (An Interactive Session)

Wednesday, Nov. 30 1:30PM - 3:00PM Room: S402AB

GU **MR** **NM**

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

FDA Discussions may include off-label uses.

Participants

Alexander Drzezga, MD, Cologne, Germany (*Moderator*) 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
Katrine Riklund, MD, PhD, Umea, Sweden, (katrine.ahlstrom.riklund@umu.se) (*Moderator*) Nothing to Disclose

Sub-Events

MSSR43A Prostate Cancer: PET, MR or Both?

Participants

Matthias J. Eiber, MD, Muenchen, Germany, (matthias.eiber@tum.de) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

- 1) To learn about pathophysiology in prostate cancer.
- 2) To understand how to interpret hybrid imaging of prostate cancer.
- 3) To learn about the role of hybrid imaging in staging, treatment evaluation and follow-up.

MSSR43B Prostate Cancer: Novel Tracers

Participants

Steven P. Rowe, MD, PhD, Parkville, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

- 1) To learn about novel tracer and their biochemical properties.
- 2) To understand the differences of information given by the use of different tracers.
- 3) To understand how to interpret examinations with different tracers.

MSSR43C Interactive Case Discussion

Participants

Matthias J. Eiber, MD, Muenchen, Germany (*Presenter*) Nothing to Disclose
Steven P. Rowe, MD, PhD, Parkville, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

- 1) To learn how to interpret hybrid imaging of prostate cancer.
- 2) To understand the pathophysiology in relation to imaging.

PS40

Wednesday Plenary Session

Wednesday, Nov. 30 1:30PM - 2:45PM Room: E450A



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

PS40A Announcement of Education Exhibit Awards

Participants

PS40B Announcement of Quality Storyboard Awards

Participants

PS40C Annual Oration in Radiation Oncology: Prostate Cancer: Improving the Flow of Research

Participants

Colleen A. Lawton, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose

Edward Y. Kim, MD, Seattle, WA (*Presenter*) Research support, Eisai Co, Ltd; Research support, Novartis AG; Research support, Johnson & Johnson; Research support, Bayer AG; Research support, Threshold Pharmaceuticals, Inc ; Research support, Eli Lilly and Company; Research support, MabVax Therapeutics Inc;

Abstract

Prostate cancer for men like breast cancer for women is the second leading cause of cancer death in the United States. This fact alone should cause nation-wide concern and result in a push for improved screening and treatment for men plagued with this disease. Yet over the past three decades we have seen screening with PSA come and go and treatment for localized disease improve, but at a relative snail's pace. Treatment for locally advanced disease has seen progress, but hereto the tempo is sluggish and adoption of the advances not universal. Recently there has been a large influx of treatment options for metastatic patients which of course is progress, but in the end these patients will likely die of their disease. The goal of this presentation will be to review what we have learned from prostate cancer research over the past three decades. This will include a review of the research on imaging for accurate staging in addition to research on screening and treatment options. We will look at where we have succeeded and where much work still needs to be done. Finally we will explore opportunities to identify what needs to be done to help increase the flow of research so as to brighten the future for prostate cancer patients.

SPHA41

Hospital Administrators Symposium

Wednesday, Nov. 30 1:30PM - 4:50PM Room: S103AB

HP

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

Participants

Jonathan W. Berlin, MD, Evanston, IL, (jonathanberlin@yahoo.com) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) The potential impact of alternate payment systems, including merit based incentive payment systems, on future radiologic practice. 2) The impact of increasing price transparency on radiology practice. 3) Important common radiology growth models and their impact on radiology/ hospital relationships. 4) Key positive and negative aspects of radiology computerized order decision support. 5) A model example of how a streamlined body MRI service can add value to radiology practices in a prospective payment environment.

ABSTRACT

This afternoon interactive seminar will explore the impact of the changing healthcare landscape on radiologic practice. Six speakers will present a wide range of topics such as the impact of price transparency and alternative payment systems including merit based incentive payment systems on radiologic practice. The pros and cons on computer decision support for radiology ordering will be explored, as will future radiology growth models and their impact of radiology hospital relationships. Attendees will also learn about how a streamlined body MRI service can add radiology value in future prospective payments systems.

URL

Sub-Events

SPHA41A Introduction

Participants

Jonathan W. Berlin, MD, Evanston, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPHA41B Positioning Radiology for Success under the Merit-Based Incentive Payment System

Participants

Ezequiel Silva III, MD, San Antonio, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPHA41C The Impact of Alternative Payment Models (APM's) on Radiology

Participants

Richard Weil, PhD, Highland Park, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPHA41D Adding Value in Alternative Payment Systems: The Case of MRI

Participants

Diego R. Martin, MD, PhD, Tucson, AZ, (dmartin@radiology.arizona.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the definition of "value" in healthcare. 2) Understand how imaging diagnostics impacts value. 3) Understand how advanced imaging technologies - with the example of MRI, a more expensive imaging test - can extract cost of healthcare delivery. 4) Understand how the principles of adding value through improved imaging diagnostics and metrics of performance can translate to an alternative shared-risk payment environment.

ABSTRACT

There is a strong pressure in our health care system to extract costs, while moving to shared risk payment models. Advanced imaging technologies, particularly CT and MRI, represent a high total expense and discussion has mostly focused on reduced utilization. In this lecture I will provide an overarching view, and supporting evidence, on how the paradigm must change in order to make optimal policies and payment models. I will discuss the value proposition of optimized advanced imaging technology, focusing on MRI. I will show how MRI may, in areas of proven value, be underutilized and that optimized implementation, coupled with documentation, can lower overall cost of care delivery and lay the foundation for a new care-delivery payment environment.

URL

SPHA41E Question And Answer

Participants

Ezequiel Silva III, MD, San Antonio, TX (*Presenter*) Nothing to Disclose
Diego R. Martin, MD, PhD, Tucson, AZ (*Presenter*) Nothing to Disclose
Richard Weil, PhD, Highland Park, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPHA41F 5 Top Radiology Growth Models and their Impact on the Physician/Hospital Partnership

Participants

Patrick D. Free, Clinton Twp, MI (*Presenter*) Vice President, McKesson Corp.

LEARNING OBJECTIVES

View learning objectives under main course title.

SPHA41G Price Transparency in Radiology: What Does It Mean for Hospitals and Radiologists?

Participants

Mark D. Hiatt, MD, MBA, Salt Lake City, UT, (mark.hiatt@regence.com) (*Presenter*) Medical Director, Regence BlueCross BlueShield; Board Member, RadSite; Former Officer, HealthHelp, LLC

LEARNING OBJECTIVES

View learning objectives under main course title.

SPHA41H Legislation, Computerized Decision-Support and the Transition to Value-Based Healthcare in Radiology

Participants

Mick Brown, Chicago, IL (*Presenter*) Vice-President, Business Development, National Decision Support Company

LEARNING OBJECTIVES

View learning objectives under main course title.

SPHA41I Question and Answer

Participants

Mark D. Hiatt, MD, MBA, Salt Lake City, UT, (mark.hiatt@regence.com) (*Presenter*) Medical Director, Regence BlueCross BlueShield; Board Member, RadSite; Former Officer, HealthHelp, LLC
Mick Brown, Chicago, IL (*Presenter*) Vice-President, Business Development, National Decision Support Company
Patrick D. Free, Clinton Twp, MI (*Presenter*) Vice President, McKesson Corp.

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO41

Interventional Oncology Series: Mechanisms Matter: Basic Science Every IO Should Know

Wednesday, Nov. 30 1:30PM - 6:00PM Room: S405AB

GI IR

AMA PRA Category 1 Credits™: 4.25
ARRT Category A+ Credits: 5.00

FDA Discussions may include off-label uses.

Participants

Muneeb Ahmed, MD, Wellesley, MA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Gain an appreciation of the basic scientific underpinnings of interventional oncology. 2) Understand how and why these mechanistic studies can have an impact on both daily clinical practice and future therapeutic paradigms. 3) Characterize the most important advances of tumor ablation over the last two decades. 4) Gain a better understanding of the cutting edge imaging techniques that facilitate successful state of the art interventional oncologic practice.

ABSTRACT

The first half of the session has been organized into a thematic unit entitled: "Mechanisms Matter: Basic science every IO should know" and will be dedicated to gaining an appreciation of the basic scientific underpinnings of interventional oncology and understand how and why such studies can have an impact on both daily clinical practice and future therapeutic paradigms. This will include an initial lecture outlining the many insights and lessons that can be directly applied from radiation therapy and hyperthermia, followed by lectures that center upon key mechanistic pathways that are being used to improve transcatheter embolization and tumor ablation. Two presentations will outline our current understanding of the potential systemic effects of post-procedure, cytokine-mediated inflammation - the negative effects leading to tumorigenesis and the potential beneficial immune (abscopic) effects of IO therapies. A highlight of the session will be a keynote address "20 years of thermal ablation: Progress, Challenges and Opportunities". Dr. Solomon, a noted thought leader in the field will not only characterize the most important advances of tumor ablation over the last two decades and place them in their proper historical and developmental context, but will also identify key areas of research in device and technique development that hold the potential to propel the field forward in the upcoming decade. The second half of the session "Advancing IO with cutting-edge imaging techniques" will be dedicated to the cutting edge imaging modalities that facilitate successful state of the art IO practice. Leading authorities will provide an in depth look at advances and adaptation of 5 of the main technologies as they relate to enhancing interventional oncology including: advanced ultrasound and fusion techniques; state-of-the-art angiographic imaging (including Cone beam CT and subtraction reconstruction); tailoring MR for IO; the the role of PET/CT; and molecular imaging.

Sub-Events

VSIO41-01 Thermal Biophysiology - The Basis for Improving Tumor Ablation

Wednesday, Nov. 30 1:30PM - 1:45PM Room: S405AB

Participants

Christopher L. Brace, PhD, Madison, WI, (clbrace@wisc.edu) (*Presenter*) Shareholder, NeuWave Medical Inc Consultant, NeuWave Medical Inc Shareholder, Symple Surgical Inc Consultant, Symple Surgical Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO41-02 Ischemia - The Primer Mover: Apoptosis, Hif-1a and VEGF Pathways

Wednesday, Nov. 30 1:45PM - 2:00PM Room: S405AB

Participants

Bradford J. Wood, MD, Bethesda, MD (*Presenter*) 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; ; ;

LEARNING OBJECTIVES

View learning objectives under the main course title.

VSIO41-03 Sensitivity of Hepatocellular Cell Lines to Aerobic and Glycolytic Metabolic Inhibitors under Simulated Heat Shock and Hypoxia

Wednesday, Nov. 30 2:00PM - 2:10PM Room: S405AB

Awards

Student Travel Stipend Award

Participants

Andrew J. Barrow, MD, Houston, TX (*Presenter*) Nothing to Disclose
Andrea Cortes, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rony Avritscher, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Derek L. West, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to explore targeted killing of hepatocellular cancer cells surviving incomplete thermal ablation through

The purpose of this study is to explore targeted killing of hepatocellular cancer cells surviving incomplete thermal ablation through the use of metabolic inhibitors. We investigate the sensitivity of hepatocellular cell lines to various metabolic inhibitors under the following conditions: normal culture conditions, following sub-lethal heat exposure, and hypoxic conditions, in order to simulate the effects of incomplete ablation.

METHOD AND MATERIALS

Human Hep3B and HepG2 and rat RH-7777 hepatocellular tumor lines were exposed to sub-lethal heat shock at 43 C or to normal incubation temperature of 37 C. Cells were then treated with serial dilutions of the glycolytic inhibitors: 3-bromopyruvate or FX-11, or modulators of oxidative phosphorylation: neutralized dichloroacetic acid (DCA), antimycin A, carbonyl cyanide-4-trifluoromethoxy phenylhydrazone (FCCP), or a combination of FX-11 and antimycin A. Hypoxia experiments were performed by pre-incubating cells in a hypoxic environment, and then treating with serial dilutions of doxorubicin, FX-11, and Antimycin A. Cell viability was assessed using resazurin indicator and plate reader.

RESULTS

All hepatocellular cell lines demonstrated cytotoxicity to all of the glycolytic and anaerobic inhibitors in a concentration dependent manner. Heat shock experiments demonstrated that hepatocellular cell lines exposed to sub-lethal heat shock were surprisingly less sensitive to 3-bromopyruvate than controls maintained at normal culture conditions. For the other inhibitors, no significant differences in sensitivity were observed between sub-lethal heat shock groups and control groups. Hypoxia experiments revealed that all hepatocellular cell lines demonstrated increased sensitivity to doxorubicin in hypoxic conditions. In addition, this effect was further potentiated by the glycolytic inhibitor FX-11, but not oxidative phosphorylation inhibitor (OXPHOS) antimycin A.

CONCLUSION

Hypoxia increases the sensitivity of hepatocellular cell lines to doxorubicin, an effect which is further potentiated by the glycolytic inhibitor FX-11, but not by OXPPOS inhibitor Antimycin A.

CLINICAL RELEVANCE/APPLICATION

Our results imply that oxidative phosphorylation is important in doxorubicin sensitivity, and that FX-11 is a useful candidate to increase the efficacy of hypoxia inducing cancer treatments such as chemoembolization and anti-VEGF therapy

VSIO41-04 Tailoring Nanodrugs for IO: Free Radicals, Heat Shock Proteins, and Beyond

Wednesday, Nov. 30 2:10PM - 2:25PM Room: S405AB

Participants

Muneeb Ahmed, MD, Wellesley, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO41-05 Thermal Ablation: Induction of Tumorigenesis Factors by in Vitro Hyperthermia

Wednesday, Nov. 30 2:25PM - 2:35PM Room: S405AB

Participants

Aurelia Markezana, MSc, Jerusalem, Israel (*Presenter*) Nothing to Disclose

Elina Zorde Khvalevsky, PhD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

Muneeb Ahmed, MD, Wellesley, MA (*Abstract Co-Author*) Nothing to Disclose

Eithan Galun, MD, PhD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

Svetlana Gourovich, BSc, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

S. Nahum Goldberg, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, AngioDynamics, Inc; Research support, Cosman Medical, Inc; Consultant, Cosman Medical, Inc;

PURPOSE

To determine whether the moderate hyperthermic doses, routinely encountered in the periablational zone during radiofrequency and microwave ablation, induce pro-tumorigenic genetic and proteomic activation of tumor cells and hepatocytes.

METHOD AND MATERIALS

An in vitro assay was established to assess the effect of hyperthermia on tumorigenesis factor induction. R3230 rat mammary tumor cells ($n=2.5 \times 10^5$) were heated in 250 μ l RPMI+10%FCS medium to $45 \pm 1^\circ\text{C}$ or $43 \pm 1^\circ\text{C}$ for 0, 2, 5, & 10 min and then incubated at 37°C in a humidified incubator for 1.5, 3, 8, or 24 hr ($n=3$ trials each; total $N=135$). Primary mouse hepatocytes ($n=4 \times 10^5$) were also heated in 1ml DMEM/F12+5%FCS medium to $45 \pm 1^\circ\text{C}$ or $44 \pm 1^\circ\text{C}$ ($N=48$). mRNA expression profile of factors and cytokines implicated in RF-induced tumorigenesis including IL-6, TNF α , STAT3, hepatocyte growth factor (HGF) and vascular endothelial growth factor (VEGF) were evaluated by relative quantitative Real-Time PCR. Heat shock protein (HSP) 70 was used as control. Secretion of cytokine IL-6 at 3 and 8 hr following $45 \pm 1^\circ\text{C}$ heating for 5 min was assessed by ELISA, with intracellular transcription factor STAT3 assessed by Western blot.

RESULTS

Dose and time dependent elevation of HSP70, IL-6, TNF α , and HGF gene expression were observed. For R3230, IL-6 and TNF α mRNA levels were maximum at 3hr incubation following $45^\circ\text{C} \times 10\text{min}$ heating (11.8 ± 7.8 and 19.1 ± 15.9 fold induction, respectively). HGF expression peaked at 8hr with a maximal induction of 24.1 ± 17.8 . HSP70 expression also peaked at 8 hr with a maximal induction of 156.2 ± 17.8 fold over unheated controls. Likewise, IL-6 expression doubled at 44°C for hepatocytes. For both cell types, STAT3 doubled its expression at 3hr. VEGF expression showed little if any upregulation. At 43°C HSP70 was the only gene with elevated expression. ELISA of IL-6 confirmed a significant time dependent increase of IL-6 secretion by 14 ± 3 % over controls ($p < 0.05$) at 8hr. Likewise, Western blot of R3230 demonstrated an increase of $20 \pm 10\%$ ($p < 0.05$) STAT3 total protein at 8hr compared to unheated controls.

CONCLUSION

Both hepatocytes and some tumor cell populations react to heating by increasing transcription, secretion, and protein production of

factors that are known to induce increased post-ablation tumorigenesis.

CLINICAL RELEVANCE/APPLICATION

Elucidation of the pathways that can potentially induce tumorigenesis post-ablation may allow us to uncover robust methods to eliminate these unwanted secondary effects.

VSIO41-06 Non-thermal Percutaneous Ablation: Cryo, IRE and More

Wednesday, Nov. 30 2:35PM - 2:50PM Room: S405AB

Participants

Stephen B. Solomon, MD, New York, NY (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO41-07 Optimizing Irreversible Electroporation (IRE) Ablation with a Bipolar Electrode

Wednesday, Nov. 30 2:50PM - 3:00PM Room: S405AB

Participants

Ayelet Wandel, MD, Holon, Israel (*Presenter*) Nothing to Disclose

Eliel Ben-David, MD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

Mohamed Faroja, MD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

Isaac Nissenbaum, BSc, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

Svetlana Gourovich, BSc, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

S. Nahum Goldberg, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, AngioDynamics, Inc; Research support, Cosman Medical, Inc; Consultant, Cosman Medical, Inc;

PURPOSE

To prospectively optimize bipolar irreversible electroporation (IRE) by characterizing the effects of electrical parameters and controlling tissue electrical properties.

METHOD AND MATERIALS

Single electrode bipolar IRE was performed in 28 in-vivo pig livers (78 ablations). First, effects of voltage (2,700- 3,000V), number of pulses, repeated cycles (1-6), and pulse width (70- 100µsec) were studied. Next, electrical conductivity was altered by instillation of hypertonic and hypotonic fluids. Finally, effects of thermal stabilization were assessed using internal electrode cooling. Treatment effect was evaluated 2-3hr post-IRE. Dimensions were compared and subjected to statistical analysis.

RESULTS

Delivering 3,000 V at 70µsec for a single 90 pulse cycle yielded $3.8 \pm 0.4 \times 2.0 \pm 0.3$ cm of ablation. Applying 6 cycles of energy increased the ablation to $4.5 \pm 0.4 \times 2.6 \pm 0.3$ cm ($p < 0.001$). Further increasing pulse lengths to 100µsec (6 cycles) increased ablation to $5.0 \pm 0.4 \times 2.9 \pm 0.3$ cm ($p < 0.001$), but resulted in electric spikes and system crashes in 40-50% of cases. Increasing tissue electrical conductivity via hypertonic solution instillation in surrounding tissues increased the frequency of generator crashes, whereas continuous instillation of distilled water eliminated this arcing phenomenon, but reduced ablation to 2.3 ± 0.1 cm. Controlled instillation of distilled water when electrical arcing was suspected from audible popping produced ablations of $5.3 \pm 0.6 \times 3.1 \pm 0.3$ cm without crashes. Finally, 3.1 ± 0.1 cm short-axis ablation was achieved without system crashes with internal electrode perfusion at 37°C vs. 2.3 ± 0.1 cm with 4- 10°C perfusion ($p < 0.001$).

CONCLUSION

Bipolar IRE ablation zones can be increased with repetitive high voltage and greater pulse widths while performing maneuvers such as judicious instillation of hypotonic fluids or internal electrode perfusion that minimize accompanied unwanted electrical arcing.

CLINICAL RELEVANCE/APPLICATION

The development of single insertion IRE devices that can achieve clinically meaningful ablation sizes will facilitate appropriate adoption of this platform for clinical practice.

VSIO41-08 Understanding Post-Procedure Inflammation: AKT and C-Met Pathways

Wednesday, Nov. 30 3:00PM - 3:15PM Room: S405AB

Participants

David A. Woodrum, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO41-09 Systemic Implications of IO Therapies: Increased Tumorigenesis?

Wednesday, Nov. 30 3:15PM - 3:30PM Room: S405AB

Participants

Muneeb Ahmed, MD, Wellesley, MA, (mahmed@bidmc.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

VSIO41-10 Targeting STAT3 to Suppress the Systemic Pro-Oncogenic Effects of Hepatic RF Ablation

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S405AB

Participants

Gaurav Kumar, PhD, Boston, MA (*Presenter*) Nothing to Disclose
S. Nahum Goldberg, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, AngioDynamics, Inc; Research support, Cosman Medical, Inc; Consultant, Cosman Medical, Inc;
Eithan Galun, MD, PhD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Muneeb Ahmed, MD, Wellesley, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To identify key expressed genes in the periablational rim after hepatic radiofrequency ablation (RFA) and their role in driving the stimulation of distant tumor growth in small animal models.

METHOD AND MATERIALS

First, gene expression analysis (Illumina array) was performed after RFA of normal liver in C57BL mice. 12 mice were allocated to receive RFA (70ICx5min) or sham electrode placement (no RF). Periablational liver was harvested at 24, 72h, and 7d post RFA. Data was analyzed for differentially expressed genes (>2 fold change) and their functional annotations. Next, STAT3 was identified as a key periablational mediator, and 16 F344 animals were allocated to hepatic RFA or sham treatment ± STAT3 inhibitor S3I-201 (4 groups, n=4) for pSTAT3 immunohistochemistry (IHC) at 24h. Finally, 24 rats were implanted with subcutaneous R3230 adenocarcinoma and allocated to RFA or sham ± S3I-201 arms (4 groups; n=6). Outcomes included tumor growth analysis, tumor proliferation (Ki67) and microvascular density(MVD) analysis.

RESULTS

At 24h post-RFA, 217 genes had altered expression (107 up-regulated/110 down-regulated). This decreased to 55 genes (27 up/28 down) and 18 genes at 72h and 7d post-RF, respectively. At 24h, functional annotations identified 7 activated pathways of which the STAT3 gene occurred in 4 including those associated with various pro-oncogenic genes and pathways. Correlative IHC of the periablational rim 24h after hepatic RFA confirmed elevated pSTAT3 activation, which was suppressed using S3I-201 (31.7±3.4 vs. 3.8±1.7% cells/field; p<0.001). The addition of S3I-201 with hepatic RFA reduced systemic distant R3230 tumor growth including compared to the sham arm (at 7d, RFA/S3I-201: 11.8±0.5mm; RFA alone: 19.8±0.7mm; S3I-201 alone: p<0.001; sham: 15±0.7mm, p<0.001 for all comparisons). Distant tumor proliferation and MVD mirrored trends in tumor growth between arms.

CONCLUSION

STAT3 activation is observed after hepatic RFA in rodents and can be suppressed using adjuvant STAT3 inhibitor. This may represent a clinically implementable solution for blocking unwanted 'off-target' effects of RFA generated by several upstream genes such as IL-6.

CLINICAL RELEVANCE/APPLICATION

Local STAT3 inhibition after hepatic RFA may offer a clinically implementable solution for blocking systemic tumorigenic effects of RFA generated by upstream cytokines/factors.

VSIO41-11 Systemic Implications of IO Therapies: Beneficial Immune Effects?

Wednesday, Nov. 30 3:40PM - 3:55PM Room: S405AB

Participants

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

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO41-12 Panel Discussion: So What Does all This Mean?

Wednesday, Nov. 30 3:55PM - 4:05PM Room: S405AB

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO41-13 Trancatheter IO: 30 Years of Progress, Challenges and Opportunities

Wednesday, Nov. 30 4:05PM - 4:20PM Room: S405AB

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. Learn the scientific rationale for intra-arterial therapy in Liver Cancer2. Understand the pharmacokinetic principles of TACE3. Recognize the impact of Cone Beam CT imaging on the efficacy of TACE

ABSTRACT

LEARNING OBJECTIVES

View learning objectives under main course title.

view learning objectives under main course title.

VSIO41-14 Advancing IO with Cutting-edge Imaging Techniques

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO41-15 Advanced Ultrasound and Fusion Techniques

Wednesday, Nov. 30 4:30PM - 4:45PM Room: S405AB

Participants

Luigi Solbiati, MD, Rozzano, Italy, (lusolbia@tin.it) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

VSIO41-16 Response Assessment by Volumetric Iodine-uptake Measurement: Preliminary Experience in Patients with Intermediate-advanced Hepatocellular Carcinoma Treated with Radioembolization

Wednesday, Nov. 30 4:45PM - 4:55PM Room: S405AB

Participants

Giulia Lorenzoni, Pisa, Italy (*Presenter*) Nothing to Disclose
Alessandro Grigolini, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Irene Bargellini, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Laura Crocetti, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Cioni, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Davide Caramella, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the volumetric iodine-uptake (VIU) changes by dual-energy CT (DECT) in assessing early response to selective internal radiotherapy (SIRT) in hepatocellular carcinoma (HCC) patients, compared with RECIST 1.1 and mRECIST.

METHOD AND MATERIALS

Nineteen patients treated with 24 sessions of SIRT were included in this retrospective study. At baseline and early (4-8 weeks) follow-up, target lesion response was assessed by RECIST 1.1, mRECIST, tumor volume (cm³), mean iodine content (µg/cm³) and VIU (mg). Cox regression and Kaplan-Meier analysis were used to explore differences in overall survival between responders and non-responders for each method.

RESULTS

There were 18 (75%) responders for tumor volume (≥10% decrease), 9 (37.5%) responders for iodine content (≥20% decrease) and 18 (75%) responders for VIU. Cumulative survival significantly (p<0.01) correlated with all these parameters, with the strongest correlation found with the iodine content. As opposite, there was no significant association between survival and RECIST 1.1 (CR+PR: 16.7%, 4 patients) and mRECIST (CR+PR: 33.3%, 8 patients).

CONCLUSION

Early assessment of volume and iodine content changes after SIRT can differentiate responders from non-responders, overcoming the limitations of RECIST 1.1 and mRECIST.

CLINICAL RELEVANCE/APPLICATION

Volumetric iodine-uptake changes can assess early response to radioembolization in hepatocellular carcinoma patients, correlating with cumulative survival.

VSIO41-17 State-of-the-Art Angiographic Imaging: Cone Beam CT and Beyond

Wednesday, Nov. 30 4:55PM - 5:10PM Room: S405AB

Participants

Ming De Lin, PhD, Cambridge, MA, (ming.lin@philips.com) (*Presenter*) Employee, Koninklijke Philips NV

LEARNING OBJECTIVES

-Discuss the role of cone-beam computed tomography (CBCT) for intraprocedural imaging during transcatheter arterial chemoembolization (TACE)-Explain the advantages of CBCT over standard 2D angiography in the detection of hepatocellular carcinoma lesions and their feeding arteries-Describe how CBCT during TACE can be used to assess the technical endpoint of embolization-Show how 3D quantification can be used in CBCT and how this fits into the treatment workflow along with MR and MDCT.

ABSTRACT

Cone-beam computed tomography (CBCT) is an imaging technique that provides 3D imaging intraprocedurally from a rotational scan acquired with a C-arm equipped with a flat panel detector. Utilizing CBCT images during interventional procedures bridges the gap between the world of diagnostic imaging, where the image acquisition is typically performed separately from the procedure, and

that of interventional radiology, which traditionally has been 2-dimensional (fluoroscopy and angiography). In the scope of transcatheter arterial chemoembolization (TACE), CBCT is capable of providing more information than standard two-dimensional imaging alone in localizing and/or visualizing liver tumors ("seeing" the tumor) and targeting tumors through precise microcatheter placement in close proximity to the tumors ("reaching" the tumor). It can also be useful in evaluating treatment success at the time of procedure ("assessing" treatment success). We will also look into how 3D quantification can be used in CBCT and how this fits into the treatment workflow along with MR and MDCT.

LEARNING OBJECTIVES

1) Discuss the role of cone-beam computed tomography (CBCT) for intraprocedural imaging during transcatheter arterial chemoembolization (TACE). 2) Explain the advantages of CBCT over standard 2D angiography in the detection of hepatocellular carcinoma lesions and their feeding arteries. 3) Describe how CBCT during TACE can be used to assess the technical endpoint of embolization. 4) Show how 3D quantification (qEASL) can be used in CBCT and how this fits into the treatment workflow along with MR and MDCT.

ABSTRACT

Cone-beam computed tomography (CBCT) is an imaging technique that provides 3D imaging intraprocedurally from a rotational scan acquired with a C-arm equipped with a flat panel detector. Utilizing CBCT images during interventional procedures bridges the gap between the world of diagnostic imaging, where the image acquisition is typically performed separately from the procedure, and that of interventional radiology, which traditionally has been 2-dimensional (fluoroscopy and angiography). In the scope of transcatheter arterial chemoembolization (TACE), CBCT is capable of providing more information than standard two-dimensional imaging alone in localizing and/or visualizing liver tumors ("seeing" the tumor) and targeting tumors through precise microcatheter placement in close proximity to the tumors ("reaching" the tumor). It can also be useful in evaluating treatment success at the time of procedure ("assessing" treatment success). We will also look into how 3D quantification (qEASL) can be used in CBCT and how this fits into the treatment workflow along with MR and MDCT.

VSIO41-18 Validation of a CBCT Virtual Injection and Perfusion Planning Tool with Selective CBCT Angiography and Radiopaque Bead Embolization

Wednesday, Nov. 30 5:10PM - 5:20PM Room: S405AB

Participants

William F. Pritchard JR, MD, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Martijn Van Der Bom, MSc, Andover, MA (*Abstract Co-Author*) Employee, Koninklijke Philips NV
William van der Sterren, MSc, Best, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Haydar Celik, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandro G. Radaelli, PHD, MS, Best, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV
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; ; ;
Juan A. Esparza, Laurel, MD (*Abstract Co-Author*) Nothing to Disclose
David L. Woods Jr, MS, BA, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Ivane Bakhutashvili, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Elliot B. Levy, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Venkatesh P. Krishnasamy, MD, Delaware, OH (*Abstract Co-Author*) Nothing to Disclose
John W. Karanian, PhD, Laurel, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the accuracy of novel virtual injection and perfusion planning software based on arterial CBCT angiograms in predicting regions of subsequent selective actual perfusion and embolization in the liver

METHOD AND MATERIALS

Nonselective dual phase CBCT angiography of the liver (XperCT, Allura Xper FD20, Philips, Best, Netherlands) was performed in 3 domestic swine. Virtual perfusion maps of 9 target hepatic arteries were extracted using novel software added on the framework of a 3D vessel-tracking and fluoroscopy guidance platform for tumor embolization (Emboguide, Philips). Target arteries were selectively catheterized and dual phase CBCT performed without reflux for retrospective comparison to the virtual perfusion maps. The virtual catheter site was selected based on actual catheter location. The software identified all downstream arterial branches supplied and generated a map of adjacent tissue perfused. One target artery in each animal was embolized to stasis using radiopaque beads (LC Bead LUMI, Biocompatibles UK, Farnham, UK) followed by CBCT. Anonymized imaging data from a patient with hypervascular liver tumors undergoing DEB/TACE were retrospectively analyzed with the same virtual perfusion software to assess its potential for prediction of subselective perfusion and embolization.

RESULTS

In all injections, the manually selected virtual injection and virtual perfusion maps corresponded to actual target vessels and contrast-perfused tissue in swine. The imageable beads co-localized in the expected distribution of the virtual injection. The software successfully correlated virtual and actual perfusion in a patient undergoing DEB TACE.

CONCLUSION

Virtual injection and perfusion maps derived from CBCT using novel software corresponded to actual target vessels and embolized tissue in a swine model.

CLINICAL RELEVANCE/APPLICATION

This virtual injection and perfusion software may provide a useful tool for procedural definition of partitions of the tumor in planning and predicting DEB/TACE delivery and facilitate sequential subselective embolization.

VSIO41-19 Tailoring MR for IO

Wednesday, Nov. 30 5:20PM - 5:35PM Room: S405AB

Participants

Stephan Clasen, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

MR imaging is now used for guidance of biopsy and for therapy with thermal ablation. During the last 15 years, field of interventional MRI has switched from experimental studies to clinical application in patients presented with cancer. The major role of image guidance for biopsy and thermal ablation is to ensure a safe and precise intervention with a percutaneous approach, i.e. biopsy of viable tumor tissue or for thermal ablation a complete coagulative necrosis of targeted tumor tissue including a safety margin without injury of critical structures. Therefore, image guidance during the intervention should allow a 3D-planning and provide an exact targeting, a reliable monitoring in case of therapy, and a controlling after ablation therapy. A precise targeting for the placement of the instrument is a precondition for a safe and effective intervention. New MR-scanners offer the unique possibility to combine the advantages of MR imaging such as excellent soft-tissue contrast, multiplanar capabilities, ultra-fast imaging, and sensitivity to thermal effects, during the entire ablation procedure with a good access to the patients. The development of fast acquisition techniques with adequate temporal and spatial resolution necessary to perform thermal therapies as well as the advance of different configured MR-Scanners e.g. open-bore contributed mostly to the development of interventional MR imaging over the last years. Finally, more sophisticated features available in high-field MR-Scanners such as assessment of different physiological information with diffusion weighted imaging (DWI) and near on-line temperature monitoring, which represents an essential feature in MR imaging-guided percutaneous ablation for the control of heat distribution. Regarding the clear advantages by using MR imaging in interventional oncology, it is somewhat surprising that the use of MR guided for intervention remains after almost 20 years of clinical evaluation still limited to some centers worldwide. Limited availability of open bore MR scanners is probably the main reason for its reduced use in interventional oncology. The feasibility of MR guided intervention specially thermal ablation has been evaluated in several clinical studies, showing its effectivity, its safety and even its time-efficacy in skilled hands.

VSIO41-20 Volumetric Changes in the Enhancing Tumor Burden Can Be Used to Evaluate Tumor Response and Predict Survival Early in Patients with Infiltrative/Multifocal Hepatocellular Carcinoma (HCC) after the First Transcatheter Arterial Chemoembolization (TACE)

Wednesday, Nov. 30 5:35PM - 5:45PM Room: S405AB

Participants

Cuihong Liu, Jinan, China (*Presenter*) Nothing to Disclose

Susanne Smolka, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

Duc Do Minh, BSc, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose

John Treilhard, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

Qiang Huang, Hangzhou, China (*Abstract Co-Author*) 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

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

Imaging based response assessment after transcatheter arterial chemoembolization (TACE) is important. A new 3D enhancement based approach (quantitative European Association for the Study of the Liver [qEASL]) has been shown to be more accurate than traditional methods (RECIST, mRECIST, WHO, EASL). Previous qEASL works were done on a lesion basis with ≤ 3 hepatocellular carcinoma (HCC) tumors per patient and the lesions had well-defined tumor borders. In this work, we evaluated patients with either multi-focal or infiltrative (ambiguous tumor border) HCC on a whole liver basis. This study investigates whether the whole liver enhancement pattern (enhancing tumor burden [ETB]) can be used to measure treatment response and predict survival.

METHOD AND MATERIALS

Retrospective study of 53 patients with infiltrative or multifocal HCC treated by TACE from 2001-14. Semi-automated 3D quantification software was used to segment the whole liver and calculate the ETB on multi-phasic contrast-enhanced MRI before and 1 month after TACE. The whole liver was segmented, then pre-contrast MR was registered to and subtracted from arterial phase MR. To calculate ETB, amount of voxels with greater enhancement than healthy liver (user indicated in 10x10x10 ROI) was measured. ETB change before and after TACE was used to assess response. Survival analysis included Kaplan-Meier curves with log-rank test and Cox regression. Cutoffs distinguishing responders from non-responders were 20,25,30,35,40,45 and 50% reduction in ETB. Akaike information criterion (AIC) was used to determine optimal cutoff to predict survival.

RESULTS

Mean age 59.9 years, 73.6% male, 30.2% presented with >50% tumor burden, 43.4% portal venous invasion, and none had extrahepatic metastasis. Mean ETB decreased significantly after TACE: 997.9 to 629.4cm³ (p<0.01). There was significant survival difference between responders (2.1-85.1months) and non-responders (15.8-44months); all cutoffs p<0.01. Based on AIC, 45% response cutoff was best predictive model (HR:0.06, 95%CI: 0.13-0.267, p<0.01)

CONCLUSION

Volumetric ETB can be used to evaluate the tumor response and predict survival in patients with infiltrative, multifocal HCC after first TACE.

CLINICAL RELEVANCE/APPLICATION

Response assessment after TACE for infiltrative and multifocal HCC by whole liver volumetric enhancement quantification is feasible

and can predict survival.

VSIO41-21 The Role of PET/CT

Wednesday, Nov. 30 5:45PM - 6:00PM Room: S405AB

Participants

Paul B. Shyn, MD, Boston, MA, (pshyn@bwh.harvard.edu) (*Presenter*) Research Consultant, Galil Medical Ltd; Research Grant, Siemens AG

LEARNING OBJECTIVES

ABSTRACT

LEARNING OBJECTIVES

1) Compare advantages of PET/CT with other imaging modalities in guiding interventional radiology procedures. 2) Describe strategies to improve lesion targeting during PET/CT interventional procedures. 3) Apply various PET/CT imaging techniques for the intraprocedural assessment of tumor ablation margins.

ABSTRACT

Positron Emission Tomography/Computed Tomography (PET/CT) enhances our capabilities in image-guided interventions in multiple ways. PET/CT enables targeting of disease foci not visible using other imaging modalities, provides uninterrupted visibility of targets despite intraprocedural changes in surrounding tissues or thermal effects of ablation, and facilitates unique intraprocedural strategies for assessing tumor ablation results. Many case examples will be shown that highlight rationales, strategies and emerging techniques for successful PET/CT-guided interventions.

MSRT45

ASRT@RSNA 2016: Dissecting the Digital Image: From Formation to Interpretation and Beyond

Wednesday, Nov. 30 2:20PM - 3:20PM Room: N230B



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

Participants

Timothy J. Blackburn, PhD, Dallas, TX, (Timothy.Blackburn@UTSouthwestern.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify key differences between analogue and digital imaging acquisitions. 2) Describe patient dose considerations with digital imaging. 3) List key features of information contained in a digital image beyond the visual image itself. 4) Compare the roles of DICOM, PACS, IHE, and HL7 in the electronic radiology department.

ABSTRACT

While the field of radiology was founded on analogue imaging modalities the current practice is now nearly completely digital. This requires changes in image acquisition systems, workflow, display/interpretation and storage. Digital imaging provides the potential of not only reducing patient dose but being able to maintain an electronic record of exposures. In an ever changing electronic radiology department the role of the radiographer must also change. This lecture will explore digital radiographic image acquisition, transmission, display and storage. Workflow, image analysis, and dose tracking will also be covered. Digital Imaging and Communications in Medicine (DICOM), Picture Archive and Communications Systems (PACS), and Health Level Seven (HL7) standards along with Integrated Healthcare Enterprise (IHE) initiatives will be reviewed.

Active Handout: Timothy J. Blackburn

http://abstract.rsna.org/uploads/2016/16000830/Active_RSNA2016_MSRT45.pdf

3D Printing Hands-on with Open Source Software: Advanced Techniques (Hands-on)

Wednesday, Nov. 30 2:30PM - 4:00PM Room: S401AB

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 (*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 advanced techniques for converting a medical imaging scan into a digital 3D printable model with free and open-source software. 2) To perform advanced customizations to the digital 3D printable model with free software 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. This advanced hands-on course builds upon the introductory course given by the same faculty. It will teach the learner advanced segmentation techniques used to convert a standard Digital Imaging and Communications in Medicine (DICOM) data set from a medical scan into a 3D printable model. Advanced manipulation of the digital model in preparation for 3D printing will then be discussed. All software used will be free. 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.

Teaching Congenital Heart Disease with 3D Printed Models II: Criss-cross or Twisted Heart and Related Conditions (Hands-on)

Wednesday, Nov. 30 2:30PM - 4:00PM Room: S401CD



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 (*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 criss-cross heart and related conditions. 2) Understand the pathologic and surgical anatomy of various forms of criss-cross heart and related conditions. 3) Develop ideas how to image the patients with criss-cross heart and related conditions 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 complex morphology of criss-cross or twisted hearts, superoinferior ventricles and topsy-turvy hearts. 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

RCC44

3D Printing: Clinical Applications III

Wednesday, Nov. 30 2:30PM - 4:00PM Room: S501ABC

IN

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

Participants

Jane S. Matsumoto, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Justin W. Adams, Clayton, Australia (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RCC44A 3D Printing Applications in Pediatrics

Participants

Jane S. Matsumoto, MD, Rochester, MN (*Presenter*) Nothing to Disclose

RCC44B 3D Printing in Clinical Sciences

Participants

Ciprian Ionita, PhD, Buffalo, NY, (cnionita@buffalo.edu) (*Presenter*) Grant, Toshiba Corporation; Grant, Stratasys, Inc; Grant, Vader Systems; Grant, Medtronic plc;

LEARNING OBJECTIVES

1) Describe the methods to create 3D printed patient specific vascular phantoms based on 3D angiography. 2) To demonstrate how patient specific 3D printed vascular phantoms can be used for bench top testing of endovascular devices and software. 3) To demonstrate the use of 3D printing in a clinical setting for endovascular treatment planning.

ABSTRACT

In the last decade Minimally Invasive Vascular Interventions became the preferred procedures for vascular disorders treatment, such as: cerebral aneurysms, stenoses, calcified valves, arteriovenous malformations, etc. During these procedures, the interventionalists insert a catheter using a peripheral artery access and thread it under fluoroscopy guidance, through the arterial network to the lesion site. Bench-top testing is essential in preclinical studies to determine the safety and limitations of the minimally invasive vascular procedures using endovascular devices. Similarly, software validation for blood flow estimation in humans, relies on bench top validation in vascular phantoms prior to in-vivo or clinical use. 3D printing of patient specific phantoms with realistic geometries can become a widely used tool for research and development of both software and devices. We recently have developed a method to create complex patient specific vascular and cardiac models which allow simulation of endovascular procedures and physiological simulations. We also translated the 3D printing into the clinical setting and performed a pilot study for endovascular treatment planning for patients with intracranial aneurysms, calcified mitral valves and AAA. In this course we will demonstrate one of the first realistic in-vitro 3D printed phantom for endovascular devices testing, treatment planning and blood flow simulations. These models have the potential to create a paradigm shift in the way the device safety and software validation is performed, as well as a new surgical planning tool.

RCC44C 3D Printing in Education

Participants

Justin W. Adams, Clayton, Australia (*Presenter*) Nothing to Disclose

RCC44D Quality and Safety in 3D Printing

Participants

Shuai Leng, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand quality control in each step of 3D printing, from the beginning to the end. 2) Establish a quality control program for the 3D printing. 3) Assess accuracy and precision of 3D printing for medical applications. 4) Optimize imaging and printing techniques to improve accuracy and efficiency of 3D printing.

MSRO43

BOOST: Head and Neck-Case-based Review (An Interactive Session)

Wednesday, Nov. 30 3:00PM - 4:15PM Room: S103CD



AMA PRA Category 1 Credits™: 1.25
ARRT Category A+ Credits: 1.50

Participants

Suresh K. Mukherji, MD, Northville, MI (*Presenter*) Nothing to Disclose
Sung Kim, MD, New Brunswick, NJ (*Presenter*) Nothing to Disclose
Francis P. Worden, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Theodoros Teknos, MD, Columbus, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review common tumors of the head and neck. 2) Review imaging findings in head and neck malignancies that specifically change staging. 3) Review the value of imaging in directly affecting management and treatment.

ABSTRACT

This session will be tumor board that includes a head and neck radiologist, head and neck surgeon, medical oncologist and radiation oncologist. We will discuss a variety of head and neck cancer cases and illustrate the value-added benefits and highlight of imaging affects staging, treatment and management.

SPOR41

RSNA-AOSR Joint Symposium: The Role of Imaging in Transplantation

Wednesday, Nov. 30 3:00PM - 4:30PM Room: E350



AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants

Richard L. Baron, MD, Chicago, IL (*Director*) Nothing to Disclose
Byung Ihn Choi, MD, PhD, Seoul, Korea, Republic Of (*Director*) Nothing to Disclose

Sub-Events

SPOR41A Imaging for Selection and Prioritization of LT Candidates with HCC: The Asian Perspective

Participants

Utaroh Motosugi, MD, Yamanashi, Japan (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the basic idea of liver transplantation in Japan. 2) To recognize the standard approach for the treatment of HCCs based on a guideline by Japanese Society of Hepatology. 3) To list the role of radiologists for selection of liver transplant candidates with HCCs.

ABSTRACT

Japan is one of the major countries, which develop large number of HCCs in the world. Traditionally, liver transplantation takes place in Japan much less frequently compared with western countries. Especially, the number of cadaveric transplant is enormously small. Living donor liver transplantation is a treatment option only for the patients with Child-Pugh class C disease, if present, with HCCs within Milan criteria: expected prognosis is <1 year. Therefore, most HCCs are managed with local treatment including percutaneous ablation and surgical resection. The liver imaging with CT and MRI has important role for the selection of candidate of liver transplantation. For this sake, dynamic CT is typically used because Japanese government recommends that to simplify the selection of the patients. Basic roles of pre-transplantation imaging in patients with HCC include staging of HCCs, evaluating extra-hepatic portal vein and other vessels for operators, screening diseases of other organs such as infection, intracranial hemorrhage, and malignancy, as well as steatosis of the donor's liver. Indication of liver transplantation beyond Milan criteria has been discussed for long time. That might be acceptable for living donor transplantation; if a donor's strong will is confirmed and there is no hope for the patients' survival otherwise. Liver transplantation in Japan usually means living donor transplantation, which implies patient-tailored management is necessary rather than standardization.

URL

SPOR41B Imaging for Selection and Prioritization of LT Candidates with HCC: The North American Perspective

Participants

An Tang, MD, Montreal, QC, (an.tang@umontreal.ca) (*Presenter*) Advisory Board, Imagia Cybernetics Inc

LEARNING OBJECTIVES

1) To review the diagnostic criteria of hepatocellular carcinoma (HCC) in North America. 2) To discuss the selection criteria of liver transplant candidates with HCC in USA and Canada. 3) To summarize the prioritization systems of liver transplant candidates with HCC.

ABSTRACT

Liver transplant candidates with HCC are competing for the same organs as those without HCC. Hence, it is important for this scarce resource to be allocated fairly and justly to those who will benefit the most from it. Unlike many other cancers, HCC is often diagnosed noninvasively by imaging without biopsy confirmation. A misdiagnosis by the radiologist can lead to management errors with potentially fatal implications not only for the transplant recipient but also for those left on the waiting list. In this lecture, we will briefly discuss the geographic regions and distribution of liver transplant centers in USA and Canada. We will provide an overview of the organizational structure of agencies coordinating transplant selection, prioritization, and logistics. We will review the diagnostic criteria of HCC in North America according to Liver Imaging Reporting And Data System (LI-RADS), which is congruent with the HCC diagnostic imaging components of the American Association for the Study of Liver Diseases (AASLD) and United Network for Organ Sharing and Organ Procurement and Transplantation Network (UNOS-OPTN) systems. We will discuss imaging modalities, contrast agents accepted, recommended minimum specifications for dynamic CT or MRI of the liver, and modalities accepted for extrahepatic spread or metastatic disease. We will summarize the selection criteria, staging and prioritization systems applicable to liver transplant candidates with HCC.

URL

SPOR41C Imaging of Liver Donors

Participants

Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Presenter*) 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

LEARNING OBJECTIVES

1) To illustrate essential components of preoperative evaluation of liver donor candidates for improved candidate selection and a reduction in transplant operative complication rates. 2) To review commonly used diagnostic imaging tests for assessment of the vascular and biliary anatomy, evaluation of the hepatic parenchyma and calculation of liver volumes. 3) To demonstrate common surgically relevant vascular and biliary anatomic variants.

ABSTRACT

Liver transplantation (LT) is widely accepted to be the only curative treatment modality for end stage liver disease today, and is also commonly performed in patients with hepatocellular carcinoma (HCC) who do not have a sufficient hepatic reserve to undergo resection with curative intent. In order to improve donor candidate selection, and to reduce complication related with liver transplantation, it is essential to evaluate presence of normal variation of the hepatic vasculature and biliary system, and abnormal changes of parenchyma such as hepatic fibrosis or steatosis and assessment of liver volume. Currently, many transplantation centers, preoperative evaluation of liver donor candidates is performed by using of computed tomography (CT) with three dimensional (3D) postprocessing techniques and MR imaging with magnetic resonance cholangiopancreatography (MRCP). CT angiography is able to delineate the small segmental hepatic arteries and accessory hepatic veins very well, and is also used for CT volumetry, and for screening of significant parenchymal abnormalities. Breath-hold T2 corrected MR spectroscopy as well as multi-echo chemical shift imaging can provide proton density fat fraction, which is well correlated with pathological degree of hepatic steatosis. Biliary system evaluation commonly involves a traditional T2 weighted noncontrast MRCP, but T1 weighted contrast-enhanced MRCP utilizing hepatobiliary contrast agents can be used as a supplement examinations to improve diagnostic confidence for biliary anatomy. Combined use of CT and MRI can effectively reduce the necessity of invasive tests such as liver biopsy, direct angiography or intraoperative cholangiogram in donor candidates. Although surgically relevant vascular and biliary anatomic variants are quite common, preoperative identification of surgically relevant vascular and biliary anatomic variants with imaging allowed most donor candidates with anatomical variants remain eligible for donation.

SPOR41D Imaging After Loco Regional Treatment as a Bridge to Transplant - Assessment of Response

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 radiologic stages that may qualify for priority points for liver transplant in North America. 2) To understand the rationale for loco regional treatment as a bridge to transplant. 3) To review the loco regional treatments most frequently used as a bridge to transplant. 4) To become familiar with the emerging LI-RADS criteria for treatment response assessment in pre-transplant patients.

SSM01

Breast Imaging (Tomosynthesis Screening)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: E451A



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

Discussions may include off-label uses.

Participants

Margarita L. Zuley, MD, Pittsburgh, PA (*Moderator*) Research Grant, Hologic, Inc;
Liane E. Philpotts, MD, New Haven, CT (*Moderator*) Nothing to Disclose

Sub-Events

SSM01-01 3D Breast Tomosynthesis with Digital Mammography versus Digital Mammography Alone: Comparison of Performance Metrics at Prevalence versus Incidence Screens

Wednesday, Nov. 30 3:00PM - 3:10PM Room: E451A

Participants

Kathryn Lowry, MD, Boston, MA (*Presenter*) Nothing to Disclose
Pragya A. Dang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Natasha K. Stout, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Elkan F. Halpern, PhD, Boston, MA (*Abstract Co-Author*) Research Consultant, Hologic, Inc; Research Consultant, Real Imaging Ltd; Research Consultant, Gamma Medica, Inc; Research Consultant, K2M Group Holdings, Inc
G. Scott Gazelle, MD, PhD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, Marval Biosciences Inc
Constance D. Lehman, MD, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company
Anne Marie McCarthy, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Prior screening trials with digital breast tomosynthesis (DBT) have suggested reduced recall rates and increased cancer detection rates compared with digital mammography (DM) alone. However, most trials have only examined test performance after the first (prevalence) DBT exam, and it is not clear whether these effects are sustained on subsequent exams. The purpose of this study was to compare the performance of DBT at initial and subsequent screens to performance with DM.

METHOD AND MATERIALS

After IRB approval, electronic medical records review identified screening mammograms performed 1/2009-2/2011 before DBT integration (DM), and performed 1/2013-2/2015 after DBT integration. DBT examinations were grouped into initial DBT examinations (DBT1) and DBT examinations with one or two prior DBT exams (DBT2+). Women without documentation of any prior screening mammography were excluded from analysis. Differences in recall rates, cancer detection rates, and biopsy rates were examined using chi square statistics.

RESULTS

A total of 69,049 screening DM examinations were compared with 12,153 DBT1 screens and 43,267 DBT2+ screens. Recall rates significantly decreased with DBT1 relative to DM (53 versus 62 recalls per 1,000; $p < 0.001$), and DBT2+ remained significantly lower than DM (56 per 1000; $p < 0.0001$). Total cancer detection rate significantly increased with DBT1 relative to DM (6.4 versus 4.4 per 1,000; $p = 0.003$), but decreased at DBT2+ exams and was no longer significantly different than DM (4.4 per 1,000; $p = 0.97$). Invasive cancer detection rate similarly increased at DBT1 exam compared to DM (4.4 versus 2.8 per 1,000, $p = 0.003$) but decreased at DBT2+ (3.0 per 1,000; $p = 0.53$). A similar trend was observed with biopsy rates, which increased with DBT1 compared with DM (12.1 versus 9.2 per 1,000; $p = 0.002$) and decreased with DBT2+ exams (10.3 per 1,000; $p = 0.07$).

CONCLUSION

Cancer detection rates increase with initial DBT examinations relative to DM but return to similar rates as DM at subsequent examinations, suggesting an underlying prevalence screen effect. The benefit of recall reductions observed with initial DBT screening persists on subsequent screens.

CLINICAL RELEVANCE/APPLICATION

The added value of DBT over time appears to be the benefit of improvements in recall rather than sustained increased cancer detection rates that are found with initial DBT prevalence screens.

SSM01-02 Detection of High Risk Breast Lesions Following the Addition of Tomosynthesis to Conventional Digital Screening Mammography

Wednesday, Nov. 30 3:10PM - 3:20PM Room: E451A

Awards

Student Travel Stipend Award

Participants

Arielle A. Bauer, MD, Aurora, CO (*Presenter*) Spouse, Employee, Medtronic plc; Spouse, Stockholder, Medtronic plc
Alexandra Colvin, BS, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Wei-Shin Wang, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the performance of conventional digital screening mammography with digital breast tomosynthesis in the detection of high risk breast lesions.

METHOD AND MATERIALS

The institutional review board approved this study. A database search from May 2009 through May 2015 was performed to identify all high risk lesions (atypical ductal hyperplasia, atypical lobular hyperplasia, lobular carcinoma in situ, and complex sclerosing lesion) initially detected through screening mammography. The number of digital screening mammograms and digital screening mammograms with tomosynthesis were also tabulated during the interval. Widespread digital breast tomosynthesis was instituted in May 2012. A total of 5,376 digital screening mammograms were performed from May 2009 to May 2012, while 28,423 digital screening mammograms with tomosynthesis were performed between May 2012 and May 2015. The Fischer exact test was employed to determine any significant association between screening modality and the detection of high risk lesions.

RESULTS

Seventy-four high risk lesions were identified with conventional digital screening mammography, corresponding to a detection rate of 1.38%, while eighty high risk lesions were identified after the institution of tomosynthesis, corresponding to a detection rate of 0.3% ($p < .001$). Of those that underwent surgical excision, 20.3% of the lesions identified with conventional mammography were upstaged, while 15% of lesions identified with digital mammography plus tomosynthesis were upstaged ($p = 0.2$).

CONCLUSION

The addition of tomosynthesis to conventional digital mammography significantly decreases the detection rate of high risk lesions when compared to conventional digital mammography.

CLINICAL RELEVANCE/APPLICATION

The addition of tomosynthesis to conventional digital mammography decreases the detection of high risk breast lesions while increasing breast cancer detection and is recommended for women undergoing breast cancer screening.

SSM01-03 New Image Processing for Digital Breast Tomosynthesis and Mammography Improved for Feature Enhancement and Dose Reduction

Wednesday, Nov. 30 3:20PM - 3:30PM Room: E451A

Participants

Tokiko Endo, MD, Nagoya, Japan (*Presenter*) Institutional Grant support, FUJIFILM Holdings Corporation

Takako Morita, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

Mikinao Ooiwa, Nagaya, Japan (*Abstract Co-Author*) Nothing to Disclose

Namiko Suda, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

Misaki Shiraiwa, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

Kazuaki Yoshikawa, MD, Hamada, Japan (*Abstract Co-Author*) Nothing to Disclose

Yukie Hayashi, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

Hirotooshi Ogawa, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

Takao Horiba, Kagamihara, Japan (*Abstract Co-Author*) Nothing to Disclose

Shu Ichihara, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

Yasuyuki Satoh, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Digital breast tomosynthesis (DBT) used in combination with digital mammography (FFDM) has been reported as lacking in its ability to demonstrate and allow characterization of microcalcifications, while the main improvement required for DBT+FFDM is dose reduction. In this study, we applied newly developed image processing to DBT and FFDM, and evaluated diagnostic performance at a combined dose the same as that of conventional FFDM alone.

METHOD AND MATERIALS

An institutional review board approved this study and written informed consent was provided by all patients. Mediolateral oblique and craniocaudal images of 200 breasts were obtained from 100 subjects aged 27–85 years (mean, 51 years). An improved reconstruction algorithm for DBT was developed to enhancing microcalcification shape and mass margins. New image processing for FFDM was developed to enhancing fine breast structure while suppressing noise. Images were acquired with the average glandular dose (AGD) for the improved DBT and FFDM processing at approximately 40 % and 70 % that of conventional FFDM respectively. The diagnostic accuracy of FFDM with new processing and reduced dose was the same as conventional FFDM in a comparison of two cohorts with almost the same number of findings. Four radiologists qualified in breast imaging interpreted the images independently. Diagnostic accuracy was assessed by comparing sensitivity, specificity and area under the receiver operating characteristic curve (AUC).

RESULTS

Sensitivity of DBT+FFDM with new processing and reduced dose increased significantly to the level of conventional FFDM (79.2 % vs. 70.8 %, $P = 0.033$) while maintaining specificity and AUC. All of four radiologists showed increased sensitivity (75.0 % vs. 62.5 %, 79.2 % vs. 75.0 %, 83.3 % vs. 75.0 %, and 79.2 % vs. 70.8 %). The AGD per view of the conventional FFDM and the improved DBT+FFDM was 1.04–3.50 mGy (mean, 1.78 mGy) and 1.03–2.57 mGy (mean, 1.62 mGy) respectively.

CONCLUSION

New image processing for DBT+FFDM for mammographic feature enhancement and dose reduction provided sensitivity improved above that of conventional FFDM alone, even at the same total AGD.

CLINICAL RELEVANCE/APPLICATION

New image processing for DBT+FFDM improved diagnostic sensitivity, while reducing patient dose dramatically.

SSM01-04 Comparison of Screening Performance Metrics in a Large Established Tomosynthesis Practice with

Conventional Digital Mammography: Are the Initial Reported Benefits Sustained?

Wednesday, Nov. 30 3:30PM - 3:40PM Room: E451A

Participants

Pragya A. Dang, MD, Boston, MA (*Presenter*) Nothing to Disclose
Kathryn Lowry, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Anne Marie McCarthy, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Elkan F. Halpern, PhD, Boston, MA (*Abstract Co-Author*) Research Consultant, Hologic, Inc; Research Consultant, Real Imaging Ltd; Research Consultant, Gamma Medica, Inc; Research Consultant, K2M Group Holdings, Inc
Constance D. Lehman, MD, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company

PURPOSE

Current evidence suggests decreased abnormal interpretation rates (AIR) and increased cancer detection rates (CDR) with Digital Breast Tomosynthesis (DBT) when compared to conventional digital mammography (DM). However, most of the reported performance metrics are from early experience with this technology. It remains unknown if these benefits are sustained over time. The purpose of our study is to compare screening performance of a large established DBT practice two years after initial implementation of DBT with DM alone, adjusting for patient variables and radiologist experience known to impact performance.

METHOD AND MATERIALS

In this IRB approved, HIPAA compliant study, we reviewed medical records to identify consecutive screening DBT exams from 1/2013-3/2015, and consecutive screening DM exams from 1/2009-3/2011. Performance statistics were calculated according to American College of Radiology BI-RADS 5th edition. AIR, CDR, positive predictive values (PPV), and Recommendations for Biopsy (RecBX) were compared for the two time periods. Logistic regression analysis was performed to assess for differences in performance, adjusting for patient demographics (age, density, race, presence of prior mammograms) and radiologist years of experience.

RESULTS

The study included 155,285 exams (78,298 DM and 76,987 DBT exams) (mean age: 57.7 years, range 28-98). After adjusting for patient demographics (age, density, race, presence of prior exam) and radiologist experience, the AIR of the DBT group (6.26, 4822/76987) was significantly lower than the DM group (6.89, 5397/78298), ($p < 0.0001$); [adjusted OR: 0.72, 95% Confidence Interval [CI] (0.70-0.76)]; adjusted CDR for DBT (4.9/1000 screens) was not significantly different from DM (4.7/1000), ($p = 0.74$); and the adjusted RecBX for 2D (1.26%) was slightly higher than DBT (1.25%) ($p < 0.001$). The PPVs (1,2,3) for DM and DBT were 6.6%, 34.8%, 40.7%, and 7.8%, 36.4%, and 41.1%, respectively.

CONCLUSION

Reduction in AIRs with DBT reported in smaller studies from early implementation of this technology are sustained over time. CDRs, however, are unchanged from the DM group in a mature tomosynthesis practice over time.

CLINICAL RELEVANCE/APPLICATION

The benefit of reduced false positives with implementation of tomosynthesis is sustained over time; however, increased cancer detection rates as noted in earlier studies may not persist in established tomosynthesis practices.

SSM01-05 Clinical Screening Performance of Tomosynthesis with Synthesized 2D Mammograms Compared to Tomosynthesis with Full Field Digital Mammography

Wednesday, Nov. 30 3:40PM - 3:50PM Room: E451A

Awards

Student Travel Stipend Award

Participants

Emily Ambinder, MD, MSc, Baltimore, MD (*Presenter*) Nothing to Disclose
Susan C. Harvey, MD, Lutherville, MD (*Abstract Co-Author*) Nothing to Disclose
Babita Panigrahi, MD, BS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan W. Woods, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Digital breast tomosynthesis (DBT) in screening mammography decreases recall rate and increases cancer detection rate. Most practices combine DBT with a 2D full field digital mammogram (FFDM) in order to facilitate comparison to prior FFDM exams. However, the combination of FFDM and DBT has a two-fold higher radiation dose. In order to mitigate the increased radiation dose, we began using synthesized 2D mammograms (SM) in place of FFDM for patients undergoing screening mammography with DBT following FDA approval of this method. The purpose of this study was to evaluate the screening performance of DBT with SM compared to the combination of DBT and FFDM for screening mammography.

METHOD AND MATERIALS

We retrospectively reviewed all screening studies utilizing DBT between 2014 and 2016. We divided the studies into two groups: DBT+FFDM (studies performed on or before 2/15/2015) and DBT+SM (studies performed after 2/15/2015). Overall recall rate, recall rate for specific findings, positive predictive value 1 (PPV1), and cancer detection rate (CDR) were compared between the two groups using the Chi-square test.

RESULTS

There were 5342 screening exams in the DBT+FFDM group and 14980 screening exams in the DBT+SM group. The total recall rate was 7% for the DBT+FFDM group and 7.2% for the DBT+SM group ($p = 0.66$). There was no effect on positive predictive value 1 (7.08 versus 7.61, $p = 0.87$) or cancer detection rate (4.87 versus 5.27, $p = 0.81$). The number of technical callbacks between these groups was similar (0.37% versus 0.40%, $p = 0.89$). Indications for recall were also compared between the two groups. No differences were found between recall rates for masses (2.68% versus 2.97%, $p = 0.29$), calcifications (1.37% versus 1.46%,

p=0.69), asymmetries (2.68% versus 2.65%, p=0.91), or distortions (0.80% versus 0.40%, p=0.89).

CONCLUSION

When DBT is performed for screening, the use of a synthesized 2D mammogram rather than an additional FFDM has no significant effect on recall rate, positive predictive value 1, or cancer detection rate, and spares unnecessary radiation dose.

CLINICAL RELEVANCE/APPLICATION

Synthesized 2D mammogram can replace the traditional 2D digital mammogram for patients undergoing screening with digital breast tomosynthesis, decreasing radiation dose.

SSM01-06 Lesion Conspicuity on Synthetic Mammography Images Compared to Full Field Digital Mammography Images in the Screening Setting

Wednesday, Nov. 30 3:50PM - 4:00PM Room: E451A

Participants

Catherine S. Giess, MD, Wellesley, MA (*Presenter*) Nothing to Disclose
Eren D. Yeh, MD, Boston, MA (*Abstract Co-Author*) Consultant, Hologic, Inc; Consultant, Statlife
Eva C. Gombos, MD, Boston, MA (*Abstract Co-Author*) Royalties, Reed Elsevier
Elisabeth P. Frost, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Christine M. Denison, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sona A. Chikarmane, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Reza Pakdaman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sughra Raza, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the conspicuity of imaging findings evaluated at screening mammography on synthetic mammography (SM) + digital breast tomosynthesis (DBT) images to conspicuity on full field digital mammography (FFDM) + DBT images.

METHOD AND MATERIALS

Seven breast imagers each prospectively evaluated approximately 100-200 screening mammograms (FFDM, DBT, and SM; total 1206 examinations) over a 12 week period in sets of 10-50 consecutive examinations per screening session. Radiologists alternated viewing SM + DBT first, followed by FFDM views at one interpretation session, and subsequently viewed FFDM views + DBT followed by SM at the next interpretation session. Presence / absence of evaluable findings, and finding conspicuity [masses (M), calcifications (C), asymmetries (A), focal asymmetries (FA), and architectural distortion (AD)] on SM compared to FFDM were evaluated and BIRADS 0 or 1 / 2 assigned. DBT-only findings were excluded from analysis.

RESULTS

Results: Mammograms in 1206 patients were reviewed, with 119 patients recalled (9.9%). There were 409 evaluated findings (after 11 DBT-only findings excluded) considered BIRADS 0, 1, or 2, including 72 A, 35 FA, 49 AD, 119 C, and 134 M. Mass conspicuity on SM compared to FFDM included 72 equal, 5 more conspicuous, 54 less conspicuous, and 3 not seen on SM. FA/A conspicuity on SM compared to FFDM included 45 equal, 16 more, and 46 less. AD conspicuity on SM compared to FFDM included 1 only on SM, 18 equal, 27 more, and 3 less. C conspicuity on SM compared to FFDM included 7 only on SM, 13 equal, 95 more and 4 less. FFDM had significantly better conspicuity than SM for masses and asymmetries (p< 0.001); SM had significantly better conspicuity for calcifications and architectural distortion than FFDM (p<0.001).

CONCLUSION

Most findings are seen on both SM and FFDM during screening mammography. A strength of SM compared to FFDM is conspicuity of calcifications and architectural distortions, while a relative weakness is conspicuity of masses and asymmetries. Radiology practices replacing FFDM with SM should be aware that masses and asymmetries may be less conspicuous, potentially increasing emphasis on DBT data for detecting these findings.

CLINICAL RELEVANCE/APPLICATION

SM can be used to replace FFDM and lower radiation dose. However, radiologists utilizing SM should be aware of its relative strengths and weaknesses compared to FFDM in depicting different lesion types.

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/>

Catherine S. Giess, MD - 2015 Honored Educator
Eren D. Yeh, MD - 2015 Honored Educator
Sughra Raza, MD - 2015 Honored Educator

SSM02

Breast Imaging (Practice Issues)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: E451B

BR

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

Participants

Susan Weinstein, MD, Philadelphia, PA (*Moderator*) Consultant, Siemens AG
Stamatia V. Destounis, MD, Scottsville, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSM02-01 Trends in Breast Imaging: An Analysis of 21 Years of RSNA Abstracts

Wednesday, Nov. 30 3:00PM - 3:10PM Room: E451B

Participants

Samantha L. Heller, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yiming Gao, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to delineate trends and shifts in breast imaging as represented through the RSNA scientific program.

METHOD AND MATERIALS

Twenty-one years (1995-2015) of available RSNA program catalogues from the annual meeting were searched for the following criteria: session topic/modality, gender and degree of presenting author, national or international origin of abstract, study design. Stated grant or society funding and industry ties or support were also recorded.

RESULTS

Over the study period, we identified 1703 breast scientific program abstracts. Although we note increasing variety of investigated modalities, studies invoking MRI were consistently represented in the highest proportion per year, even from early years (27/87 (31%) in 1995; 20/96 (21%) in 2000; 16/75 (21%) in 2005; 28/72 (39%) in 2010; 30/116 (26%) in 2015. Tomosynthesis (DBT) abstracts have recently increased rapidly in number, representing 0% in 1995, and 2000, 5/75 (6.6%) in 2005, 5/72 (6.9%) in 2010 and 24/116 (24%) in 2015. Women were more frequently presenting authors than men, consistent over the study period (43/71 [61%] women in 1995 and 70/96 [73%] women in 2015). The majority of presenters held MD degrees (range 79.3-87.4% per year) while PhD's represented a minority (12.6%-20.7% per year). Prospective studies were consistently in the minority of abstract study design. Proportion of international representation has increased over time (24.1% of abstracts in 1995 compared to 54.3% in 2015). Although majority of studies do not report external sources of funding, industry ties and support were consistently more common than grant funding (up to 3x as much in some years).

CONCLUSION

Even as new radiologic modalities are explored, there is consistent and long-standing interest in core breast modalities, in particular MRI. International representation has steadily increased over 21 years. Majority of studies are unfunded; however, industry support permeates radiology research to a greater degree than government grants.

CLINICAL RELEVANCE/APPLICATION

A long-range overview and analysis of trends and patterns in breast imaging research allows for reflection on and discussion of current and future directions in the breast imaging field.

SSM02-02 State Mandated Breast Density Reporting Language: The Patient Experience

Wednesday, Nov. 30 3:10PM - 3:20PM Room: E451B

Participants

Lucy B. Spalluto, MD, Nashville, TN (*Presenter*) Nothing to Disclose
Consuelo Wilkins, MD, MSc, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To survey women who have received screening mammography reports containing state mandated breast density language regarding their understanding of exam results, preference for exam results, and understanding of the role of the radiologist.

METHOD AND MATERIALS

Study participants were identified through an institutional participant repository recruitment tool of patients confirming interest in research studies and through ResearchMatch.org. Inclusion criteria included women within the targeted state greater than age 40. Email invitations containing a link to the anonymous, electronic based survey were sent to potential participants. The survey was composed of 4 sections: Demographics, Understanding for examination results, Preference for result reporting, and Understanding of the role of the radiologist. The survey was administered via a mature, secure web application.

RESULTS

920 responses were elicited from the 1924 invited participants for a 47.8% response rate. While most women (95%, 832 of 870) felt that the state mandated language adequately informed patients that they have dense breast tissue and informed them that dense breast tissue can affect the interpretation of a mammogram (96%, 835 of 870), patients were uncertain what to do with this

information. 41% (358 of 865) did not think the statement adequately informed patients what to do if they have dense breast tissue and 83% (716/ of 868) did not think the statement adequately informed patients of what additional screening options are available to patients with dense breast tissue. While most of the surveyed women (83%, 717 of 860) knew a radiologist is a doctor, only 41% (349 of 848) knew that radiologists perform minimally invasive procedures.

CONCLUSION

The importance of breast density and patient awareness of breast density has led to legislation in many states mandating radiologists to directly notify patients of their breast density. In some of these states, standard legal language is issued for reporting. The results of this study demonstrate that the current mandated language may not meet the informational needs of patients. Further needs assessment for breast density reporting should be considered.

CLINICAL RELEVANCE/APPLICATION

The informational needs of patients receiving breast density results should be established in order to optimize breast density reporting methods.

SSM02-03 Impact of Second-Opinion Review of Breast Imaging at a Cancer Center: Is It Worthwhile?

Wednesday, Nov. 30 3:20PM - 3:30PM Room: E451B

Awards

Student Travel Stipend Award

Participants

Kristen Coffey, MD, New York, NY (*Presenter*) Nothing to Disclose
Donna D. D'Alessio, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Delia M. Keating, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Second-opinion review of breast imaging studies can be a time consuming and labor-intensive process. The purpose of our investigation is to determine if reinterpretation of outside studies impacts clinical management, specifically by detecting additional cancer and preventing unnecessary biopsy.

METHOD AND MATERIALS

Retrospective IRB-approved review of submitted outside breast imaging studies for 200 patients seeking second opinions between January and April 2014 was performed. Each case was evaluated for concordance between the original report and second-opinion interpretation. Second-opinion review resulting in the recommendation and performance of new biopsies was further subdivided into benign, high-risk, and malignant categories based on histopathology obtained at our institution.

RESULTS

Second-opinion review of 200 patients found a change in interpretation in 55 cases (28%; 95% CI: 21-34). Overall, 26 recommendations led to a major change in management (13%; 95% CI: 9-18). Twenty new biopsies were performed, yielding 10 malignancies (5%; 95% CI: 2-9) and 4 high-risk lesions (2%; 95% CI: 1-5). Surgical management was changed to mastectomy in 60% patients with new sites of biopsy-proven malignancy. Eight biopsies were spared (4%; 95% CI: 2-8) due to benign interpretation of the imaging findings, with no disease at 1-year follow up.

CONCLUSION

Reinterpretation of outside studies at our cancer center resulted in a change in interpretation in more than a quarter of submitted studies, detecting additional cancer in 5% and averting biopsies in 4%. The practice of second opinion review is therefore a worthwhile utilization of resources and valuable for patient care.

CLINICAL RELEVANCE/APPLICATION

Subspecialty second-opinion review of outside breast imaging has a significant impact on surgical management.

SSM02-04 Management of Two or More Sites of Indeterminate Calcifications in Women without a Concurrent Breast Cancer Diagnosis

Wednesday, Nov. 30 3:30PM - 3:40PM Room: E451B

Participants

Lauren Q. Chang Sen, MD, Houston, TX (*Presenter*) Nothing to Disclose
Monica L. Huang, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jessica W. Leung, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Wei Wei, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Beatriz E. Adrada, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To Investigate the malignancy rate of simultaneous stereotactic biopsies of two or more distinct sites of indeterminate calcifications in women without a concurrent breast cancer diagnosis

METHOD AND MATERIALS

This is a retrospective observational IRB-approved study. Stereotactic biopsy patients with concurrent breast cancer or single site biopsy of calcifications were excluded from the study. During a 39-month period at our institution, 264 patients with two or more distinct sites of calcifications (in either the same or opposite breast) underwent 557 stereotactic core biopsies, constituting the study cohort. Fisher's exact test was used to compare cancer rates.

RESULTS

Of 264 patients, 52 separate calcifications in ipsilateral or bilateral breasts who underwent stereotactic biopsies, 71 (26.9%)

Of 204 patients with 2 separate calcifications in ipsilateral or bilateral breasts who underwent stereotactic biopsies, 71 (29.9%) patients were diagnosed with malignancy: 8 invasive ductal carcinomas (five grade 2 and three grade 3, mean 0.9cm, median 0.6cm, range 0.3-1.7cm,) and 63 DCIS;. Another 57 (21.6%) patients had high risk histopathology on core biopsy. No significant difference in cancer yield is detected between ≥ 2 simultaneous biopsy of calcifications in the same one (53/172, 30.8%) versus both breasts (18/92, 19.6%), $p=0.06$. There is a significantly lower cancer rate in patients with calcifications of the same morphology (31/156, 19.9%) compared to those of different morphologies (40/108, 37.0%), $p=0.003$. 126 out of 156 (80.8%) patients with calcification of the same morphology had the same pathology category (benign vs. high risk vs. malignant). In those 126 patients, 17 (13.5%) patients were diagnosed with cancer.

CONCLUSION

There is a substantial cancer rate in patients with stereotactic biopsies of multiple separate calcifications in the same or both breasts. When there are multiple similar appearing distinct sites of calcifications, the same histopathology is detected in 80.8% of patients.

CLINICAL RELEVANCE/APPLICATION

Although 80.8% of calcifications with the same morphology had the same histopathology, near 20% had different histopathology. Therefore, biopsy of each site is still required for surgical management.

SSM02-05 Neoplastic Seeding in the Setting of Percutaneous Image Guided Breast Biopsies

Wednesday, Nov. 30 3:40PM - 3:50PM Room: E451B

Participants

Lumarie Santiago, MD, Houston, TX (*Presenter*) Nothing to Disclose
Beatriz E. Adrada, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Monica L. Huang, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rosalind P. Candelaria, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe imaging features, primary tumor features, and biopsy technique in neoplastic seeding (NS) following percutaneous breast biopsies (BX).

METHOD AND MATERIALS

An IRB-approved retrospective review of patients presenting from January 1, 2009 - January 30, 2016 with new diagnosis of breast cancer, abnormal mammogram or palpable abnormality and subsequent diagnosis of NS along the BX needle tract. All patients underwent diagnostic mammography (FFDM) and whole breast ultrasound (US). Tumor histology, grade, receptor status, size, and TNM staging as well as BX guidance, needle gauge, and number of passes were recorded. The time from BX to NS diagnosis was measured. The imaging features of the primary breast malignancy (PBM) and NS were reviewed.

RESULTS

Eight (0.2%) NS cases were identified in 4,010 patients. Mean PBM cancer size was 2.7 cm (range 1.6-5.7). US guidance was used in 6 cases (75%). Multiple insertion core needle BX was done in 6 (75%) cases. Single insertion vacuum assisted needle BX was done in 1 case. Sampling information was absent in 1 case. The mean number of passes was 4.25 (range 1-11). The mean time from BX to NS diagnosis was 60.8 days (range 34-165). In 7 (87.5%) cases tumor histology was IDC. A single case of papillary carcinoma was noted. In 6 (75%) cases tumor grade was high (2/3). All (100%) PBM were Her2 negative, 6 (75%) were PR negative and 5 (62.5%) were ER negative. In 7 (87.5%) cases tumors were unifocal. All PBM presented with a mass by FFDM. Associated calcifications were noted in 2 (25%) cases. Corresponding US masses were most frequently irregular (75%), not circumscribed (87.5%) and heterogeneous (50%). Most frequent NS FFDM presentation was focal asymmetry (37.5%) and occult (25%). Most frequent NS US presentation was mass (87.5%) often irregular (62.5%), not circumscribed (75%) and hypoechoic (87.5%). NS was most frequently subdermal in location (75%).

CONCLUSION

Multiple insertion BX, Her2 negative and high grade tumors may be risk factors for NS after percutaneous BX. PBM and NS have variable FFDM and US features. NS most frequently presented as a mass on US while having variable presentation at FFDM.

CLINICAL RELEVANCE/APPLICATION

Although rare, NS should be suspected based on its temporal and geographic relationship to the initial biopsy when there is apparent disease progression in HER2 negative and high-grade cancers.

SSM02-06 Practice Changing Outcomes of Tomosynthesis: Shifting Volumes and Diminishing Distinctions between Screening and Diagnostic Patients

Wednesday, Nov. 30 3:50PM - 4:00PM Room: E451B

Participants

Reni S. Butler, MD, Madison, CT (*Abstract Co-Author*) Nothing to Disclose
Christine Puciato, RT,BS, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Maria Gumkowski, RT, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Jacquelyn Crenshaw, RT, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Anees Chagpar, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Laura S. Sheiman, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Madhavi Raghu, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Liane E. Philpotts, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Digital breast tomosynthesis (DBT) is changing the practice of breast imaging with decreased screening recalls and abbreviated diagnostic studies. The purpose of this study is to examine trends in the volume of screening and diagnostic mammograms in the last three years, and to assess alterations in how they are performed which may blur distinction between the two, specifically the

proportion of screening patients receiving immediate results and the proportion of diagnostic patients imaged with only four views.

METHOD AND MATERIALS

A HIPAA compliant audit of the breast imaging electronic database (PenRad, MN) at a dedicated breast center offering DBT to all patients was performed to identify screening and diagnostic mammograms performed over 3 one-year intervals: A:10/1/12–9/30/13, B:10/1/13–9/30/14, C:10/1/14–9/30/15. The volume of each type of exam performed during this time was recorded along with the volume of patient visits to the clinical breast center (a surrogate for diagnostic referrals). In addition, the percentage of screening patients receiving immediate results was assessed, and the number of diagnostic patients imaged with only four routine views was determined.

RESULTS

The total number of exams performed during the three periods was similar A: 16,906, B: 16,813, C: 16,415. The number of clinical patient visits increased slightly over the three years. Screening mammograms increased (A: 5,726, B: 5,764, C: 6,710) by 17% while diagnostic mammograms decreased (A: 5,387, B: 5,048, C: 3,805) by 29%. The percentage of screening patients receiving immediate results increased by a factor of 2.5: from 18% in year 1 to 46% in year 3. The percentage of diagnostic patients imaged with only four routine views increased by a factor of 3: from 24% in year 1 to 73% in year 3.

CONCLUSION

Continued utilization of DBT in the screening and diagnostic environment over time allows for both a reduction in volume and number of views for diagnostic mammograms and an increase in volume of screening mammograms.

CLINICAL RELEVANCE/APPLICATION

DBT is changing current paradigms of breast imaging practice, including the way screening and diagnostic mammograms are defined and performed, with implications for patient scheduling, breast center staffing, and the option to give more patients immediate results.

SSM03

Cardiac (Acute Chest Pain/Pulmonary Vascular Disease)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S502AB



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

Participants

Istvan Battyani, MD, PhD, Pecs, Hungary (*Moderator*) Nothing to Disclose
E. Kent Yucel, MD, Boston, MA (*Moderator*) Nothing to Disclose
Diana Litmanovich, MD, Haifa, Israel (*Moderator*) Nothing to Disclose

Sub-Events

SSM03-01 Overall Cost-Effectiveness of Acute Chest Pain CT in Comparison with Standard Treatment

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S502AB

Participants

Julian L. Wichmann, MD, Charleston, SC (*Presenter*) Nothing to Disclose
Katharina Otani, PhD, Tokyo, Japan (*Abstract Co-Author*) Employee, Siemens AG
Christian Tesche, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Stefan Baumann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; Consultant, Guerbet SA; ; ;
Sheldon Litwin, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Richard Bayer, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Matthias Renker, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Christine M. Carr, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Previous studies have demonstrated more efficient time-to-diagnosis and time-to-discharge with cardiac CT angiography (cCTA) as the initial imaging test in patients presenting with acute chest pain over traditional management protocols, along with reduced cost of the index episode of care; however some failed to identify benefits in down-stream test utilization. We evaluated the comparative cost-effectiveness and efficacy of cCTA in the overall care for chest pain patients.

METHOD AND MATERIALS

We performed a retrospective single-center analysis in 2,156 patients who presented to the emergency department (ED) with acute chest pain. Patient cohorts matched by patient characteristics and pretest likelihood for coronary artery disease (CAD) had undergone cCTA as a primary imaging test (n=1,139) or a traditional standard of care protocol (n=1,017). Cost-relevant factors of ED visits, utilization of downstream tests, and total patient care cost were compared.

RESULTS

No significant differences between groups were observed for age, gender, race, BMI, or CAD risk factors (all $P>0.08$). In addition, no significant differences in the diagnosis of CAD, pulmonary embolism, or aortic dissection were observed (all $P>0.11$). Time to discharge (4.5 vs. 7 hours), hospital admission rate (12.6% vs. 54.2%), length of hospital stay (48 vs. 72 hours), and readmission rate within 30 days (3.5% vs. 14.6%) were significantly lower (all $P>0.001$) in cCTA patients. Reduced rates of additional downstream testing (e.g. nuclear stress test) and invasive coronary angiography (4.9% vs. 22.7%; $P<0.001$), and ultimately lower total cost per patient (11,783\$ vs. 18,996\$, $P<0.001$) were observed in the cCTA arm.

CONCLUSION

In this large single-center study the use of cCTA as the initial imaging test in patients presenting with acute chest pain was associated with shorter ED and hospital stays, lower readmission rates, and ultimately lower total patient care cost, mainly owing to reduced rates of additional downstream test utilization.

CLINICAL RELEVANCE/APPLICATION

cCTA may improve the efficacy of healthcare delivery in patients with acute chest pain compared to traditional management and ultimately reduce the associated overall cost of care.

SSM03-02 Cardiac MRI Assessment of Candidates for Vasodilator Treatment of Pulmonary Hypertension (PHTN): Reproducibility and Accuracy

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S502AB

Participants

Silanath Terpenning, MD, Albuquerque, NM (*Presenter*) Nothing to Disclose
Loren H. Ketai, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Lana Melendres, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Michel Boivin, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Christopher T. Bunn, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Determine the reproducibility and accuracy of cardiac MRI for assessment of right ventricular (RV) function in patients with

pulmonary hypertension (PHTN) who are initiating vasodilator therapy.

METHOD AND MATERIALS

Patients with PHTN who underwent cardiac MRI between 2/16/2015 to 3/18/2016 for pre- vasodilator therapy assessment or reassessment while on vasodilators were retrospectively studied. Non-gadolinium enhanced MRIs were performed at 1.5T and included standard SSFP images and phase contrast assessment of pulmonary valve flow (PVF). Readers independently measured right ventricular (RV) volumes including RV end diastolic volume (RVEDV) and determined cardiac output (CO) using these volumes and using PVF. Reader agreement for measurement of RV volumes was assessed by interclass correlation coefficients (ICCs). MRI CO measurements were compared to right heart catheterization (RHC), results assessed by linear regression and Bland-Altman analysis.

RESULTS

20 patients underwent a total of 33 cardiac MRIs, 13 MRIs performed after initiation of treatment. Correlative RHC data was available for 20 MRIs. Median interval between MRI and catheterization was 5 days (range 0-101). Reader ICCs for RVEDV were high whether measured on 4-chamber (.981) or short axis (.976) views. ICCs for CO measured on 4 chamber view (.934) and short axis view (.868) were also high, as was the ICC for CO measured using or PVF (.942). Measurements of CO on 4-chamber and short axis views and CO measured using PVF all correlated with the RHC CO. The CO calculated from PVF attained the best correlation with RHC CO for both readers ($r = .844$, $r^2 = .712$ and $r = .771$, $r^2 = .594$). Bland Altman analysis confirmed agreement between the PVF CO and RHC CO, and demonstrated differences between these measures of CO to be 0.54 ± 1.3 L/min and 0.65 ± 1.5 L/min for the two readers.

CONCLUSION

In patients with PHTN being considered for vasodilator therapy cardiac MRI assessment of RV volumes is highly reproducible. CO measurement using PVF may manifest a small negative bias compared to RHC CO, but is highly correlated with it. Together MRI measurement of RV volumes and CO may be sufficient for following trends in vasodilator treatment response.

CLINICAL RELEVANCE/APPLICATION

Cardiac MRI may help guide therapy in the growing number of PHTN patients on long term vasodilator treatment

SSM03-03 Correlation between Systolic and Diastolic Left Ventricular Strain and Right Ventricular Function in Pulmonary Arterial Hypertension: Assessment by Cardiac Magnetic Resonance Imaging

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S502AB

Awards

Trainee Research Prize - Fellow

Participants

Manijeh Zarghampour, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Mounes Aliyari Ghasabeh, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Celia P. Corona-Villalobos, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Todd Kolb, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Rachel Damico, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Stephen M. Mathai, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Takahiro Sato, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Bharath Ambale Venkatesh, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Elzbieta Chamera, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Joao A. Lima, MD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Paul M. Hassoun, MD, Baltimore, MD (*Abstract Co-Author*) Scientific Advisory Board, Gilead Sciences, Inc
Ihab R. Kamel, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Stefan L. Zimmerman, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pulmonary Hypertension (PH) is characterized by increased pulmonary vascular resistance, which leads to right ventricular (RV) pressure overload and failure. Through ventricular interdependence, altered RV pressure and volumes influence left ventricular (LV) filling dynamics and function. We sought to investigate the relationship of systolic and diastolic LV strain measurements with global function of the RV and PH severity on cardiovascular magnetic resonance (CMR) imaging.

METHOD AND MATERIALS

In this retrospective, IRB approved and HIPPA compliant study 42 patients (87% female, mean age 59 ± 11 years) with suspected PH were referred to CMR and right heart catheterization (RHC). Cine SSFP CMR in short-axis, 2-chamber and 4 chamber planes were used with feature tracking strain software (MTT, Toshiba Medical Systems, Tokyo, Japan) to calculate longitudinal and circumferential systolic and diastolic strain indices. Pearson's Correlation coefficient was used to assess the relationship between LV strain measurements and global function of RV.

RESULTS

By RHC, 37 patients were diagnosed with PH and 5 had no PH. Mean pulmonary artery pressure (mPAP) was 35.3 ± 13.0 mmHg and mean pulmonary vascular resistance (PVR) was 6.5 ± 5.0 Woods units. LV peak longitudinal systolic strain was associated with RV function but not mPAP, with a significant negative correlation of RV ejection fraction (EF) and global peak longitudinal strain ($r = -0.45$, $p = 0.003$). Figure 1 shows an example of longitudinal strain results for one of the participants. Similar significant correlations were seen between systolic longitudinal strain and RV mass. Conversely, LV early diastolic longitudinal strain rate was not correlated with RVEF or RV mass. Peak systolic circumferential strain and early diastolic circumferential strain rate showed no significant correlation with either RVEF or RV mass.

CONCLUSION

Reduced RV function in the setting of PH is associated with concomitant reductions in LV longitudinal systolic function, whereas longitudinal diastolic function and circumferential strain are less affected.

CLINICAL RELEVANCE/APPLICATION

Negative effects of PH on cardiac function are not limited to the RV, but can also be associated with reduced LV systolic function, which could contribute to patient symptoms and may be relevant for patient management.

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
Ihab R. Kamel, MD, PhD - 2015 Honored Educator

SSM03-04 Abbreviated Interpretation of Coronary CTA in the Emergency Setting

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S502AB

Participants

Jeffrey D. Robinson, MD, MBA, Seattle, WA (*Presenter*) Consultant, HealthHelp, LLC; President, Cleareview, Inc;
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Kathleen R. Fink, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Rachael M. Edwards, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Ferdia Bolster, FFRRCSI, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Joel A. Gross, MD, MS, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study is designed to test the accuracy of limited axial interpretation (AI) of coronary CT angiography (CCTA) compared to the conventional full interpretation (FI), which uses advanced post-processing tools, to identify patients with no or minimal coronary artery disease (CAD) in the Emergency Department (ED).

METHOD AND MATERIALS

This is a retrospective IRB-approved study. A stratified random sample of 86 exams from 163 consecutive conventionally performed CCTA exams were selected to achieve a 1:1 ratio of patients with and without >30% stenosis in at least one coronary segment. 60 exams used dedicated CCTA and 26 used triple rule-out (TRO) protocols. Exams were randomly allocated among 5 readers who examined only the axial source images saved in PACS and recorded on a per-segment basis, whether there was no stenosis, 1-30% stenosis or >30% stenosis. The original reports were reviewed independently and segmental assessment of stenosis abstracted using the same criteria. The diagnostic accuracy of the AI was assessed by calculating the sensitivity and specificity per patient using the final dictated reports based on the CI as the reference standard.

RESULTS

Allowing for variations in coronary artery anatomy, 1,186 segments were identified by AI for interpretation. A total of 287 segments were not evaluable (163 due to motion, 85 which were too small to assess, 37 with poor contrast enhancement, and 2 for other reasons), leaving 899 segments from 84 patients available for analysis. Of these patients, 33 (39%) had >30% stenosis in at least one segment by FI. AI had an overall per-patient sensitivity of 91% (30/33, 95% confidence interval: 76-98%) and specificity of 78% (40/51, 95% confidence interval: 65-89%). The dedicated CCTA and TRO protocols had similar sensitivity (85% vs. 100%, $p=0.26$) and specificity (80% vs. 76%, $p=0.74$).

CONCLUSION

AI shows good sensitivity and specificity in identifying patients with minimal or no CAD compared to FI.

CLINICAL RELEVANCE/APPLICATION

Limited axial interpretation can identify patients with no or minimal CAD reduce costs, speed results delivery and improve access to CCTA in the ED while preserving data for post-processing if needed.

SSM03-05 Triple-Rule-Out CT Angiography with Dual-Energy Spectral Imaging for Evaluation of Acute Chest Pain: Improving Image Quality with Monochromatic Images at Optimal Energy Level

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S502AB

Participants

Qi Yang, Xianyang, China (*Presenter*) Nothing to Disclose
Zhanli Ren, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoxia Chen, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Chenglong Ren, Shanxi, China (*Abstract Co-Author*) Nothing to Disclose
Lei Yuxin, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Chuangbo Yang, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the clinical value of using monochromatic images in dual-energy spectral CT in triple-rule-out CT angiography (CTA).

METHOD AND MATERIALS

Thirty consecutive patients with acute chest pain (HR<65BPM) underwent prospective ECG-triggered triple-rule-out CTA with spectral mode on a Discovery CT750HD scanner. A biphasic contrast injection (Iohexol, 350mgI/ml) was used for enhancement: 0.8ml/kg at 4.5ml/s flow rate in 1st phase and 20ml at 3.0ml/s in 2nd phase, followed by 30ml of saline. Monochromatic images were reconstructed with 40%ASiR and analyzed using Gemstone Spectral Imaging (GSI) viewer on an AW4.6. Region-of-interest

was placed on coronary artery, pulmonary artery, thoracic aorta and muscle to measure CT number and standard deviation, and to calculate the contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) as function of energy for arteries. The optimal energy level (in keV) for obtaining the best CNR for the arteries was obtained. CNR values at the optimal energy were compared with those at 70keV (which has the average energy of 120kVp). Two senior radiologists also evaluated the image quality at these two energies using a 5-point scoring system in consensus. The measurements between the two energies were statistically compared.

RESULTS

The optimal energies for achieving the highest CNR for coronary artery, thoracic aorta and pulmonary artery were 65.4 ± 1.0 keV, 65.2 ± 1.4 keV and 65.0 ± 1.5 keV, respectively. SNR and CNR values at the optimal energies for these 3 arteries were (22.80 ± 4.06 , 18.30 ± 2.76), (17.98 ± 1.93 , 19.14 ± 3.45) and (19.01 ± 4.34 , 19.65 ± 3.60), respectively. These values were significantly higher than the corresponding values of (17.96 ± 3.63 , 14.10 ± 3.19), (14.43 ± 1.53 , 15.21 ± 4.47) and (15.22 ± 3.52 , 15.10 ± 3.40) in the 70keV images (all $p < 0.05$). Image quality scores for these 3 arteries at the optimal energies were also judged better than those at 70keV: 4.5 ± 0.6 vs. 3.2 ± 0.8 for coronary artery, 4.4 ± 0.6 vs. 3.2 ± 0.8 for aorta and 4.5 ± 0.6 vs. 3.2 ± 0.8 for pulmonary artery (all $p < 0.05$).

CONCLUSION

Monochromatic images at 65keV in triple-rule-out CTA with spectral imaging yielded best CNR and highest diagnostic confidence.

CLINICAL RELEVANCE/APPLICATION

Dual-energy spectral CT with optimal energy level selection may improve image quality for imaging coronary artery, pulmonary artery and thoracic aorta in triple-rule-out CTA.

SSM03-06 Prevalence of Coronary Artery Disease (CAD) in Premenopausal Women Presenting with Acute Chest Pain Diagnosed by Coronary CT Angiography

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S502AB

Awards

Student Travel Stipend Award

Participants

Krystal D. Airola, MD, Stony brook, NY (*Presenter*) Nothing to Disclose

Jie Yang, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

Donglei Yin, PhD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

Kavitha Yaddanapudi, DMRD, MBBS, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

Dharmesh Tank, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to identify the prevalence of CAD in premenopausal women who present with acute chest pain as identified on Coronary Computed tomography angiogram (CCTA) and to identify the various risk factors that are associated with a positive study.

METHOD AND MATERIALS

We retrospectively evaluated the CCTA and the medical records in 498 premenopausal female patients who presented to our ER with acute chest pain and underwent CCTA. The various parameters evaluated were age, family history, diabetes, hypertension, obesity (BMI), hyperlipidemia and smoking (current, former or never). The CCTA results were categorized as normal, nonobstructive (<50% stenosis), borderline (around 50%) and obstructive CAD (includes moderate and severe obstruction >50%). We used Chi square test to examine marginal association and further evaluation with multivariable regression analysis.

RESULTS

In this study of the patients evaluated were in the age range is 22-55 yrs. Of these 498 patients a total of 106 (21%) had CAD; 85 (17.07 %) had non obstructive CAD, 11(2.2%) had obstructive CAD and 10 (2%) had borderline obstructive CAD. Increasing age was associated with higher incidence of CAD ($p = 0.0070$)with no CAD on CCTA in females <35yrs. Patients who never smoked and who had quit smoking >1year had a similar risk of CAD (18.75 and 18.99 %) compared to current smokers who had twice the risk of CAD(36.3%). Hypertension ($p = 0.004$), hyperlipidemia ($p = 0.05$), family history ($p = 0.01$), diabetes ($p = 0.0001$) and obesity ($p = 0.0001$), were significantly associated with presence of CAD on CCTA. The significant independent risk factors for presence of CAD were age ($p = 0.0043$), diabetes ($p = 0.0236$) and obesity ($p = 0.0014$) based on multivariable regression analysis.

CONCLUSION

The prevalence of CAD in premenopausal females presenting to the ER with chest pain is 21.2 % as diagnosed by CCTA. The risk factors strongly associated with presence of CAD and a positive CCTA were increasing age, diabetes and obesity. Women under 35 years of age had no identifiable CAD on CCTA in our study.

CLINICAL RELEVANCE/APPLICATION

Coronary artery disease (CAD) is major cause of mortality with more than 250, 000 deaths annually in women in the United states.

The mortality from CAD has decreased in the last decade however the mortality in younger women from CAD is raising . It is therefore important to identify the burden of CAD in younger women by non invasive testing such as CCTA.

SSM04

Cardiac (PET/MRI/CT/SPECT 2)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S504AB



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

FDA Discussions may include off-label uses.

Participants

James C. Carr, MD, Chicago, IL (*Moderator*) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA
Vincent B. Ho, MD, MBA, Bethesda, MD (*Moderator*) In-kind support, General Electric Company
Cristina Fuss, MD, Portland, OR (*Moderator*) Nothing to Disclose

Sub-Events

SSM04-01 **Body Composition Profiling using MRI - Normative Data for Subjects with Cardiovascular Disease Extracted from the UK Biobank Imaging Cohort**

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S504AB

Participants

Olof Dahlqvist Leinhard, PhD, Linköping, Sweden (*Presenter*) Stockholder, AMRA AB; Employee, AMRA AB
Jennifer Linge, Linköping, Sweden (*Abstract Co-Author*) Employee, AMRA AB
Janne West, MSc, PhD, Linköping, Sweden (*Abstract Co-Author*) Employee, AMRA AB; Stockholder, AMRA AB
Jimmy D. Bell, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Magnus Borga, PhD, Linköping, Sweden (*Abstract Co-Author*) Stockholder, AMRA AB

PURPOSE

To describe the distribution of MRI-derived body composition measurements in subjects with cardiovascular disease (CVD) compared to subjects without any history of CVD.

METHOD AND MATERIALS

1864 males and 2036 females with an age range from 45 to 78 years from the UK Biobank imaging study were included in the study. Visceral adipose tissue volume normalized with height² (VATi), total abdominal adipose tissue volume normalized with height² (ATATi), total lean thigh muscle volume normalized with body weight (muscle ratio) and liver proton density fat fraction (PDFF) were measured with a 2-point Dixon imaging protocol covering neck to knee and a 10-point Dixon single slice protocol positioned within the liver using a 1.5T MR-scanner (Siemens, Germany). The MR-images were analyzed using AMRA® Profiler research (AMRA, Sweden). 213 subjects with history of cardiovascular events (angina, heart attack, or stroke) (event group) were age and gender matched to subjects with high blood pressure (HBP group), and subjects without CVD (controls). Kruskal-Wallis and Mann-Whitney U tests were used to test the observed differences for each measurement and group without correction for multiple comparisons.

RESULTS

VATi in the event group was 1.73 (1.13 - 2.32) l/m² (median, 25%-75% percentile) compared to 1.68 (1.19 - 2.23) in the HBP group, and 1.30 (0.82-1.87) in the controls. ATATi in the event group was 4.31 (2.90-5.39) l/m² compared to 4.05 (3.07-5.12) in the HBP group, and 3.48 (2.48-4.61) in the controls. Muscle ratio in the event group was 0.13 (0.12 - 0.15) l/kg as well as in the HBP group, compared to 0.14 (0.12 - 0.15) in the controls. Liver PDFF in the event group was 2.88 (1.77 - 7.72) % compared to 3.44 (2.04-6.18) in the HBP group, and 2.50 (1.58 - 5.15) in the controls. Kruskal-Wallis test showed significant differences for all variables and group comparisons (p<0.007). The post hoc test showed significant differences comparing the controls to both the event group and the HBP group. These were more significant for VATi and ATATi (p<10⁻⁴) than for muscle ratio and PDFF (p<0.03). No significant differences were detected between the event group and the HBP group.

CONCLUSION

Cardiovascular disease is strongly associated with high VATi, liver fat, and ATATi, and with low muscle ratio.

CLINICAL RELEVANCE/APPLICATION

The metabolic syndrome component in CVD can be effectively described using MRI-based body composition profiling.

SSM04-02 **Monoenergetic Reconstructions for Imaging of Coronary Artery Stents Using A Novel Dual Layer CT: First In-vitro Experience**

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S504AB

Participants

Tilman Hieckethier, MD, Cologne, Germany (*Presenter*) Nothing to Disclose
Bettina Baessler, MD, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
Jochen von Spiczak, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose
Jan-Robert Kroeger, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose
Jonas Doerner, MD, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
Walter Giepmans, Best, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Guido Michels, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
David C. Maintz, MD, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander C. Bunck, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In-stent restenosis have an important impact on long-term prognosis after percutaneous coronary intervention (PCI). However, accurate assessment of coronary stents after PCI using non-invasive CT imaging remains challenging despite new stent materials and improvements in CT technology. A new dual layer detector technology now allows monoenergetic (monoE) image reconstructions, which are supposed to decrease artifacts caused by coronary stents. Therefore we systematically investigated the influence of different monoE reconstructions on the visualization of the coronary stent lumen.

METHOD AND MATERIALS

Ten different coronary stents (diameter 3.0 mm) embedded in plastic tubes filled with contrast agent (500 HU) were scanned with a 128-slice dual layer CT (IQon, Philips, 120 kV, 125 mAs). Images were reconstructed (0.67mm slice thickness, 0.35mm increment) with standard filtered back projection (FBP) and 6 different monoE settings (60, 70, 80, 90, 100, 150 keV). Each stent and reconstruction was assessed using established parameters: image noise (standard deviation (SD) in a standardized ROI), in-stent attenuation difference (mean attenuation difference between stented and non-stented lumen) and visible lumen diameter (mean visible diameter of the stented tube).

RESULTS

The image noise was significantly lower in all monoE data compared with FBP (FBP 13.41, 60 keV 11.62, 70 keV 11.67, 80 keV 11.69, 90 keV 11.71, 100 keV 11.75, 150 keV 11.80 HU SD; $p < .01$). The in-stent attenuation difference was significantly smaller in monoE data with higher keV levels than in FBP (FBP 148.18, 60 keV 154.13 $p=.036$, 70 keV 143.43 $p=.109$, 80 keV 137.25 $p=.052$, 90 keV 133.02 $p=.043$, 100 keV 130.12 $p=.039$, 150 keV 123.99 HU $p=.035$). The visible lumen diameter was significantly greater in monoE data with higher keV levels than in FBP (FBP 0.65, 60 keV 0.68 $p=.541$, 70 keV 0.71 $p=.053$, 80 keV 0.74 $p<.01$, 90 keV 0.77 $p<.01$, 100 keV 0.79 $p<.01$, 150 keV 0.90 mm $p<.01$).

CONCLUSION

Well-established objective CT image-quality assessment parameters of coronary stents are significantly improved by utilization of monoE reconstructions with adequate keV level.

CLINICAL RELEVANCE/APPLICATION

Non-invasive evaluation of coronary stents is an important and challenging task. MonoE reconstructions have the potential to improve coronary stent assessment crucially.

SSM04-03 Late Gadolinium Enhancement of Myocardial Scar by Spectral Photon-counting CT: Comparison with Magnetic Resonance Imaging

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S504AB

Participants

Amir Pourmorteza, PhD, Bethesda, MD (*Presenter*) Researcher, Siemens AG
Manu N. Lakshmanan, PhD, Bethesda, MD (*Abstract Co-Author*) Research support, Siemens AG;
Rolf Symons, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Chia-Ying Liu, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Tyler E. Cork, BS, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Pooyan Sahbaee, Durham, NC (*Abstract Co-Author*) Employee, Siemens AG
Cynthia Davies-Venn, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Mark A. Ahlman, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Veit Sandfort, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
David A. Bluemke, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Research support, Siemens AG

PURPOSE

Energy-discriminating photon-counting computed tomography (PCCT) has the potential to increase the contrast resolution of contrast agents based on their k-edge. The aim of this study was to compare the performance of late-enhancement PCCT with 3T magnetic resonance imaging (MRI) for the detection of chronic myocardial infarction in an animal model.

METHOD AND MATERIALS

We used a canine model of chronic myocardial infarction. Animals were euthanized 12 minutes after an intravenous injection of 20 ml gadoteric acid (Dotarem, Guerbet). PCCT images of the ex-vivo hearts were acquired at 140 kVp tube voltage, 300 mAs tube current, 1 second rotation time, and energy thresholds of 25, 50, 75 and 90 keV. Images were reconstructed with a quantitative soft tissue kernel (D30f), 1 mm slice thickness, and 1 mm increment. Linear material decomposition calibrated to test vials with known concentrations of gadolinium (Gd) and tissue equivalent material was used to calculate Gd-concentration maps in the myocardium. PCCT data were compared with 3T MRI late Gd enhancement (LGE) images (Verio, Siemens). A T1-weighted Inversion Recovery 3D gradient echo sequence (TR/TE, 20/3.2 ms; flip angle, 15°) was used. The field of view was 12x10 cm with a matrix of 256x208, resulting in a voxel size of 0.46x0.48x0.3 mm. Scar to myocardium contrast was calculated as the percent difference between the mean voxel intensity of 5 regions-of-interest (ROIs) in infarcted and remote myocardium.

RESULTS

PCCT infarct volume accurately reflected scar morphology of the subendocardial scar compared with MRI LGE images in two ex vivo hearts. Scar and myocardium Gd concentrations were measured in 5 regions in infarcted and remote myocardium. Mean Gd concentration in remote myocardium was 1.2 mM for both hearts compared to 5.2 and 7.7 mM in the scars of heart 1 and heart 2, respectively. PCCT Gd-mapping increased the contrast-to-noise ratio (CNR) between scar and remote myocardium from 3.7, 3.2 to 4.4, 8.8 for heart 1 and heart 2, respectively. In comparison, CNR for LGE MRI was 16.5 and 10.7.

CONCLUSION

The spectral information of PCCT has the potential to improve the detection of chronic myocardial infarction compared to conventional CT by providing quantitative maps of gadolinium concentration in late gadolinium enhancement images.

CLINICAL RELEVANCE/APPLICATION

The spectral information of PCCT may improve CT sensitivity for the detection of chronic myocardial infarction.

SSM04-04 Long-term Prognosis of Unrecognized Myocardial Infarction Detected with Magnetic Resonance Imaging in an Elderly Population

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S504AB

Participants

Charlotte Ebeling Barbier, MD, Uppsala, Sweden (*Presenter*) Nothing to Disclose
Raquel E. Themudo, MD, Uppsala, Sweden (*Abstract Co-Author*) Nothing to Disclose
Tomas Bjerner, MD, PhD, Uppsala, Sweden (*Abstract Co-Author*) Medical Advisory Board, Carestream Health, Inc
Lars O. Johansson, PhD, Uppsala, Sweden (*Abstract Co-Author*) Nothing to Disclose
Lars Lind, MD, PhD, Uppsala, Sweden (*Abstract Co-Author*) Nothing to Disclose
Hakan K. Ahlstrom, MD, PhD, Uppsala, Sweden (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of the present study was to investigate the prognostic impact of unrecognized myocardial infarctions (UMIs) detected with magnetic resonance imaging (MRI) for major adverse cardiac events (MACE) in community living elderly individuals.

METHOD AND MATERIALS

Late enhancement MRI was performed in 248 randomly chosen 70-year-olds. Individuals with myocardial infarction (MI) scars, with or without a hospital diagnosis of MI were classified as recognized MI (RMI) or UMI, respectively. Medical records and death certificates were scrutinized. MACE was defined as cardiac death, non-fatal MI, a new diagnosis of angina pectoris, or symptom-driven coronary artery revascularization.

RESULTS

During follow-up (mean 11 years) MACE occurred in 10% (n=18/182) of the individuals without MI scars, in 20% (n=11/55) of the individuals with UMI, and in 45% (n=5/11) of the individuals with RMI, with a significant difference between the UMI group and the group without MI scars (p=0.045), and between the RMI group and the group without MI scars (p=0.0004). Hazards ratios for MACE adjusted for risk factors and sex were 2.55 (95% CI 1.20-5.42; p=0.015) for UMI and 3.28 (95% CI 1.16-9.22; p=0.025) for RMI.

CONCLUSION

The presence of an MRI-detected UMI entailed a more than double risk for MACE in community living 70-year-old individuals.

CLINICAL RELEVANCE/APPLICATION

LE-MRI detects UMIs in individuals without cardiovascular risk factors or other signs of myocardial injury. These individuals have an increased risk for MACE. Thus, LE-MRI identifies individuals at risk who would remain undetected with prevailing techniques. Although likely, it remains to be evaluated whether these individuals would benefit from life style changes and cardiovascular medication. If such protective measures are needed, then these individuals will have to be identified. Thus, health care management will need to consider: i) the possibility of primary prevention as LE-MRI can be used to detect individuals at cardiovascular risk, and ii) to what extent LE-MRI could and should be used for this purpose

SSM04-05 Whole-Heart Isotropic Late Gadolinium Enhanced Imaging in a Single Breath-Hold: Usefulness of the 3D-mDixon Sequence at 3T MRI

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S504AB

Participants

Morikatsu Yoshida, Amakusa, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Nakaura, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Taihei Inoue, MD, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Koichi Yokoyama, Amakusa, Japan (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masafumi Kidoh, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Daisuke Utsunomiya, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazunori Harada, Amakusa, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

The two-dimensional (2D) inversion recovery (IR) sequence is used as a reference standard for late gadolinium enhanced (LGE) imaging, however, its acquisition time tends to be long. We compared the clinical usefulness of the 3D multi-echo Dixon (mDixon)- and the 2D-IR technique for cardiac LGE imaging on a 3T MR system.

METHOD AND MATERIALS

This retrospective study received institutional review board approval; written informed consent was waived. We enrolled 31 patients with suspected ischemic heart disease who underwent cardiac MRI study. We obtained 2D-IR short-axis images (voxel size: 1.48 × 2.36 × 7 mm) and 3D-mDixon whole-heart transverse images (voxel size: 1.97 × 2.0 × 2.0 mm) in all patients and reconstructed the short-axis MPR images with the 3D-mDixon technique. We performed qualitative inferiority analysis of the overall image quality, artifacts, and the sharpness of LGE images using a 4-level scale. In patients with myocardial LGE, we compared the LGE area using the paired t-test. The correlation between the two sequences was evaluated with the Pearson test.

RESULTS

With the 3D-mDixon technique, single breath-hold isotropic whole-heart coronary LGE imaging was technically successful in all patients. With the 2D-IR technique, 3 to 5 (average 3.4 ± 0.8) breath-holds were required to obtain short-axis images of the left ventricle. Of the 31 patients, 21 had myocardial LGE. The mean difference in the overall image quality, artifacts, and LGE sharpness between the 3D mDixon and the 2D-IR sequence was 0.18 (95% CI: -0.18 - 0.55), 0.27 (95% CI: -0.09 - 0.64), and 0.40 (95% CI: -0.03 - 0.83), respectively, demonstrating their non-inferiority. There was no significant difference in the LGE area between 3D-mDixon- (8.07 ± 4.93 cm²) and 2D-IR scans (6.87 ± 4.52 cm²) (p = 0.45), and the correlation was nearly perfect (r = 0.98, p < 0.001, bias: 1.10, 95%: CI 0.63 - 1.58).

CONCLUSION

The image quality of the single breath-hold 3D mDixon sequence is not inferior to the multi-breath-hold 2D-IR sequence for cardiac LGE imaging at 3T MRI, and it may shorten the acquisition time.

CLINICAL RELEVANCE/APPLICATION

Single breath-hold isotropic LGE imaging with the 3D-mDixon technique can markedly reduce the scan time and the image quality is not inferior to that of the 2D-IR sequence at cardiac 3T MRI.

SSM04-06 Left Bundle Branch Block: Usefulness of MRI in the Evaluation of Regional Left Ventricular Dyssynchrony and in the Detection of Previous Myocardial Infarction with Late Enhancement

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S504AB

Participants

Marco Di Girolamo, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Giuseppe Muscogiuri, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Stefano Fierro, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Bruno Tagliaferro, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Vincenzo David, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Left bundle branch block (LBBB) is a common cardiac conduction abnormality diagnosed on ECG. LBBB can be a primary abnormality of the cardiac electrical conduction system or it can be secondary to other cardiologic pathologies such as myocardial infarction and cardiomyopathies. The presence of LBBB per se cannot be used as a single diagnostic criteria for the diagnosis of previous myocardial infarction. Aim of this study was to evaluate the mechanical left ventricular dyssynchrony with high temporal resolution cine MRI and to evaluate the presence of late-enhancement (LE) in order to diagnose previous myocardial infarction.

METHOD AND MATERIALS

38 patient with LBBB underwent cardiac MRI using a 1.5 T magnet (Magnetom Sonata, Siemens). The MRI protocol consisted of a left ventricular trueFISP functional study followed by Late Enhancement data sets acquired 10-15 minutes after iv administration of 0.2mmol/kg BW of extracellular Gd contrast agent. We used a segmented Inversion Recovery Turbo-FLASH sequence (TR:8ms;TE:4ms;TI:250-320ms;sl.thick:8mm). Different pattern of LE were related to the underlying pathology as stated by clinical and other diagnostic imaging features.

RESULTS

We detected a characteristic dyssynchronous ventricular contraction with septal flattening during early ventricular systole in all the patients, tenting of mitral valve apparatus in 5 pts and functional mitral regurgitation in 2 pts. In 1 pt we found the characteristic functional features of dilated cardiomyopathy with no myocardial area of LE. In 8 pts we found areas of LE (transmural in 3 pts and subendocardial in 5 pts) with typical patterns of myocardial infarction (MI). The location of MI was septal in 4 pts, infero-septal in 2 pts, lateral in 1pt, and superior in 1 pt. In 30 patients we found a reduction of the ejection fraction (75%).

CONCLUSION

Cardiac MRI is a useful diagnostic tool in the evaluation of LBBB when the assessment of ventricular dyssynergy on echocardiography is not technically feasible and when the area of a previous myocardial infarction cannot be determined.

CLINICAL RELEVANCE/APPLICATION

MRI is a useful diagnostic tool in the evaluation of LBBB when US assessment of ventricular dyssynergy isn't feasible and a previous possible myocardial infarction has to be determined.

SSM05

Chest (Nodule/Screening II)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S404AB

CH CT

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

FDA Discussions may include off-label uses.

Participants

Edith M. Marom, MD, Ramat Gan, Israel (*Moderator*) Nothing to Disclose
Christopher A. Meyer, MD, Madison, WI (*Moderator*) Stockholder, Cellectar Biosciences, Inc Investor, NeuWave, Inc

Sub-Events

SSM05-01 Risk Stratification of New Solid Nodules at Incidence CT Lung Cancer Screening

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S404AB

Participants

Joan E. Walter, BSc, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marjolein A. Heuvelmans, MD, PhD, Groningen, Netherlands (*Presenter*) Nothing to Disclose
K Ten Haaf, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Rozemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Peter M. Van Ooijen, MSc, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
U Yousaf-Khan, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Robin Peters, MD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Pim A. De Jong, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Carlijn Van Der Aalst, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
G.H. De Bock, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Willem P. Mali, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Harry Groen, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Harry De Koning, Rotterdam, Netherlands (*Abstract Co-Author*) Research Grant, F. Hoffmann-La Roche Ltd Equipment support, Siemens AG Medical Advisory Board, F. Hoffmann-La Roche Ltd
Matthijs Oudkerk, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop a model for risk stratification of new solid nodules at the incidence screening rounds of a large randomized low-dose computed tomography (LDCT) lung screening trial, and assess the key determinants.

METHOD AND MATERIALS

This trial was approved by the Ministry of Health. All participants gave informed consent. In total, 7,557 individuals underwent baseline LDCT screening. Following baseline, incidence-screenings took place after 1, 3 and 5.5 years. This study included participants of the first two incidence screening rounds with solid non-calcified nodules, newly detected after baseline and in retrospect not present on previous screens. Lung cancer diagnosis was based on histology, and benignity was based on histology or a stable volume for ≥ 2 years. Multi-regression analysis was performed to develop a risk model considering 9 variables, namely: age, gender, pack-years, smoking status, time since previous scan, solid nodule count at baseline, nodule margin, nodule location, and nodule volume.

RESULTS

In the first two incidence screening rounds of the trial, radiologists registered 1,222 new solid nodules in 10.8% (787/7,295) of participants. A new solid nodule was lung cancer in 6.2% (49/787) of participants with new solid nodules (50 lung cancers in 49 participants). In 359 of 787 (45.6%) participants, no solid nodule had been found during baseline screening and a lower number of solid nodules at baseline screening significantly increased the probability of a new solid nodule being lung cancer ($P=0.038$). Nodule volume had a high discriminatory power (area under the receiver-operating curve: 0.795, 95% confidence interval: 0.728, 0.862, $P<0.0001$). After backwards stepwise selection, nodule volume, solid nodule count at baseline, and time since previous scan were included in the model, yielding an AUC of 0.825 (95% CI: 0.768, 0.882). The difference between the AUCs was non-significant (0.795 vs. 0.825, $P=0.15$).

CONCLUSION

New solid nodules are regularly found during LDCT screening. Due to their suspiciousness for malignancy appropriate stratification is necessary. Nodule volume is the key determinant in risk stratification, with only marginal improvement considering other risk factors.

CLINICAL RELEVANCE/APPLICATION

About 11% of participants in LDCT screening develop new solid nodules within 3 years. Nodule volume is the key determinant in risk stratification, with only marginal improvement considering other risk factors.

SSM05-02 Nodule Size is Poorly Represented by Nodule Diameter in Low-dose CT Lung Cancer Screening

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S404AB

Participants

Marjolein A. Heuvelmans, MD, PhD, Groningen, Netherlands (*Presenter*) Nothing to Disclose
Rozemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Gonda J. de Jonge, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Peter M. Van Ooijen, MSc, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Pim A. De Jong, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Matthijs Oudkerk, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the correlation between nodule diameter and nodule size of nodules found in low-dose computed tomography (CT) lung cancer screening.

METHOD AND MATERIALS

We investigated baseline data of 2,240 solid nodules (volume 50-500 mm³) in 1,500 lung cancer screening participants. Nodule volume, x, y, and z diameter and minimum / maximum diameter in any direction were generated by semi-automated software (LungCARE, Siemens). Range in maximum axial and mean nodule diameter per nodule volume category (50-100 mm³, 100-200 mm³, 200-300 mm³, 300-400 mm³, 400-500 mm³) was determined. Semi-automated nodule volume represented nodule size. Intra-nodule diameter variation was defined as maximum minus minimal nodule diameter.

RESULTS

Median participant age was 59 years, 14.1% were women. Median nodule volume was 82.4 mm³ (interquartile range [IQR], 62.9–125.4 mm³). Median nodule diameter was 6.1 mm (IQR, 5.4–7.2 mm) for mean diameter, and 6.6 mm (IQR, 5.9–7.7 mm) for maximum axial diameter. Range in mean nodule diameter per volume category varied from 8.55 mm (3.0 – 11.5 mm) for nodules with volume of 50-100 mm³ to 6.1 mm (7.2 – 13.3 mm) for nodules with volume of 200-300 mm³; range in maximum axial diameter varied from 11.2 mm (7.3 – 18.5 mm) for nodules with volume of 200-300 mm³, to 7.0 mm (9.1 – 16.1 mm) for nodules with volume of 400-500 mm³. Intra-nodule diameters varied by a median of 2.8 mm (IQR, 2.2-3.7 mm). Intra-nodule diameter variation for smaller intermediate-sized nodules (50-200 mm) was 2.8 mm (IQR 2.2-3.5 mm), and was smaller than intra-nodule diameter variation for larger intermediate-sized nodules (200-500 mm; median 3.6 mm [IQR 2.5-5.1 mm], P<0.01).

CONCLUSION

Nodule size is poorly represented by diameter, as a nodule has an infinite number of diameters, but only one volume. Median intra-nodule diameter variation was found to be higher as the 1.5mm LungRADS cutoff for nodule growth.

CLINICAL RELEVANCE/APPLICATION

The relationship between nodule diameter and nodule size is poor, which may lead to misclassification of lung cancer screening participants in diameter-based nodule management protocols.

SSM05-03 Effects of Contrast-enhancement, Reconstruction Slice Thickness and Convolution Kernel on the Diagnostic Performance of Radiomics Signature in Solitary Pulmonary Nodule

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S404AB

Participants

Yanqi Huang, Guangzhou, China (*Presenter*) Nothing to Disclose
Lan He, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the effects of contrast-enhancement, reconstruction slice thickness and convolution kernel on the differential diagnosis performance of radiomics signature in SPNs, and to determine the optimal imaging parameters for extracting radiomics features.

METHOD AND MATERIALS

240 patients with SPNs (malignant, n=180; benign, n=60) underwent un-enhanced CT (NECT) and contrast-enhanced CT (CECT) which were reconstructed with different slice thickness and convolution kernel. 150 radiomics features were extracted separately from each set of CT and feature selection was done with Lasso logistic regression model with which a radiomics signature was built. Diagnostic performance of radiomics signatures of CT for discriminating benign and malignant SPNs were assessed and compared with respect to the area under the curve (AUC) of the receiver operating characteristic curve (ROC) and net reclassification improvement (NRI).

RESULTS

NECT-based radiomics signature demonstrated better discrimination and classification capability than CECT in both primary (AUC: 0.979 vs. 0.879, p<0.001; NRI=1.667) and validation cohort (AUC: 0.783 vs. 0.726, p=0.017; NRI=0.200). Thin-slice (1.25mm) CT-based radiomics signature has better diagnostic performance than thick-slice CT (5mm) in both primary (AUC: 0.979 vs. 0.867, p<0.001; NRI=1.467) and validation cohort (AUC: 0.783 vs. 0.712, p=0.008; NRI=0.289). Standard convolution kernel-based radiomics signature had higher performance than lung convolution kernel-based CT in both primary (AUC: 0.867 vs. 0.773, p<0.001; NRI=1.156) and validation cohort (AUC: 0.712 vs. 0.686, p=0.007; NRI=0.311).

CONCLUSION

The contrast-enhancement, reconstruction slice thickness and convolution kernel affected the diagnostic performance of radiomics signatures in SPNs, of which un-enhanced, thin-slice and standard convolution kernel-based CT is more informative.

CLINICAL RELEVANCE/APPLICATION

this study presents that the contrast-enhancement, reconstruction slice thickness and convolution kernel affect the diagnostic performance of Radiomics signature in SPNs, of which un-enhanced, thin-slice and standard convolution kernel-based CT is more informative. The difference in parameters of CT image acquisition should be considered in the future radiomics studies.

SSM05-04 Computerized Margin and Texture Analyses for Differentiating Consolidative Mucinous Adenocarcinoma and Bacterial Pneumonia

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S404AB

Participants

Hyun Jung Koo, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Mi Young Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ja Hwan Koo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yu Sub Sung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung-Han Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang-Min Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hwa Jung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hai Xu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We sought to create a computerized method of computed tomography (CT)-based margin analysis, and to retrospectively investigate the value of computerized margin and texture analyses for differentiating consolidative mucinous adenocarcinoma and bacterial pneumonia manifesting as air space consolidation.

METHOD AND MATERIALS

We established a method of selective margin analysis by comparing the target lesion with normal lung attenuation, drawing a slope to represent the attenuation changes. This approach was applied to 97 patients with pathologically confirmed consolidative mucinous adenocarcinoma (n=52) or proven bacterial pneumonia (pneumococcal, n=24; Klebsiella pneumonia, n=21), all of whom underwent enhanced CT imaging between January 2005 and April 2015. Inter-value correlations between 1 mm and 5 mm data and among multiple regions of interest were obtained using intra-class correlation coefficient values. CT visual assessment findings and CT margin and texture parameters were compared for differentiating the two disease entities.

RESULTS

The internal attenuation and margin parameters in multiple regions of interest showed excellent intraclass correlation coefficient values in 1 mm and 5 mm CT images, respectively. All measured attenuation slopes obtained from the variable pixel numbers at the margins revealed a difference between mucinous adenocarcinoma and bacterial pneumonia ($p < 0.001$), and mucinous adenocarcinoma produced a sharply declining attenuation slope at the margin of the lesions when compared with bacterial pneumonia. On multivariable logistic regression analysis, pneumonia had an ill-defined margin (odds ratio (OR), 4.84; 95% CI, 1.26–18.52; $p = 0.02$), surrounding ground-glass opacity (OR, 8.55; 95% CI, 2.09–34.95; $p = 0.003$), and gradually declining attenuation at the margin (OR, 12.63; 95% CI, 2.77–57.51, $p = 0.001$) when compared with mucinous adenocarcinoma.

CONCLUSION

Attenuation slopes at the margin of lesions derived from CT images have the potential to act as an imaging parameter for differentiating mucinous carcinoma and bacterial pneumonia.

CLINICAL RELEVANCE/APPLICATION

By defining attenuation slopes at the margins of lesions, our findings introduce CT margin analysis as a potential biomarker for differentiating mucinous adenocarcinoma from bacterial pneumonia manifesting as air space consolidation.

SSM05-05 Chest X-ray Equivalent Ultralow Dose Chest Computed Tomography for Pulmonary Nodule Detection - A Prospective Intra-individual Comparative Study

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S404AB

Participants

Michael Messerli, MD, St. Gallen, Switzerland (*Presenter*) Nothing to Disclose
Thomas Kluckert I, MD, St. Gallen, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Meinhard Knitel, St. Gallen, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Fabian Rengier, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Ralf W. Bauer, MD, Frankfurt, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens Healthcare GmbH; Speakers Bureau, Bayer Healthcare; Speakers Bureau, GE Healthcare
Hatem Alkadhi, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Sebastian Leschka, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Simon Wildermuth, MD, St. Gallen, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this prospective intra-individual comparative study was to evaluate the tin filtration technique at 100 kV at an exposure level comparable to plane film chest X-ray for pulmonary nodule detection in a clinical scenario without patient pre-selection.

METHOD AND MATERIALS

202 patients undergoing clinically indicated standard dose chest CT were prospectively included and scanned with an additional ultralow dose protocol at 100 kV with tin filtration and fixed tube current at 70 mAs. Standard dose CT was read in consensus by two board-certificated radiologists to determine the presence of lung nodules and served as standard of reference (SOR). Two radiologists independently assessed and recorded the presence of lung nodules and their locations on ultralow dose CT. Sensitivity and specificity of the ultralow dose protocol was compared against the SOR, including subgroup analysis of different nodule sizes (≤ 4 , 5–8, ≥ 8 mm), nodule type (solid, subsolid, calcified nodules) and BMI (≤ 30 , > 30 kg/m²).

RESULTS

441 nodules were defined as SOR with a median diameter of 3 mm (range 1 - 24 mm). Overall sensitivity for nodule detection in ultralow dose CT was 91% including all nodules regardless of size, type and patient BMI. In a per-patient analysis, the sensitivity and specificity of ultralow dose CT for the detection of the presence of at least one nodule was 98% and 97%, respectively for

normal weighted patients ($BMI \leq 30 \text{ kg/m}^2$). In overweighed patients ($n = 39$) with a $BMI > 30 \text{ kg/m}^2$ per-patient sensitivity and specificity for nodule detection was 96% and 82%, respectively. The mean (\pm SD) effective radiation dose for ultralow dose CT was $0.13 \pm 0.01 \text{ mSv}$, whereas the mean effective dose of standard dose CT was $1.8 \pm 0.7 \text{ mSv}$.

CONCLUSION

Our study suggests that ultralow dose CT with a 100 kV protocol with spectral shaping, that is comparable to the exposure level of plane film chest X-ray, is suitable for the detection and follow-up of pulmonary nodules without patient selection.

CLINICAL RELEVANCE/APPLICATION

Given the promising results of lung cancer screening programs, X-ray equivalent exposure with advantages of cross-sectional CT images will be a major argument against parties expressing reservation against these programs.

Chest (Radiation Dose)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S406B



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

Participants

Seth J. Kligerman, MD, Denver, CO (*Moderator*) Nothing to Disclose
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Moderator*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Fuji Pharma Co, Ltd; Research Grant, FUJIFILM RI Pharma Co, Ltd; Research Grant, Guerbet SA;

Sub-Events**SSM06-01 Effect of Tin Filtration on Image Quality and Radiation Dose: Preliminary Experience With a Third-Generation Dual-Source CT System in 133 Adult Patients**

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S406B

Participants

Rayyan A. Daghistani, MBBS, Lille, France (*Presenter*) Nothing to Disclose
Jean-Baptiste Faivre, MD, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Alain Duhamel, PhD, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Nunzia Tacelli, MD, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Jacques Remy, MD, Mouvoux, France (*Abstract Co-Author*) Research Consultant, Siemens AG
Martine J. Remy-Jardin, MD, PhD, Lille, France (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

To evaluate the image quality and radiation exposure of low-kV examinations with tin pre-filtration.

METHOD AND MATERIALS

133 consecutive patients, less than 90 kg of body weight (b.w.) (mean BMI: 23.35 kg/m²), underwent sequential non-contrast chest CT examinations for the follow-up of chronic respiratory disease: (a) the first examination was obtained with a second-generation dual-source CT system (Somatom Flash) with an individually-adapted selection of the kilovoltage according to the patient's weight (50-80 kg b.w.: 100 kV/65 mAs; 80-90 kg b.w.: 120 kV/65 mAs) (Group 1); (b) the second examination was performed with a third-generation dual-source CT (Somatom Force) at 100 kV with tin pre-filtration (100 Sn kV/300 mAs) (Group 2). In both groups, chest examinations were performed in dual-source, single-energy, high-pitch helical mode with milliamperage modulation; images were reconstructed with iterative reconstructions (Group 1: SAFIRE; Group 2: ADMIRE; strength=3 in both groups). Between T0 and T1, the patient's weight was stable (± 3 kg) and the severity of the underlying disease was not dramatically modified.

RESULTS

In Group 1, CT examinations were obtained at 100 kV (n=112; 84%), 120 kV (n=21; 16%) (mean DLP : 67.2 \pm 33.07 mGy.cm). Compared to Group 1, Group 2 examinations were characterized by : (a) a significantly lower mean objective noise (22.06 \pm 5.9 HU vs 25.52 \pm 8.78 HU; p=0.0006) ; (b) a better SNR (2.44 \pm 1.2 vs 1.99 \pm 0.89 ; p<0.0001); (c) a significantly higher score of visibility of normal anatomical structures on lung and mediastinal images (1.27 \pm 0.12 vs 1.18 \pm 0.13 ; p<0.0001) ; (d) a significantly lower DLP (27.08 \pm 7.22 mGy.cm ; p<0.0001) (effective dose: 0.4 mSv). Similar trends for improvement in objective and subjective image noise and SNR and reduction in radiation exposure were observed in the subgroup of 112 patients scanned at 100 kV at T0, then at 100 Sn kV at T1.

CONCLUSION

Tin pre-filtration at 100 kV improves the image quality and reduces the radiation exposure of routine chest examinations in adult patients <90 kg b.w.

CLINICAL RELEVANCE/APPLICATION

High image quality at very low dose levels can be achieved by using a Sn 100 kV-protocol for routine non-contrast chest CT examinations of adult patients of average size.

SSM06-02 Comparison of Chest CT Radiation Doses (CTDIvol, DLP, & SSDE) from ACR Dose Index Registry Across Different Geographical Regions and Types of Medical Facilities According To Age Groups

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S406B

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
Jo-Anne O. Shepard, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mythreyi Bhargavan-Chatfield, PhD, Reston, VA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare chest CT radiation doses (CTDIvol, DLP & SSDE) from the ACR Dose Index Registry (DIR) across different US facilities types and geographical regions

METHOD AND MATERIALS

Using Radiology PlayBook identification (RPID) numbers, we assessed CT dose metrics CTDIvol, DLP and (SSDE) for 171,641 chest CT studies (mean age 61.7±16.5yrs) in the ACR DIR from 2011-2015 (10% sample). Data were stratified according to the geographic census into (New England (NE), Middle Atlantic (MA), South Atlantic (SA), East North Central (ENC), East South Central (ESC), West South Central (WSC), Mountain (MO) and Pacific (PA)) regions and then sub-stratified based on the year of CT exam (2011-15), patient age (≤40; 41-64; ≥65 years) and type of medical facility (academic, community, multispecialty, freestanding). Mean and standard deviations for maximum CTDIvol (mGy) and SSDE and DLP (mGy.cm) were calculated. ANOVA test was used to compare the variation

RESULTS

The national mean CTDIvol, SSDE and DLP for chest CT were 14±11, 15±11 and 470±349. There is significant variation among census divisions. The highest CTDIvol and DLP was seen for ESC (15±14, n=11403, 544±355, n=11336) and lowest CTDIvol was for NE (12±9, n=17450) (p<0.0001) and lowest DLP was for MO (364±298, n=6764). For SSDE, NE had the lowest (12±9, n=12028), and WSC had the highest values (17±10, n=2636). The mean SSDE values of academic, community, multispecialty and freestanding facilities were 15±2, 15±1, 14±3, 11±1 (p<0.0001), respectively. Across all 8 census divisions, young patients received higher dose compared to other age groups. The mean±SD CTDIvol, DLP and SSDE for <40 years age group were 14±11.9, 507±373, 16±11; while, 14±11, 489±366, 15±11 for 41-64 years and 12±10, 448±323 and 14±10 for >64 years (value<0.0001). Since the inception of the ACR DIR in 2011, chest SSDE has decreased by average 13.2% in different regions. The biggest decrease (15.2%) was in ESC; while there was no decrease in SA region

CONCLUSION

There were significant variations in the values of CTDIvol, DLP, and SSDE for chest CT among different US census regions. In all 8 census divisions, young adults received the higher dose compared to middle-age or elderly patients

CLINICAL RELEVANCE/APPLICATION

According to ACR DIR chest CT radiation dose has decreased over last 5 years across all regions of US but more efforts are needed to reduce dose in young adults

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

SSM06-03 Ultra-Low Dose CT in Raw-Data-Based Iterative Reconstruction for Lung Screening

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S406B

Participants

Xin Sui, MD, Beijing, China (*Presenter*) Nothing to Disclose
Xiao Li Xu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Qian Ni Du, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Lan Song, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wei Song, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zheng Yu Jin, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

the purpose of this study was to evaluate the sensitivity of ultra-low-dose CT with tin filtration (100Sn kVp) and advanced model-based iterative reconstruction (ADMIRE) for the detection of ground glass nodule (GGN) and partial solid nodules (pSN).

METHOD AND MATERIALS

58 patients (34 males, 24 females; mean [SD] age, 54.3[8.7] years) who were referred to the follow-up of GGN or pSN and underwent LDCT (100 kVp, 25 mAs) and ultra-low dose CT (100Sn kVp, 32mAs) scanning on a third-generation dual-source CT scanner (SOMATOM Force; Siemens Healthcare, Germany). All the CT images were reconstructed with ADMIRE. A reference standard was established by a consensus panel of 2 different radiologists on LDCT. Image noise and diagnostic confidence were assessed on LDCT and ultra-low dose CT. The detection of GGN and pSN was rated on ultra-low dose CT.

RESULTS

The effective radiation dose of ultra-low-dose was 0.08±0.03 mSv and it was significantly lower than that of the LDCT protocol which was 0.78±0.21 mSv (p<0.05). The mean body mass index (BMI) was 23.9 (±3.5) kg/m². A total of 64 GGNs and 25 pSN were identified on LDCT images. The nodule size was ranged from 3.5 to 15.4 mm. All images with LDCT were of diagnostic quality. With ultra-low dose CT, the frequencies of nondiagnostic image quality were 2 (3.1%) GGNs and 1(4%) pSNs, which were ranged from 3.5mm to 4.7mm on the lower lobe. A total of 86 (96.6%) and 85 (95.5%) on ultra-low dose CT were detected by two observers, respectively.

CONCLUSION

With tin filtration and ADMIRE, ultra-low-dose CT at a dose level equivalent to a chest x-ray has a comparable high sensitivity for GGN and pSN detection with LDCT.

CLINICAL RELEVANCE/APPLICATION

It is feasible to benefit patients to detect GGN and pSN by using ultra-low-dose CT which has a significantly low radiation dose

equivalent to a chest radiograph only.

SSM06-04 Age Dependent Benefits of Spectral Shaping in Ultra-High Pitch Non-Enhanced Chest CT of Pediatric Patients

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S406B

Participants

Malte N. Bongers, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Michael Esser, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
Juergen F. Schaefer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ilias Tsiflikas, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the potential of spectral shaping in lowering the radiation exposure of ultra-high pitch non-enhanced chest CT (UHP) in pediatric patients.

METHOD AND MATERIALS

Three pediatric phantoms (newborn, one-year old, five-years old) were scanned with standard low-kV (70-90kV) and tin-filtered Sn100kV UHP protocols. Image noise (IN) and signal-to-noise-ratios (SNR) were determined and compared (figure 1). 150 pediatric patients (0-18 years) having received low-kV or Sn100 kV UHP non-enhanced chest CT were retrospectively selected from institution's PACS. Two blinded radiologists assessed both datasets regarding overall image quality (IQ, Likert scale) and diagnostic accuracy (ROC-statistics using clinical diagnosis and follow-up). In age- and water-equivalent-diameter-matched subgroups effective doses (ED) were calculated and compared between both protocols.

RESULTS

Comparing IN and SNR of low-kV and Sn100kV UHP, in the newborn phantom no significant differences could be found (IN_{low-kV}: 23.77 ± 3.04 , IN_{Sn100kV}: 22.93 ± 2.92 , $p = 0.55$; SNR_{low-kV}: 32.78 ± 4.09 , SNR_{Sn100kV}: 34.18 ± 4.36 , $p = 0.50$). Sn100kV UHP showed significantly lower IN and significantly higher SNR in the one-year old (IN_{low-kV}: 23.77 ± 2.79 , IN_{Sn100kV}: 21.14 ± 2.59 , $p = 0.04$; SNR_{low-kV}: 33.70 ± 3.92 , SNR_{Sn100kV}: 38.07 ± 4.47 , $p = 0.03$) and five-years old phantom (IN_{low-kV}: 23.23 ± 0.91 , IN_{Sn100kV}: 19.64 ± 0.86 , $p < 0.0001$; SNR_{low-kV}: 33.86 ± 1.35 , SNR_{Sn100kV}: 40.38 ± 1.74 , $p < 0.0001$). In pediatric patients, subjective IQ (IQ_{low-kV}: 3.7, IQ_{Sn100kV}: 3.8, $p = 0.45$) and diagnostic accuracy (AUC_{low-kV}: 0.96, AUC_{Sn100kV}: 0.97) were not significantly different between both UHP protocols. ED of Sn100kV UHP was significantly lower in patients over five years (ED_{low-kV}: 0.16 mSv, ED_{Sn100kV}: 0.13 mSv, $p = 0.07$).

CONCLUSION

Additional spectral filtering (Sn100kV) of ultra-high pitch non-enhanced chest CT is capable to lower radiation exposure in pediatric patients without impairing image quality and diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

Due to the rapidly dividing cells and longer expected life time of children, lowering radiation exposure in pediatric CT is of highest interest to minimize the risk of radiation injury.

SSM06-05 Prospective Evaluation of Ultra-low Dose Computed Tomography Using 100 kV with Tin Filter: What is the Dose Reduction and is Computer-aided Pulmonary Nodule Detection Required?

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S406B

Participants

Chi Wan Koo, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Edwin A. Takahashi, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
David L. Levin, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Ronald S. Kuzo, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Anne-Marie G. Sykes, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Darin B. White, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Rebecca M. Lindell, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Matthias Wolf, Malvern, PA (*Abstract Co-Author*) Employee, Siemens AG
Luca Bogoni, PhD, Malvern, PA (*Abstract Co-Author*) Employee, Siemens AG
Ahmed Halaweish, PhD, Rochester, MN (*Abstract Co-Author*) Employee, Siemens AG
Rickey Carter, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Adam Bartley, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG
Joel G. Fletcher, MD, Rochester, MN (*Abstract Co-Author*) Grant, Siemens AG ;

PURPOSE

Ultra-low dose chest CT (ULD) can be performed with low tube potential and a tin filter (100kV/Sn). Our purpose was to describe the observed radiation dose reduction, radiologist performance, and need for computer aided nodule detection (CAD) using ULD chest CT.

METHOD AND MATERIALS

After informed consent, 54 patients prospectively underwent routine low dose chest CT (LD CT) with automatic exposure control (120 kV, 70 quality reference mAs [QRM], CTDI_{vol} of 6 ± 2 mGy) followed immediately by an ULD CT technique (100 kV/Sn, 50 QRM, CTDI_{vol} of 0.4 ± 0.2 mGy). Reference standards were established by an experienced thoracic radiologist who marked each detected nodule on a dedicated computer workstation. Exams were anonymized and four different radiologists blinded to the technique and reference findings each interpreted the LD and ULD CTs. Automated comparison of reference and reader detections

was performed using an overlapping spheres method. The exams were separately processed using CAD with all CAD-labeled nodules categorized as true or false positives compared with the reference standard.

RESULTS

Forty-four reference nodules were detected in 25 of 54 (57%) patients (median size 11 mm; 13 ground glass, 19 solid, 12 partial solid). Two of 4 readers had lower nodule detection sensitivity for ULD compared to LD ($p < 0.04$). Single reader sensitivity ranged from 46-87% for LD and from 39-65% for ULD CT. Sensitivity of double reading was 86% (38/44; 95% CI: 73 -95%) for LD, but only 59% (26/44; 95% CI: 43-74%) for ULD. Sensitivity for CAD was 75% (33/44) for LD and 70% (31/44) for ULD CT, with a median of 3 false positives per patient. CAD detected a greater proportion of missed nodules with ULD compared to LD (15/21[71%] vs. 11/21 [52 %], respectively).

CONCLUSION

ULD chest CT performed with 100 kV/Sn reduced patient dose by over 90% but decreased nodule detection sensitivity. CAD demonstrated persistent high sensitivity regardless of dose and detected nodules missed by radiologists. Use of 100 kV/Sn ultra-low dose CT in conjunction with CAD may be a feasible strategy to lower patient dose while preserving pulmonary nodule detection sensitivity.

CLINICAL RELEVANCE/APPLICATION

Use of CAD with 100 kV/Sn ultra low-dose chest CT for pulmonary nodule detection can reduce patient dose by over ten-fold while maintaining detection sensitivity.

SSM06-06 The Latest Model-Based Iterative Reconstruction (MBIR) with Lung-specific Setting: Quantification of Pulmonary Emphysema on Submillisievert CT

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S406B

Awards

Student Travel Stipend Award

Participants

Akinori Hata, MD, Suita, Japan (*Presenter*) Nothing to Disclose

Masahiro Yanagawa, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

Osamu Honda, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

Noriko Kikuchi, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the influence of latest model-based iterative reconstruction (MBIR) with lung-specific setting, MBIR with conventional setting, and filtered back projection (FBP) on quantification of pulmonary emphysema on submillisievert chest computed tomography (CT) compared with routine-dose CT reconstructed using FBP.

METHOD AND MATERIALS

Ten patients were included in this prospective study. CT images at routine dose (Auto mA) and reduced dose (10 mA) were scanned. Radiation dose parameters were recorded. Reduced-dose CT was reconstructed using FBP with sharp kernel (FBP-Bone) and with soft tissue kernel (FBP-Standard) and MBIR with lung-specific setting (MBIR-Lung) and with conventional setting (MBIR-Standard). Routine-dose CT was reconstructed using FBP with sharp kernel. Lung volume and extent of emphysema were evaluated automatically. The extent of emphysema was obtained by calculating the percentage of low attenuation area (%LAA) values lower than -950 Hounsfield Units. The differences in the lung volume and %LAA between routine-dose FBP and each reduced-dose CT reconstructed using MBIR and FBP were assessed with the Steel test.

RESULTS

The estimated radiation dose was 5.98 ± 1.62 mSv for routine-dose CT and 0.18 ± 0.02 mSv for reduced-dose CT. There was no significant difference between the lung volume of each reduced-dose CT and that of routine-dose FBP ($p > 0.05$). There was no significant difference between the %LAA of MBIR-Lung and that of routine-dose FBP ($p > 0.05$). The %LAA of MBIR-Standard was significantly lower than routine-dose FBP ($p < 0.05$) and those of FBP-Bone and FBP-Standard were significantly higher than routine-dose FBP ($p < 0.01$).

CONCLUSION

The quantification of %LAA using MBIR-Lung on submillisievert CT was almost equal to routine-dose FBP.

CLINICAL RELEVANCE/APPLICATION

On submillisievert CT, MBIR with lung-specific setting may be the most appropriate for quantifying pulmonary emphysema.

SSM07

Emergency Radiology (Emergency Neuroradiology)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S403B



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

Participants

Jamilik-Omari Johnson, MD, Atlanta, GA (*Moderator*) Research Grant, Koninklijke Philips NV; Royalties, Cambridge University Press
Scott D. Steenburg, MD, Zionsville, IN (*Moderator*) Nothing to Disclose

Sub-Events

SSM07-01 Potential for Lower Dose Spiral Head CT to Detect Intracranial Findings Causing Neurologic Deficit

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S403B

Participants

Joel G. Fletcher, MD, Rochester, MN (*Presenter*) Grant, Siemens AG; ;
David R. De Lone, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Amy L. Kotsenas, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Norbert G. Campeau, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Vance Lehman, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Maria Shiung, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Adam Bartley, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
David R. Holmes Iii, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Alicia Toledano, DSc, Kensington, MD (*Abstract Co-Author*) Consultant, iCAD, Inc
Rickey Carter, 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 ability of lower dose head CT using either standard filtered back projection (FBP) or iterative reconstruction (IR) to display intracranial findings (ICF) that may cause neurologic deficit.

METHOD AND MATERIALS

Using a retrospective, case-control design, CT projection data from 83 unenhanced spiral head CT exams in patients with suspected neurologic deficit were collected. Positive cases required presence of histopathology, surgery, progression of findings, or corresponding neurological deficit. Negative cases required negative CT findings and negative neurological assessment. Routine clinical images were obtained using 250 effective. mAs (emAs) and IR. Based on prior results and using validated noise insertion, four additional lower dose configurations were reconstructed (25 emAs -IR, 50 emAs -FBP and -IR, 100 emAs -FBP and -IR, 200 emAs -FBP). Three neuroradiologists circled ICF's and provided a diagnosis, confidence (0 - 100), and image quality rating. Matching of reference and reader markings was performed by a non-reader neuroradiologist. The difference between the JAFROC figure-of-merit (FOM) at routine and lower dose configurations was estimated along with 95% confidence intervals (CIs), with the lower 95% CI limit required to be greater than -0.10 to demonstrate non-inferiority.

RESULTS

63 ICF's (25 infarcts, 6 intra- and 9 extra-axial hemorrhages, 25 masses; non-exclusive) were identified by reference standard in 40/83 (48%) patients with routine head CT (CTDI 38.3 mGy). JAFROC FOM at 250 emAs routine dose was 0.82 (95% CI: 0.76, 0.89). Using non-inferiority criteria, the JAFROC FOM was non-inferior for dose levels corresponding to ≥ 100 emAs when IR was utilized [100 emAs -IR FOM 0.78 (95% CI: 0.71, 0.85), with the difference from routine dose being -0.04 (95% CI: -0.08, 0.01)]. For 100 emAs -FBP, this difference was -0.06 (95% CI: -0.11, -0.02). This difference was worse and larger for lower dose levels. Diagnostic image quality was better at higher dose levels and with IR ($p < 0.05$).

CONCLUSION

Observer performance for dose levels from 100 to 200 emAs was non-inferior to that observed at 250 emAs with IR, with IR preserving non-inferiority at a mean CTDI/SSDE of 15.2/10.5 mGy.

CLINICAL RELEVANCE/APPLICATION

Substantial opportunity exists for lowering radiation dose at unenhanced head CT with the use of iterative reconstruction, but is limited by lower radiologist performance at very low doses.

SSM07-02 Analysis of the Causes of Overuse of Head CT Examinations for the Investigation of Minor Head Trauma

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S403B

Participants

Arkadi Beytelman, MA, Rosh Haayin, Israel (*Presenter*) Nothing to Disclose
Eli Konen, MD, Ramat Gan, Israel (*Abstract Co-Author*) Research Consultant, RadLogics Inc
Dan Greenberg, Beer Sheva, Israel (*Abstract Co-Author*) Nothing to Disclose
Eyal Zimlichman, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Eyal Klang, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Minor head injury is a common cause for emergency CT. There are known protocols in assessing the need for CT in minor head injury. One of the most recognizable protocols is the Canadian CT Head Rule (CCHR). The purpose of this study was to estimate the volume and rate of CTs performed in the emergency department of a large tertiary hospital that are unwarranted by CCHR criteria and to analyze factors that contribute to unnecessary examinations.

METHOD AND MATERIALS

One thousand brain CT scans performed due to minor head injury during 2014 were randomly collected. Medical records were assessed for the following parameters: whether the CT referral met the CCHR criteria, type of the referring physician (emergency physician, internal medicine, surgery, neurologist, other), seniority of the referring physician (beginning resident, experienced resident, senior), cause of head trauma (four wheels motor vehicle accident, two wheels accident, fall accident, etc.).

RESULTS

A total of 955 cases were included in the analysis of which 104/955 (10.9%) examinations were unjustified by the CCHR criteria. In patients younger than sixty five, 104/279 (37.3%) of the examinations were unjustified.

When assessing contributing factors, we found that neurologists conducted more unwarranted CTs (odds ratio 3.5, $p=0.011$) while surgeons tended to order less (odds ratio 0.676, $p=0.126$). There was no statistically significant difference between the seniority of the referring physician and over referral.

The type of injury that was found to cause the most unjustified CTs was involvement in a four wheels motor vehicle accident (odds ratio 3.034, $p<0.001$).

CONCLUSION

The study demonstrates excess use of CTs due to minor head injuries that are not justified by CCHR criteria, especially in the younger patients with an excess of 37.3%. Contributing factors are the type of the referring physician and the type of injury.

CLINICAL RELEVANCE/APPLICATION

CT overuse cause both unnecessary radiation exposure and waste of healthcare resources. Analysis of the causes for overuse can be implemented both for specific education programs and also for implementation of computerized referring protocols that can help as decision support.

SSM07-03 Comparing CT/MRI Diagnostic Accuracy in Posterior Fossa Strokes, Analyzing Diagnostic Yield in Patients with Localizing Symptoms

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S403B

Awards

Student Travel Stipend Award

Participants

Manav Bhalla, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose

Andrew P. Klein, MD, Pewaukee, WI (*Abstract Co-Author*) Nothing to Disclose

John L. Ulmer, MD, Milwaukee, WI (*Abstract Co-Author*) Stockholder, Prism Clinical Imaging, Inc Medical Advisory Board, General Electric Company

Sarika Pamarthy, MBBS, MS, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

Kieran E. McAvoy, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose

Brian Fitzsimmons, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose

Leighton P. Mark, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose

Stephen A. Quinet, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose

Namrata Bhalla, Brookfield, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Cerebellar and brain stem strokes present with diverse symptomatology and often may not present with the classic stroke symptom of unilateral weakness. Patients presenting with dizziness, vertigo, ataxia/gait disturbances, often receive suboptimal stroke imaging. Our study analyzes distribution patterns in CT and MRI accuracy in posterior fossa stroke to identify possible causes of under diagnosis and pitfalls in ED stroke screening protocols. Formulating refined clinical filters in the decision tree will improve effective use of imaging and patient outcomes.

METHOD AND MATERIALS

77/500 patients (of 1000 planned in this ongoing retrospective institutional study) presented with posterior fossa symptoms including dizziness, vertigo, ataxia and gait disturbances. CT/MRI imaging was performed within a 24-hour interval. The accuracy, positive (PPV) and negative (NPV) predictive values of final CT/MRI interpretations were calculated using final clinical discharge diagnosis as the gold standard.

RESULTS

Overall, 42/500 patients had posterior fossa strokes which were all identified by MRI; 11 presented within the 0-4.5 hr tPA window period (only 1 CT positive, i.e. 9%), 6 within 4.5-24 hrs period (1 CT positive, i.e. 17%) and 25 after 24 hours (7 CT positive, i.e. 28%) of presentation. Amongst the patients presenting with localizing symptoms, 26/77 (33%) patients had stroke (compared to overall stroke incidence of 47.7%). Half of these strokes were located in cerebellar and/or brain stem, where CT is only 21% sensitive. If this happens to be in 0-4.5 hrs period, it further drops to 9%. MRI is highly sensitive and superior to CT, in accuracy and predictive value, across different time frames and symptom profiles.

CONCLUSION

Appropriate patient selection and robust clinical filters will improve quality of CT/MRI stroke evaluation of the posterior fossa. MRI has greater diagnostic value, especially in CT negative patients with unresolved symptoms. Other confounding factors that favor use of MRI include symptom overlap with varying territory of involvement and the need to rule out non-vascular etiology.

CLINICAL RELEVANCE/APPLICATION

Preferential utilization of MRI may be justified in critical posterior fossa strokes where there is significant risk of a missed

diagnosis/mortality.

SSM07-04 Eliminating Medical Waste: Unnecessary Head CTs in Healthy Adults

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S403B

Awards

Trainee Research Prize - Resident

Participants

Douglas T. Hiday Jr, MD, Providence, RI (*Presenter*) Nothing to Disclose
Jin K. Jung, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Matthew R. Shalvoy, MD, Cumberland, RI (*Abstract Co-Author*) Nothing to Disclose
Brian L. Murphy, MD, Barrington, RI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To examine the diagnostic yield of brain imaging in adults without trauma presenting to the emergency room.

METHOD AND MATERIALS

All brain computed tomography (CT) examinations performed at our institution as part of an emergency room (ER) visit during 2015 for patients age 18-40 were reviewed (n = 3302). Exclusion criteria were pregnancy or within 2 weeks postpartum, head trauma within the previous two weeks, prior known intracranial pathology and/or procedure, and referral based on outpatient imaging. In the end, 685 cases met inclusion criteria and were reviewed for positive findings. For each study, the patient's demographics and a brief clinical history were recorded, including presenting complaint(s), Glasgow Coma Scale (GCS), and both prior and subsequent imaging findings.

RESULTS

Nineteen cases had positive intracranial findings (2.8%). Their chief complaints were altered mental status (9), new/unevaluated seizures (5), hemiplegia (3), and progressive focal visual deficits (2). If a patient was GCS 15 at time of presentation without hypertensive emergency/urgency, a new/unevaluated seizure disorder, visual changes, or hemiplegia, their CT scan was negative. In absence of a known malignancy or hypertensive urgency/emergency, a prior negative CT brain examination also had a NPV of 100%.

CONCLUSION

During 2015, 685 head CTs performed in patients 18-40 years old presenting to the ER without trauma yielded 19 positive results, translating to a diagnostic yield of 2.8%. If CTs were only performed for patients with a GCS of 14 or less, hypertensive urgency/emergency, new/unevaluated seizures, persistent visual deficits, or hemiplegia, 579 head CTs (85%) could have been omitted without missing any of the 19 positives cases, eliminating substantial healthcare cost and reducing unnecessary radiation exposure to patients. This finding represents a significant opportunity for improving the quality of care delivered in the ER nationwide and warrants further investigation.

CLINICAL RELEVANCE/APPLICATION

Adults under 40 presenting to the ER without trauma are a low-risk population for intracranial pathology and as many as 85% of brain CTs could potentially be eliminated from the diagnostic work-up.

SSM07-05 The Role of Computed Tomography (CT) in Predicting Diplopia in Orbital Blunt Trauma

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S403B

Participants

Michaela I. Cellina, Milan, Italy (*Presenter*) Nothing to Disclose
Caterina Bebbere, Sassari, Italy (*Abstract Co-Author*) Nothing to Disclose
Marcello A. Orsi, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Giancarlo Oliva, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The management of orbital fracture, in terms of need of surgical repair and timing of surgery, is controversial: the evaluation of diplopia is the most important criterion for planning whether to undertake surgical intervention. Our aim was to determine the orbital CT findings that can be used to predict the development of permanent diplopia in patient with orbital fractures.

METHOD AND MATERIALS

We retrospectively evaluated CT of all patients presented to our Emergency Department for blunt craniofacial trauma (N=3334) from January 2014 to March 2016, selecting only patient with CT-demonstrated orbital fracture. The following CT variables were assessed: fracture location (medial wall, floor, lateral wall, roof, medial wall + floor, lateral wall + floor, lateral wall + roof, multiple locations), fracture multifocality, bone fragments displacement, extraocular muscle thickening, muscle entrapment, muscle displacement, muscle hooking, intraconal emphysema, extraconal emphysema, intraconal hematoma, extraconal hematoma, fat herniation. All patients underwent complete ophthalmological evaluation and Hess-Lancaster test, in order to establish the presence of diplopia. After performing group comparison with Pearson χ^2 test, we derived our prediction model by using logistic regression, with diplopia as the prediction and CT variables as predictors.

RESULTS

We observed 299 patients (male: 221; female: 78; age range: 4-93 years; mean age: 46) with orbital fracture due to a blunt trauma, 46 (15.4 %) with a Hess Lancaster test-proven diplopia. The CT variables with statistically significant difference between the group with diplopia and the group without diplopia were as follows: floor fracture (p=.014), bone fragments displacement (p=.001), multifocality (p=.005), muscle thickening (p=.001), muscle entrapment (p<.001), muscle displacement (p<.001), fat herniation (p=.003). The CT variables with significance as predictors of diplopia were: floor location (odds ratio [OR], 2.87; 95% confidence interval [CI]: 1.22, 6.73; p=.01), muscle thickening, muscle entrapment (OR, 10.69; 95% CI: 3.76, 30.4; p<.001) and muscle displacement (OR, 11.51; 95% CI: 3.05, 43.3; p<.001).

CONCLUSION

The development of persistent diplopia can be predicted on the basis of CT findings after an orbital trauma.

CLINICAL RELEVANCE/APPLICATION

Such patients should be directed toward early surgical repair in order to re-establish extraocular muscle function.

SSM07-06 Blunt External Laryngeal Injuries: Factors that Influence Accurate Prospective Diagnosis with Computed Tomography

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S403B

Awards

Student Travel Stipend Award

Participants

Sonya Khan, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

Clint W. Sliker, MD, Ellicott City, MD (*Abstract Co-Author*) Nothing to Disclose

Deborah M. Stein, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Elizabeth A. Guardiani, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Determine accuracy of prospectively diagnosed blunt external laryngeal injury (BELI) with computed tomography (CT). Determine if available clinical history or observation of coexisting facial or cervical injuries on the CT influences diagnostic accuracy.

METHOD AND MATERIALS

IRB approved, retrospective review of patients who presented to a Level I Trauma Center between January 2000 and September 2015, diagnosed with BELI and imaged with CT. Initial CT reports were reviewed, noting: if BELI was prospectively diagnosed by reporting radiologist, the study indication, and if there were coexisting midfacial/mandible fractures and/or cervical artery or spine injury. Multivariate linear regression analysis ($p > 0.05$) was used to determine likelihood of prospective CT diagnosis of BELI when history suggesting injury or relevant mechanism was provided relative to when nonspecific history was provided.

RESULTS

76 patients met inclusion criteria (age 15-77 years, mean 42.3, SD 15.7). BELI was prospectively diagnosed by CT in 57.89% (44/76) of patients. When history specifying laryngeal injury or anterior neck trauma was available at initial CT interpretation, BELI was prospectively diagnosed in 50% (26/44) and 36% (16/44) of patients, respectively. Frequencies of coexisting injuries were: 36.84% (28/76) midface/mandibular fractures, 13.16% (10/76) cervical spine injuries, and 6.67% (5/76) common or cervical internal carotid artery injuries. Multivariate linear regression analysis shows that clinical history suggesting laryngeal injury was significantly associated with accurate prospective diagnosis, coefficient 0.440222 ($p = 0.044$, CI [0.0125, 0.8678]). Cervical spine injury was also significantly associated with a positive diagnosis, coefficient 0.4825736 ($p = 0.014$, CI [0.1008, 0.8642]).

CONCLUSION

When reviewing CT scans of the cervical region in patients with history of acute blunt trauma, radiologists will accurately diagnose BELI more frequently if provided with a clinical history suggesting a laryngeal injury or if diagnosis is made of a coexisting cervical spine injury.

CLINICAL RELEVANCE/APPLICATION

Blunt external laryngeal injuries are rare (incidence 0.04-0.06%) but clinically significant injuries for which early intervention can improve outcomes. Early clinical diagnosis can be difficult, thus the radiologist may be first to suspect BELI, rendering it crucial for him/her to understand when risk for BELI is high when reviewing cervical CT's in post-blunt trauma patients.

SSM08

Gastrointestinal (Radiogenomics)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: E353A



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

Participants

Andrew D. Smith, MD, PhD, Jackson, MS (*Moderator*) Research Grant, Pfizer Inc; President, Radiostics LLC; President, Liver Nodularity LLC; President, Color Enhanced Detection LLC; President, eMASS LLC; Pending patent, Liver Nodularity LLC; Pending patent, Color Enhanced Detection LLC; Pending patent, eMASS LLC;
Srinivasa R. Prasad, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSM08-01 Hepatocellular Adenoma MRI Phenotype Identification: 2016 Update

Wednesday, Nov. 30 3:00PM - 3:10PM Room: E353A

Participants

Sylvain Bise, Pessac, France (*Abstract Co-Author*) Nothing to Disclose
Nora Frulio, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Arnaud Hocquelet, Pessac, France (*Presenter*) Nothing to Disclose
Jean-Frederic Blanc, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Nicolas Alberti, MD, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Charles Balabaud, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Herve Trillaud, MD, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose
Paulette Bioulac-Sage, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic resonance imaging (MRI) might be the cornerstone of the management of hepatocellular adenomas (HCA). The objective was to perform correlation between MRI and pathological HCA subtypes, to improve MRI diagnosis towards a less invasive diagnosis strategy.

METHOD AND MATERIALS

Pathological and radiological data of 116 HCAs were consecutively and retrospectively analyzed to investigate new MR features of the 4 HCA pathological subtypes. Complication risks according to both HCA subtypes and sizes were also analyzed.

RESULTS

38/43 (88.4%) HNF1 α mutated (H-HCAs) were discriminated by (i) fatty component (homogenous or heterogeneous) and (ii) hypovascular pattern association on MRI, with sensitivity (Se) of 88.4% and specificity (Sp) of 97.2%. 51/58 (87.9%) inflammatory HCAs (IHCAs) displayed MRI features of sinusoidal distension (SD) including 3 different patterns (global SD and atoll sign previously described, and a new "croissant sign" (portion of peripheral rim hyperintense on T2W and/or arterial phase with persistent delayed enhancement - 14/58, 24.1%), corresponding to Se of 87.9% and Sp of 100%. Central Hemosiderin deposits (13/58, 22.4%) appeared very specific (100%) of IHCAs in association to SD. β -catenin mutation were unidentifiable from IHCAs (14 b-IHCAs, 24.1%). HCAs remaining non-classifiable by MRI were H-HCAs (4/116, 3.4%) and IHCAs (3/116, 2.5%) with tumor area remodeled by necrotic/hemorrhagic changes >50%, H-HCA without steatosis (1/116, 0.8%), IHCAs without SD (4/116, 3.4%), β -catenin mutated (6/116, 5.1%) and unclassified HCAs (9/116, 7.7%). Malignant transformation (6/116, 5.1%) and bleeding (24/116, 20.6%) cases were not found below HCA sizes of 5.2cm and 4.2cm respectively.

CONCLUSION

The contribution of new MRI criteria in addition to previously described classical criteria, allow identifying 88% of the 2 main HCAs subtypes (H-HCA, IHCA) and therefore decreasing considerably the place of biopsy in diagnosis strategy.

CLINICAL RELEVANCE/APPLICATION

The contribution of new MRI criteria in addition to Laumonier's criteria allows to identify 88% of the 2 major HCAs subtypes in discriminating (i) low to moderate steatotic H-HCAs with "hypovascular pattern", and (ii) remodeled IHCAs bearing peripheral "croissant sign" +/- central hemosiderin deposits.

SSM08-02 The Value of Gadoteric Acid-enhanced and Diffusion-weighted MR Imaging for Predicting Cytokeratin19-Positive Hepatocellular Carcinoma

Wednesday, Nov. 30 3:10PM - 3:20PM Room: E353A

Participants

Seo-Youn Choi, MD, Bucheon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seong Hyun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Eun Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong Ah Hwang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Jeong Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Hye Min, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the value of preoperative MR imaging for predicting cytokeratin (CK) 19-positive hepatocellular carcinoma (HCC) and to evaluate the prognosis after surgery of CK 19-positive HCC.

METHOD AND MATERIALS

Two hundred and four patients with a CK19-positive HCC and 38 with a CK19-negative HCC who underwent surgery after gadoteric acid-enhanced and diffusion-weighted MR imaging were retrospectively evaluated. Two radiologists evaluated the preoperative MR imaging findings in consensus. Significant MR imaging findings for differentiating two groups were identified on univariate and multivariate analyses. Time-to-recurrence rate after surgery was also compared between two groups.

RESULTS

In univariate and multivariate analyses, lobulated or ill-defined margin ($p = 0.024$), rim enhancement on arterial phase ($p < 0.001$), lower tumor-to-liver signal intensity ratio on hepatobiliary phase images (≤ 0.5221 , $p = 0.01$) and tumor-to-liver ADC ratio (≤ 0.820 , $p < 0.001$) were independently significant factors for predicting CK19-positive HCC. When three of these four criteria are combined, 63.2% (24/38) of CK19-positive HCCs were identified with specificity of 90.7% (185/204). When all four criteria are satisfied, specificity was 99.5%. The time-to-recurrence rate was significantly higher in patients with CK19-positive HCCs compared with those with CK19-negative HCCs (23.9% vs. 3%, 36.1% vs. 10.0%, 36.1% vs. 20.1% and 45.2% vs. 29.8% in 6months, 1, 2 and 3years, respectively) ($p = 0.001$).

CONCLUSION

Gadoteric acid-enhanced and DW MR imaging may be helpful for predicting CK19-positive HCCs with higher time-to-recurrence rate.

CLINICAL RELEVANCE/APPLICATION

Lobulated or ill-defined margin, rim enhancement on arterial phase, lower tumor-to-liver signal intensity ratio on hepatobiliary phase images and lower tumor-to-liver ADC ratio were independently significant factors for predicting CK19-positive HCC, which is related to poor prognosis or early recurrence of HCC after surgical resection.

SSM08-03 Volumetric Textural Analysis of Colorectal Masses at CT Colonography: Differentiating Benign from Malignant Pathology and Comparison with Human Readers

Wednesday, Nov. 30 3:20PM - 3:30PM Room: E353A

Participants

B. Dustin Pooler, MD, Madison, WI (*Presenter*) Nothing to Disclose
Meghan G. Lubner, MD, Madison, WI (*Abstract Co-Author*) Grant, Koninklijke Philips NV; Grant, Johnson & Johnson;
Yifan Hu, MS, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Jake R. Theis, MD, Bloomington, MN (*Abstract Co-Author*) Nothing to Disclose
Richard Halberg, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Zhengrong Liang, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Perry J. Pickhardt, MD, Madison, WI (*Abstract Co-Author*) Co-founder, VirtuoCTC, LLC; Stockholder, Collectar Biosciences, Inc; Stockholder, SHINE Medical Technologies, Inc; Research Grant, Koninklijke Philips NV

PURPOSE

To apply higher-order volumetric texture analysis to colorectal masses at CT colonography (CTC) for differentiation of benign and malignant lesions, and compare against human performance.

METHOD AND MATERIALS

A validated volumetric texture analysis method was applied to 63 pathologically-proven colorectal masses (mean size, 4.2 cm; range, 3-8 cm) at non-contrast CTC in 60 adults (mean age, 66.5 years; range, 45.9-91.6 years). 32 (51%) of the 63 masses were invasive adenocarcinoma and 31 (49%) were benign advanced adenomas. Analyzed texture features included density, gradient, and curvature. Three readers with CTC experience (radiology resident, fellow, and staff) independently analyzed the likelihood of malignancy using a 5-point scale (1=definitely benign, 2=probably benign, 3=indeterminate, 4=probably malignant, 5=definitely malignant). Areas under the ROC curve (AUC) and point accuracy levels were compared.

RESULTS

The ROC AUC for differentiating benign and malignant lesions using the texture features from the original density and higher-order derivative images of gradient and curvature reached 0.9363. AUC for the resident, fellow, and staff was 0.926, 0.869, and 0.960, respectively. Volumetric texture analysis was 83.6% sensitive and 87.5% specific at a threshold score of 0.5300. Resident/fellow/staff/pooled sensitivity and specificity using 3-5 score as positive were 93.5%/81.8%/96.9%/90.7% and 81.3%/74.2%/77.4%/77.6%, respectively. Pooled accuracy for the three readers was 85%.

CONCLUSION

Higher-order volumetric textural analysis demonstrated excellent performance for distinguishing benign from malignant colorectal masses at CTC, comparable to experienced human performance.

CLINICAL RELEVANCE/APPLICATION

Higher-order volumetric textural analysis may be useful in characterization of colorectal masses at CT.

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
Meghan G. Lubner, MD - 2014 Honored Educator
Meghan G. Lubner, MD - 2015 Honored Educator

SSM08-04 Pathological T Stages of Rectal Cancer Can Be Accurately Discriminated via Radiomic Features From

Post-Chemoradiation T2w MRI

Wednesday, Nov. 30 3:30PM - 3:40PM Room: E353A

Participants

Jacob T. Antunes, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Justin T. Brady, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Scott R. Steele, MD, Tacoma, WA (*Abstract Co-Author*) Nothing to Disclose
Conor Delaney, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Joseph Willis, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Jayakrishna Gollamudi, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Raj M. Paspulati, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Pablo R. Ros, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Anant Madabhushi, PhD, Piscataway, NJ (*Abstract Co-Author*) Nothing to Disclose
Satish Viswanath, Cleveland, OH (*Presenter*) Scientific Advisory Board Member, Virbio Inc

PURPOSE

Treatment response evaluation in rectal cancer typically involves tumor-node-metastasis (TNM) staging, which may be visually identifiable on *in vivo* MRI but has high interobserver variability (expert agreement ~53%). We present preliminary results of using radiomics (computer-extracted features from radiographic images) to identify quantitative imaging signatures on post-chemoradiation T2w-weighted (T2w) MRI that differentiate between pathologic T stages, a marker of tumor response to treatment.

METHOD AND MATERIALS

38 rectal cancer patients with pathologic T stage from excised specimens (and N0 M0) had been pre-operatively imaged using a 3T T2w turbo-spin echo MRI post-chemoradiation. 78 first-order statistical, gray level, gradient, Haralick, and Gabor radiomic features were extracted from T2w volumes on a per voxel basis. Tumor extent was annotated on T2w images based on visual inspection by an expert radiologist. Our approach comprised of (1) computing statistics to describe feature values within each tumor annotation (median, variance, kurtosis, skewness, entropy), (2) ranking features using statistical analysis to identify significant differences between different groups of patients, and (3) clustering of the top 3 radiomic features to determine whether they differentiate pathologic T stage groupings.

RESULTS

Our cohort comprised 4 T stage groups: T0 (n = 7), T1-2 (n = 11), T3 (n = 11), and T4 (n = 9). Scatterplots of top features in 3D space demonstrate excellent clustering of T0 vs T1-2 patients (89% accuracy) and T3 vs T4 patients (80% accuracy). The T2w intensity does not capture any differences between T0 vs T1-2 tumors and T3 vs T4 tumors. Top-ranked radiomic features comprised macro-scale Gabor operators which capture oriented filter responses indicative of sub-visual micro-architectural differences between different pathologic T stages.

CONCLUSION

Gabor radiomic features on T2w MRI appear to be predictive of pathologic T stage following neoadjuvant chemoradiation in patients with rectal cancer. This could help more definitively assess treatment response in these patients *in vivo*.

CLINICAL RELEVANCE/APPLICATION

Tumor stage is used for treatment response assessment in patients with rectal cancer, and radiomic features from post-chemoradiation MRI may be able to accurately identify pathologic T stage. These may be useful in predicting patient response to neoadjuvant treatment *in vivo* to help assist pre-operative planning.

SSM08-05 VEGFR2 Expression in Hepatocellular Carcinoma, Dysplastic and Regenerative Liver Nodules and Correlation with Pre-Biopsy Dynamic Contrast Enhanced CT

Wednesday, Nov. 30 3:40PM - 3:50PM Room: E353A

Participants

Wolfgang M. Thaiss, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Sascha Kaufmann, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christopher Kloth, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
Hans Bosmuller, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Marius Horger, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the distribution of Vascular Endothelial Growth Factor Receptor 2 (VEGFR2) in hepatocellular carcinoma (HCC), dysplastic (DN) and regenerative liver nodules (RLN) for possible group differentiation and to correlate the results with pre-histology, *in vivo* dynamic contrast enhanced CT (DCE-CT) data.

METHOD AND MATERIALS

Retrospective database search revealed 34 patients (63.6y, SD 8.9, 7 female) at our institution that underwent liver biopsy or surgery due to suspected HCC or dysplastic nodules after DCE-CT was performed between 2009 and 2015. Patients received no previous chemo- or interventional therapy. Immunohistochemistry for VEGFR2 was performed and the Immunoreactive Score (IRS) was used for staining quantification. DCE-CT was performed at 80 kVp with a 128-row CT scanner (Somatom Definition AS+), evaluation and ROI measurements were carried out using syngo Volume Perfusion CT Body (Siemens Healthcare). Blood flow, blood volume and hepatic perfusion index were assessed. One-way ANOVA with Tukey correction for group comparison and Pearson's r for correlations were used.

RESULTS

Histology confirmed HCCs (n = 10), DN (n = 7) and RLN (n = 34). Mean IRS for VEGFR2 in HCCs was 9.1 (SD 3.0), 7.3 (SD 1.6) for dysplastic nodules and 5.2 (SD 2.8) for regenerative liver nodules (p=0.0004 for HCC vs. RLN; p=0.06 for HCC vs. DN, not

significant). Perfusion values varied significantly between all three groups for blood flow and hepatic perfusion index ($p < 0.001$ and $p < 0.0001$) and for blood volume in HCC vs. RLN ($p < 0.0001$) and DN vs. RLN ($p = 0.0019$). Strong correlations between VEGFR2-IRS and perfusion parameters were observed for blood flow in HCCs ($r = 0.88$, $p < 0.01$) and hepatic perfusion index in HCCs and DN ($r = 0.85$, $p < 0.04$; $r = 0.9$, $p < 0.01$).

CONCLUSION

Immunostaining revealed different expression levels for VEGFR2 in HCCs, dysplastic liver nodules and regenerative liver nodules. Non-invasive perfusion assessment of HCC and its precursors is feasible using DCE-CT and perfusion markers blood flow, blood volume and hepatic perfusion index correlated well with VEGFR2-immunostaining.

CLINICAL RELEVANCE/APPLICATION

The strong correlations between DCE-CT perfusion parameters and the expression levels of VEGFR2 in immunohistochemistry propose new horizons in diagnosis and anti-VEGFR therapy monitoring in HCC and its precursors.

SSM08-06 CT Radiogenomic Characterization of ATRX and DAXX Alterations in Primary Pancreatic Neuroendocrine Tumors

Wednesday, Nov. 30 3:50PM - 4:00PM Room: E353A

Awards

Trainee Research Prize - Resident

Participants

Jonathan McGovern, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Aatur Singhi, MD, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose

Amir Borhani, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose

Alessandro Furlan, MD, Pittsburgh, PA (*Abstract Co-Author*) Book contract, Reed Elsevier; Research Grant, General Electric Company

Herbert J. Zeh, MD, Johnstown, PA (*Abstract Co-Author*) Nothing to Disclose

Kevin M. McGrath, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose

Nathan Bahary, MD, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose

Anil K. Dasyam, MD, Pittsburgh, PA (*Abstract Co-Author*) Book contract, Reed Elsevier

PURPOSE

To compare the computed tomography (CT) characteristics of primary pancreatic neuroendocrine tumors (PanNETs) in patients with and without loss of the death domain-associated protein (DAXX) or alpha thalassemia/mental retardation syndrome X-linked (ATRX) proteins. PanNETs with DAXX/ATRX alterations have previously been shown to be associated with poor prognosis.

METHOD AND MATERIALS

Institutional review board approval was obtained and the requirement for informed consent was waived for this retrospective study. In 186 subjects with pathology-proven PanNETs, contrast-enhanced multiphasic CTs were available in 127 and the remaining subjects were excluded. Of these 127 subjects, 33 were DAXX/ATRX-negative and 94 were DAXX/ATRX-positive. Two blinded reviewers evaluated preoperative multiphasic CTs in consensus for the following variables: Invasion of adjacent organs and vessels, the presence of cystic or necrotic degeneration, hepatic, osseous, or lymph node metastases, tumor calcification, objective and subjective tumor enhancement, lobulated/irregular or smooth contour, tumor size, and the presence of biliary or pancreatic ductal dilatation. Statistical analysis was performed using chi-squared tests or Student's t-tests.

RESULTS

Subjects with DAXX/ATRX-negative PanNETs were significantly more likely to have tumors which demonstrated vascular invasion ($p < 0.001$), hepatic or osseous metastases ($p < 0.001$), and pancreatic ductal dilatation ($p < 0.001$). Additionally, PanNETs associated with loss of DAXX/ATRX were larger in size (mean 51.5 mm, in comparison with 27.8 mm for wild-type tumors; $p < 0.001$), more likely to be irregular in contour ($p < 0.001$), and more likely to contain calcifications ($p < 0.007$). There was no significant difference between groups in invasion of adjacent organs, the presence of cystic or necrotic degeneration, biliary dilatation, metastatic lymphadenopathy, or in subjective or objective tumor enhancement.

CONCLUSION

PanNETs which harbor alterations in the DAXX or ATRX proteins demonstrate radiographic evidence of aggressive behavior, including vascular invasion, hepatic or osseous metastases, larger size, irregular contour, tumor calcification, and pancreatic ductal dilatation.

CLINICAL RELEVANCE/APPLICATION

Identification of imaging characteristics suggesting the presence of DAXX/ATRX alterations could guide pathologic diagnosis and have implications for clinical prognosis and management.

SSM09

Gastrointestinal (Small Bowel Imaging)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: E353B



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

Participants

Joel G. Fletcher, MD, Rochester, MN (*Moderator*) Grant, Siemens AG; ;
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Moderator*) Research Grant, DONGKOOK Pharmaceutical Co, Ltd

Sub-Events

SSM09-01 Dual-Energy CT of Gastrointestinal Stromal Tumors: Impact of Noise-Optimized Virtual Monochromatic Imaging on Image Quality and Diagnostic Accuracy

Wednesday, Nov. 30 3:00PM - 3:10PM Room: E353B

Participants

Simon S. Martin, MD, Frankfurt, Germany (*Presenter*) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Jan-Erik Scholtz, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Boris Bodelle, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Volkmar Jacobi, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Moritz H. Albrecht, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the impact of a noise-optimized algorithm for reconstruction of virtual monoenergetic images (VMI+) regarding detection and localization of abdominal gastrointestinal stroma tumors (GIST) on image quality and diagnostic accuracy in dual-energy CT (DECT).

METHOD AND MATERIALS

Arterial phase DECT images of 27 patients (15 men; 65.9±14.1 years) with GIST were reconstructed with standard linear blended (F_{0.5}), VMI+ and traditional monoenergetic (VMI) algorithm in 10-keV increments from 40 to 100 keV. Attenuation measurements were performed in GIST lesions and metastases for objective signal-to-noise (SNR) and contrast-to-noise ratio (CNR) calculation. Five-point scales were used to evaluate contrast enhancement and overall image quality. Diagnostic accuracy for the detection of GIST lesions and metastases was assessed in F_{0.5}, 70-keV VMI, 40-keV VMI+ and 60-keV VMI+ series and receiver operating characteristics (ROC) curve analysis was performed.

RESULTS

VMI+ series at 40-keV showed highest quantitative image parameters (SNR, 11.0±4.6; CNR, 9.2±4.5). Subjective assessment of vascular enhancement peaked in the 40-keV VMI and VMI+ series (both median, 5), whereas subjective overall image quality values were highest in 50-keV and 60-keV VMI+ series (both median, 5). Sensitivity and specificity for detection of GIST lesions and metastases were 96% and 91% for 40-keV VMI+, 90% and 87% for 60-keV VMI+, 88% and 87% for 70-keV for VMI, and 90% and 86% for F_{0.5} reconstructions. Area under the curve (AUC) was significantly superior (P≤0.039) for 40-keV VMI+ (0.998) compared to 60-keV VMI+ (0.949), 70-keV VMI (0.939) and F_{0.5} series (0.961).

CONCLUSION

Diagnostic accuracy in the detection of GIST lesions and metastases can be significantly increased using 40-keV VMI+ reconstructions compared with standard linearly blending and traditional VMI technique in arterial phase DECT.

CLINICAL RELEVANCE/APPLICATION

Noise-optimized virtual monoenergetic reconstruction (VMI+) can improve diagnostic accuracy for detection and localization of GIST lesions and metastases.

SSM09-02 -Radiation Dose Consideration with CT Enterography Exams in Adult IBD Patients: A Report on 246 Examinations

Wednesday, Nov. 30 3:10PM - 3:20PM Room: E353B

Awards

Student Travel Stipend Award

Participants

Khalid W. Shaqdan, MD, Boston, MA (*Presenter*) Nothing to Disclose
Rodrigo Canellas, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Manuel Patino, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Avinash R. Kambadakone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Onofrio A. Catalano, MD, Napoli, Italy (*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

This study evaluates filtered back projection (FBP) and iterative reconstruction (IR) algorithms on image quality and radiation dose

in adults undergoing CT enterography (CTE) exams.

METHOD AND MATERIALS

From Dec 2012 to Mar 2015, 246 portal venous phase CTE exams (5mm thickness) were performed in 240 patients (mean age = 43.4, mean bodyweight = 73 kg, male-female ratio=117:123). 122 CTE scans were processed using FBP, and 124 examinations were processed using IR (ASiR, n = 96 and SAFIRE, n = 28). 120 kVp (ATCM 75 - 450 mA) was applied in 218 exams and in 28 exams 100 kVp (Quality ref mAs 180) was used. Two readers independently reviewed 30 randomly sampled CTE for image quality, noise, and artifacts using 5-point scale. Size-specific-dose-estimates (SSDE) were compared and statistically analyzed. Objective noise and attenuation were also determined. Examinations were retrieved using dose-monitoring software (eXposure) to obtain SSDE, and ACR dose index registry was used to obtain benchmark radiation doses.

RESULTS

Diagnostic interpretations were rendered in all 246 exams. The diagnostic image quality (IQ) scores were high (mean IQ = 4.25) with comparable scores for FBP and IR images (FBP = 4.4 and IR = 4.2). IR image noise had lower noise (FBP = 22 and IR = 12.3), and higher CNR than FBP (FBP=1.9 and IR = 2.4). The median SSDE value (9.6 mGy) was 30% lower than the benchmark reported value in ACR dose index registry (13.9 mGy). The mean SSDE was lower for IR (FBP = 8.6 mGy and IR = 7.4 mGy) and higher dose reduction in patients weighing ≤ 90 kg (FBP = 9.7 mGy and IR = 8.7 mGy) over those weighing > 90 kg (FBP = 12.3 and IR = 11.9).

CONCLUSION

CTE exams in adults had 30% lower dose than the benchmark and studies performed with IR produces diagnostically adequate image quality when compared to FBP at a lower radiation dose especially in those with average to smaller body weight.

CLINICAL RELEVANCE/APPLICATION

CTE is often preferred exam in evaluation of IBD patients for both diagnosis and disease monitoring, therefore accumulation of radiation is a concern since patients are often young and will require serial studies. With a combination of low-dose techniques and IR methods, one can markedly reduce radiation dose at CTE while maintaining diagnostic accuracy.

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

SSM09-03 Correlation of MRI Features and MRI Activity Scoring Systems to Histopathology in The Terminal Ileum in Crohn's Disease

Wednesday, Nov. 30 3:20PM - 3:30PM Room: E353B

Participants

Carl A. Puylaert, MSc, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Charlotte J. Tutein Nolthenius, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jeroen Tielbeek, MD, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Frans M. Vos, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Stuart A. Taylor, MBBS, London, United Kingdom (*Abstract Co-Author*) Research Consultant, Robarts Clinical Trials, Inc
Jaap Stoker, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Research Consultant, Robarts Clinical Trials

PURPOSE

To evaluate several magnetic resonance imaging (MRI) activity scoring systems for diagnosis and grading of Crohn's disease (CD) in the terminal ileum (TI) as compared to histopathology.

METHOD AND MATERIALS

Ethics approval and written informed consent were obtained prior to inclusion, Suspected/proven CD were prospectively included from December 2011 until August 2014. Each patient underwent MR enterography (MRE) and ileocolonoscopy with standardized TI biopsies within two weeks time. The TI at MRE was evaluated by two observers for individual disease features on MRI, based on which four MRI scoring systems (CDMI, London, MaRIA and Clermont) were calculated. MRI features and scoring systems were correlated to the histopathological eAIS score (0-6). Reproducibility and diagnostic accuracy were evaluated by the weighted kappa and intraclass coefficient (ICC).

RESULTS

A total of 114 patients (mean age 31 years; female 55%) were included. Enhancement, length, perimural T2 signal, apparent diffusion coefficient (ADC) and relative contrast enhancement (RCE) showed good reproducibility (ICC: 0.6-0.8). Wall thickness, mural T2 signal, pattern and degree of enhancement, mural edema, length and ADC showed moderate correlation to eAIS ($r=0.40-0.60$), while other individual features showed no or poor correlation ($r<0.40$). All four scoring systems showed moderate correlation to eAIS and good reproducibility. CDMI showed the highest correlation to eAIS ($r=0.52-0.57$) and highest agreement (ICC=0.78), although the difference was not significant. Diagnostic accuracies for scoring systems ranged from 74-77% for observer 1 and from 69-72% for observer 2. Reproducibility, correlation coefficients and diagnostic accuracy did not differ significantly between the scoring systems.

CONCLUSION

For all four scoring systems reproducibility, correlation to the histopathological reference standard and diagnostic accuracy were comparable. Therefore, the choice for usage may be based on other aspects such as personal preference, experience and practical considerations.

CLINICAL RELEVANCE/APPLICATION

Four MRI scoring systems (CDMI, London, MaRIA and Clermont) are comparable for diagnosis and grading of CD activity and show similar reproducibility; preference can be based on other aspects.

SSM09-04 **Bowel Inflammatory Severity of Non-stricturing Crohn Disease on MR Enterography: Can DWI Modify MaRIA Score System for Improved Quantitative Assessment?**

Wednesday, Nov. 30 3:30PM - 3:40PM Room: E353B

Participants

Jin Sil Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hye Young Jang, 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
Kyunghwa Han, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ah Young Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic Resonance Index of Activity (MaRIA) is a score system developed before use of DWI to measure bowel inflammatory severity of Crohn disease (CD) on MR enterography (MRE). Its validation results diverged and interpretation of "ulcer" in the score system seems to cause inconsistency. This study is to determine whether DWI can modify and add to MaRIA for improved quantitative assessment of bowel inflammation.

METHOD AND MATERIALS

Fifty consecutive adults suspected of CD underwent MRE and ileocolonoscopy within 1 week. MRE including DWI ($b=900$ s/mm²) was performed after oral administration of 1500 mL 2.5% sorbitol over a prolonged time (80 min) to achieve good fluid distention of both the small bowel and the right-sided colon. Endoscopy recorded inflammatory activity according to CD endoscopic index of severity (CDEIS) to serve as reference standard. Excluding final non-CD diagnoses, technical failure, and unobtainable reference standard, 79 segments (39 terminal ilea and 40 right-sided colons) in 42 patients (M:F, 33:9; 27±6.2 years) were analyzed. MaRIA score and modified (m) MaRIA score, in which the original "ulcer" (presence vs. absence) was replaced with DWI grades (0–2), were obtained by three random independent readers. MaRIA and mMaRIA were compared regarding their correlation with CDEIS, accuracies for diagnosing active (CDEIS≥3) and severe (CDEIS≥12) inflammation, and interobserver agreement. Additionally, it was determined whether DWI was an independent factor to predict CDEIS when adjusted for MaRIA.

RESULTS

Both MaRIA and mMaRIA correlated strongly with CDEIS without statistically significant difference between them: $r=0.737$ (95% CI, 0.652–0.810) and 0.742 (0.651–0.816), respectively ($p=.387$). ROC areas were not significantly different between MaRIA and mMaRIA for diagnosing active inflammation, 0.908 vs. 0.904 ($p=.814$), and severe inflammation, 0.901 vs. 0.886 ($p=.485$). Intra-class correlation coefficient among the three readers was significantly higher for mMaRIA than for MaRIA, 0.841 vs. 0.697 ($p<.001$). DWI grade was not independently correlated with CDEIS when adjusted for MaRIA ($\beta=3.22$; $p=.076$).

CONCLUSION

mMaRIA (ulcer replaced with DWI grades) could significantly improve interobserver agreement; however, DWI did not independently contribute to predict CDEIS when adjusted for MaRIA.

CLINICAL RELEVANCE/APPLICATION

mMaRIA incorporating DWI enables to assess bowel inflammatory severity of CD more consistently across readers.

SSM09-05 **Value of MRI for Prediction of Histopathologic features of Ileal Crohn's Disease**

Wednesday, Nov. 30 3:40PM - 3:50PM Room: E353B

Participants

Mathilde Wagner, MD, PhD, Paris, France (*Presenter*) Consultant Olea Medical
Makel Ko, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Manjil Chatterji, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Xiaofei Zhang, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Joana Torres, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Noam Harpaz, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Bachir Taouli, MD, New York, NY (*Abstract Co-Author*) Consultant, MEDIAN Technologies ; Grant, Guerbet SA

PURPOSE

To assess the value of magnetic resonance enterography (MRE) including diffusion-weighted imaging (DWI) for characterization of histopathologic tissue composition of small bowel Crohn's disease (CD) strictures.

METHOD AND MATERIALS

During a one-year period, consecutive patients with ileal CD and ileal strictures who underwent small bowel resection and a preoperative contrast-enhanced MRE exam including DWI within one month before surgery were retrospectively included. Pattern, degree of enhancement, presence of ulcerations, fistulas, abscesses and stenotic lesions were assessed by 3 radiologists in consensus. One of the radiologists performed a quantitative analysis in strictured small bowel segments: wall thickness (mm) on T2 HASTE and T1 fat sat, enhancement ratios (ER) on contrast-enhanced images ($ER=[\text{signal intensity (SI) post} - \text{SI pre}]/\text{SI pre}] \times 100\%$), mean apparent diffusion coefficient (ADC) and computed the MaRIA score. A pathologist assessed the degree of inflammation using a 3-point scale. Smooth muscle actin (SMA) and Sirius red (SR) immunostains were performed, quantified using morphometry and normalized by the length of the involved segment. The ratio of the two normalized staining ($=\text{SMA}/\text{SR}$) was computed.

RESULTS

35 patients with CD (M/F: 17/18, mean age 33y) were included. The mean delay between MRE and surgery was 10.6 days (1–30).

40 ileal segments were analyzed. Layered pattern at early post-contrast phase was more frequent with marked inflammation ($P=0.015$). Mean ADC was significantly lower in inflammation grade 2-3 compared to grade 1 (1.07 ± 0.14 vs. 1.28 ± 0.27 10^{-3} mm^2/s , $P=0.028$). MaRIA score was significantly higher in grade 2-3 than in grade 1 (30 ± 9 vs. 23 ± 8 , $P=0.013$). Weak but significant correlations were found between inflammation grade and ADC/MaRIA score ($r = -0.388/0.376$, $P < 0.021$). Maria score and wall thickness on T1 were correlated with SMA staining ($r = 0.514/0.378$, $P < 0.016$). The wall thickness on T2 was correlated with the ratio ($r = 0.368$, $P = 0.019$) and was significantly higher in strictures with predominant muscle hypertrophy ($P = 0.037$).

CONCLUSION

MRI parameters can predict tissue composition of stricturing ileal CD. These findings need to be verified in a prospective study.

CLINICAL RELEVANCE/APPLICATION

Quantitative MRI can potentially be used to predict tissue composition of ileal stricturing CD, and can potentially be used for treatment response.

SSM09-06 MR Enterography for the Evaluation of Anastomosis Status In Crohn Disease: A Double-institutional Retrospective Study

Wednesday, Nov. 30 3:50PM - 4:00PM Room: E353B

Participants

Chiara Pozzessere, MD, Siena, Italy (*Presenter*) Nothing to Disclose
Maria A. Mazzei, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Volterrani, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Alfredo Cirigliano, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Raphael Dautry, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Youcef Guerrache, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Paul Bazerries, Angers, France (*Abstract Co-Author*) Nothing to Disclose
Giulia Fiorilli, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Carla Vindigni, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Philippe A. Soyer, MD, PhD, Paris, France (*Abstract Co-Author*) Consultant, Guerbet SA;
Mourad Boudiaf, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Anastomosis strictures after ileocolic resection are common in Crohn disease (CD) and differentiating between inflammatory recurrence from fibrotic alteration is challenging for the clinical management. The aim of the study was to evaluate Magnetic Resonance Enterography (MRE) in characterizing the anastomosis status in patients with Crohn disease who had previously undergone ileocolic resection and, in particular, in differentiating between inflammatory recurrence from fibrotic alterations.

METHOD AND MATERIALS

Informed consent was obtained for all patients. From two different institutions, sixty-three consecutive MREs, of patients with CD who had previously undergone ileocolic resection were retrospectively and independently analyzed by two readers. The results were compared to the endoscopic findings. Interobserver agreement was calculated. Correlations between MRE findings and anastomotic status were evaluated at univariate analysis. A P value ≤ 0.05 was considered statistically significant.

RESULTS

Inter-observer agreement was good ($k=0.8$). At univariate analysis, wall thickening, restricted diffusion and wall enhancement were the most discriminating variables between normal and abnormal anastomosis ($P < 0.001$). Greater wall thickening ($>6\text{mm}$), wall stratification, greater degree (moderate to severe) of restricted diffusion, greater degree (moderate to severe) of wall enhancement and layered enhancement pattern were the most discriminating variables between inflammatory recurrence and fibrotic strictures ($P < 0.001$).

CONCLUSION

In this double-institutional retrospective study, MRE could differentiate between normal and abnormal anastomosis and, in the abnormal cases, between inflammatory recurrence and fibrotic strictures.

CLINICAL RELEVANCE/APPLICATION

MRE is useful for anastomosis status evaluation in patients with CD who underwent ileocolic resection and, in particular, it can differentiate between inflammatory recurrence and fibrotic alterations.

SSM10

Genitourinary (Benign Gynecological Disease)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: E351

GU **OB** **MR** **US**

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

Participants

Julia R. Fielding, MD, Dallas, TX (*Moderator*) Nothing to Disclose
Raj M. Paspulati, MD, Cleveland, OH (*Moderator*) Nothing to Disclose

Sub-Events

SSM10-01 **Colorectal Endometriosis: Indication to Bowel Resection Based on Pelvic MR Findings in A Single Center**

Wednesday, Nov. 30 3:00PM - 3:10PM Room: E351

Participants

Arnaldo Scardapane, Bari, Italy (*Presenter*) Nothing to Disclose
Filomenamila Lorusso, Castellana Grotte, Italy (*Abstract Co-Author*) Nothing to Disclose
Amato Antonio Stabile Ianora, Bari, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefano Bettocchi, Bari, Italy (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Angelelli, Bari, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

to establish the role of MRI in predicting the need and the type of surgery in patients with colorectal endometriosis

METHOD AND MATERIALS

The MR Images of 195 patients operated for pelvic endometriosis were reviewed in consensus by two experienced radiologists. All MR scans were acquired with a 1.5 T scanner and a phased array coil. A standard high resolution pelvic MR was performed in all patients consisting in a standard High resolution pelvic MRI protocol (T2w TSE sequences in the axial, sagittal and coronal plane and in T1w and THRIVE sequences in the axial plane) completed by MR- Colonography (MR-C) in all the cases. The presence of endometriotic pelvic lesions was annotated. Intestinal lesion were measured in short and long axis and the grade of stenosis was established on MR-C. A multivariate logistic regression was used to establish the predictors of intestinal resection in the laparoscopic procedure, while one way ANOVA was used to compare nodules resected with different techniques (shaving, discoid or segmental resection).

RESULTS

56/195 (29%) patients received an intestinal resection, namely 20/56 received a discoid resection and 36/56 segmental resection). Multivariate logistic regression demonstrated a predictive value of nodular short axis (OR=2.29 (1.21-4.35); p=0.011) and the degree of stenosis (OR=1.20 (1.06-1.35); p=0.03). ROC analysis demonstrated an AUC of 0.98 for the "short axis" and 0.97 for the parameter "stenosis". Using a cut off value of 11 mm of short axis and 30% of stenosis sensitivity and specificity values were respectively 93%-98% and 94%-98%. ANOVA analysis showed significantly higher values of Short axis, long Axis and Stenosis for patients receiving segmental resection vs discoid resection vs adhesiolysis and rectal shaving.

CONCLUSION

The presence of an endometriotic rectal nodule > 11 mm in short axis causing a luminal stenosis > 30% in pelvic MRI reliably predict the need of a rectal resection. Nodule size differs significantly in women receiving different type of resection.

CLINICAL RELEVANCE/APPLICATION

MRI is a non invasive method that can predict the need and the type of bowel resection in patients with colorectal endometriosis.

SSM10-02 **Society of Radiologists in Ultrasound (SRU) Guidelines for Adnexal Cysts: Adherence and Practical Challenges**

Wednesday, Nov. 30 3:10PM - 3:20PM Room: E351

Participants

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
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
Laura Huffman, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Lisa Barroilhet, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Sadowski, MD, Madison, WI (*Presenter*) Nothing to Disclose

PURPOSE

In 2010, the Society of Radiologists in Ultrasound (SRU) published a consensus statement directing management of asymptomatic adnexal cysts. The purpose of this study is to evaluate radiologists' subsequent adherence to the guidelines for a large group of cysts with known outcomes.

METHOD AND MATERIALS

IRB-approved retrospective multi-institutional study evaluated ultrasound (US) imaging features, dictated recommendations, and clinical outcomes of consecutive adnexal cysts from Jan-Jun 2011. Dictated reports were categorized according to specific recommendation when articulated, or via subjective assessment of the degree of concern expressed in the report language. Images were reviewed and SRU rating retrospectively assigned.

RESULTS

Images and reports were analyzed for 556 cysts. Specific recommendations were made in dictated reports for 349 (62.8%) cysts: 64 no followup (11.5%), 231 US (41.5%), 27 MRI (4.9%) and 27 surgical evaluation (4.9%). The overall correlation between dictated report and SRU approach was weak (Pearson's $R=0.34$ [95% CI 0.26-0.41] $p < .0001$). In total, SRU and original dictations concurred on management in 245 (44%) cysts. Original reports underrecommended followup in 152 (27.3%) cysts and overrecommended followup in 159 (28.7%) cysts. If recommendations are binarized into "no followup" and "any followup", Sn, Sp, PPV and NPV for neoplasm were 80.4%, 37.1%, 20.2% and 90.5% for the original reports and 96.7%, 54.7%, 29.8% and 98.8% for the SRU rating. In logistic regression, both recommendation types were predictors of neoplasm but a one unit increase in SRU rating conferred a higher odds ratio (SRU OR 2.59 [95% CI 2.06;3.27], $p < .0001$ vs. original dictation OR 1.59 [95% CI 1.15,2.22], $p = .005$).

CONCLUSION

Adherence to SRU management guidelines for adnexal cysts was 44% in originally dictated reports. Original dictations recommended followup for fewer neoplasms and more physiologic cysts, and were overall less predictive of neoplasm than the retrospectively applied SRU approach.

CLINICAL RELEVANCE/APPLICATION

The 2010 Society of Radiologists in Ultrasound (SRU) guidelines for management of adnexal cysts provide a framework for clear management recommendations and are more predictive of neoplasm than an unstructured approach.

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

SSM10-03 Uterine Adenomyosis: Development of an US and MRI Based Scoring System While Comparing the Diagnostic Accuracy of Two Modalities

Wednesday, Nov. 30 3:20PM - 3:30PM Room: E351

Participants

Anil Chauhan, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

William A. Shaffer, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

Evan S. Siegelman, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, BioClinica, Inc Consultant, ICON plc Consultant, ACR Image Matrix

Lisa P. Jones, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

Jill E. Langer, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

Steven C. Horii, MD, Philadelphia, PA (*Abstract Co-Author*) Spouse, Employee, Cerner Corporation

Maria C. Reyes, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

Hanna M. Zafar, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Major studies defining US and MRI criteria for diagnosing uterine adenomyosis have been published more than a decade ago. Imaging technology, indications of imaging and clinical management of uterine symptomatology has overwhelmingly changed since then and this warrants a re-assessment of diagnostic accuracy of US and MRI in diagnosing adenomyosis. The purpose of this study was: 1) To compare the accuracy of US and MRI for the diagnosis of adenomyosis; and 2) To develop US and MRI based scoring systems for diagnosis of adenomyosis.

METHOD AND MATERIALS

We retrospectively identified 76 patients who have had hysterectomy along with pre-operative US and MRI exams. Cases with no transvaginal exam, and mass lesions involving more than half of the uterus were excluded. The imaging exams were interpreted blindly by experienced radiologists. Multiple imaging features were recorded along with confidence level of radiologist for interpreting these exams. Nine US and 10 MRI features were given scores of one each in pursuit of developing a scoring system.

RESULTS

Adenomyosis was present in 42 out of 76 (55%) patients on pathology. The sensitivity, specificity, positive predictive value and negative predictive value of US were 86%, 56%, 71%, and 76%, respectively. Similar values for MRI were 69%, 71%, 74%, and 65%. Maximum Junctional Zone thickness and presence of subendometrial/myometrial T2 hyperintensities on MRI demonstrated sensitivity/specificity of 50%/85% and 62%/76%, respectively. Moderate/Severe heterogeneity, linear striations, hyperechoic foci, and echogenic islands within the myometrium led to sensitivity and specificity of 88% and 56%. US score of > 3 and > 6 led to Sensitivity/Specificity of 67%/67% and 38%/85%, respectively. MRI score of > 2 and > 4 led to Sensitivity/Specificity of 57%/85% and 43%/91%, respectively. Thirty out of 76 (40%) cases had US-MRI discordance, with US being more correct (12 vs 5) in presence of disease and MRI being more correct (9 vs 4) in absence of disease.

CONCLUSION

Although both US and MRI have inherent limitations for diagnosing adenomyosis, adding scoring system can potentially improve specificity of the imaging diagnosis.

CLINICAL RELEVANCE/APPLICATION

Adenomyosis is highly prevalent in symptomatic female patient and imaging has potential limitations in its diagnosis. Therefore, a scoring system based on common imaging features may add value in improving specificity of adenomyosis diagnosis by imaging.

Honored Educators

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

Evan S. Siegelman, MD - 2013 Honored Educator

SSM10-04 Monitoring Leiomyoma Response to Uterine Artery Embolization Using Diffusion and Perfusion Indices from Diffusion-Weighted Imaging

Wednesday, Nov. 30 3:30PM - 3:40PM Room: E351

Participants

Mengqiu Cao, Shanghai, China (*Presenter*) Nothing to Disclose
Shiteng Suo, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Yan Zhou, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Xuebin Zhang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jianrong Xu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the potential of diffusion and perfusion indices (ADC and perfusion fraction f) from DWI at 3.0 T in monitoring treatment response to uterine artery embolization (UAE) at 6-month follow-up.

METHOD AND MATERIALS

Twelve female patients (median age, 42 years; range, 24–56 years) with symptomatic uterine fibroids who underwent pelvic MRI and DWI before and 6 months after UAE were included. 3.0-T DWI was acquired by using b-values of 0 and 1000 s/mm² for ADC calculation, and 0~1200 s/mm² for perfusion fraction f calculation. The Wilcoxon signed-rank test and Spearman rank correlation test were used for statistics.

RESULTS

All patients underwent successful UAE procedures with a relief of symptoms, reduced fibroid volume and complete infarction at follow-up MRI. A total of 17 fibroids were studied. The median ADCs showed a statistically significant increase from 1.20×10^{-3} mm²/s (range, 0.86– 1.66×10^{-3} mm²/s) at baseline to 1.56×10^{-3} mm²/s (range, 1.00– 1.86×10^{-3} mm²/s) at 6-month follow-up ($P = 0.0003$). Conversely, the median perfusion fraction f was significantly decreased after UAE ($P = 0.0001$), with a median pre-UAE value of 14.2% (range, 6.7%–17.6%) and a median post-UAE value of 9.2% (range, 3.2%–14.6%). Significant correlations were found between fibroid volume reduction rate and percentage changes in ADC and perfusion fraction f at 6-month follow-up relative to baseline, with p values of -0.50 ($P = 0.04$) and 0.55 ($P = 0.02$), respectively.

CONCLUSION

ADC and perfusion fraction f obtained from DWI at 3.0 T may help to evaluate treatment response to UAE.

CLINICAL RELEVANCE/APPLICATION

DWI-derived diffusion and perfusion indices (ADC and perfusion fraction f) may facilitate the quantitative assessment of treatment response to UAE at 6-month follow-up.

SSM10-05 The Predictive Value of Quantitative DCE Metrics for Immediate Therapeutic Response of High-Intensity Focused Ultrasound Ablation of Symptomatic Uterine Fibroids

Wednesday, Nov. 30 3:40PM - 3:50PM Room: E351

Participants

Chao Wei, HeFei, China (*Presenter*) Nothing to Disclose
Jiang Ning Dong, Hefei, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the value of quantitative dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) parameters in the prediction of the immediate therapeutic response of high-intensity focused ultrasound (HIFU) therapy in the treatment of symptomatic uterine fibroids.

METHOD AND MATERIALS

A total of 78 symptomatic uterine fibroids (diameter: 3.0 cm-9.3 cm) in 65 female patients were treated with MR-HIFU therapy. All patients underwent conventional and DCE MRI scan in 3 days before and after HIFU treatment. Permeability parameters K_{trans} , K_{ep} , V_e , V_p , and T1 perfusion parameters BF, BV of Pretreatment were measured as a baseline; and immediate non-perfused volume ratio (NPVR) was used as an immediate ablation efficiency. Dates were assigned to NPVR >70 % and NPVR <70 % group. Then the differences of DCE-MRI parameters between the previous group and the correlations between the DCE-MRI parameters and NPVR were analyzed retrospectively. The ROC curve analyses were performed to study the predictive performance of different parameters for ablation efficacy.

RESULTS

(1) It was observed that the pretreatment K_{trans} , K_{ep} , V_e , BF values of the NPVR >70 % group was significantly lower than the NPVR <70 % group ($p < 0.05$). (2) The immediate NPVR was negatively correlated with the K_{trans} , BF, BV values before HIFU treatment ($r = -0.561$, -0.712 and -0.528 , respectively; $p < 0.05$ for all). (3) The AUC of pretreatment K_{trans} , BF, BV values used to

predict the immediate NPVR were 0.810, 0.909, 0.795 respectively ($p < 0.05$ for all), At the cut-off value, Ktrans, BF, BV provided the higher sensitivity (Ktrans: 96.8%, BF:90.3%, BV:71.0%) and specificity (Ktrans: 57.4%, BF:81.9%, BV:74.5%) in predicting for the ablation efficacy.

CONCLUSION

A higher Ktrans, BF, BV value at baseline DCE-MRI suggested a poor ablation efficacy of HIFU therapy for symptomatic uterine fibroids. The BF values showed the best predictive value, followed by Ktrans and then BV.

CLINICAL RELEVANCE/APPLICATION

The pretreatment DCE-MRI parameters could be useful biomarkers for prediction the ablation efficacy in selecting of suitable candidates for HIFU treatment or changing the treatment plan which most likely to yield optimum results.

SSM10-06 Deeply Infiltrative Endometriosis (DIE) with Myometrial Invasion: 'Mantle-shaped' Pattern (MSP)-A Marker for Severe DIE Associated with High Prevalence of Intestinal and Bladder Lesions

Wednesday, Nov. 30 3:50PM - 4:00PM Room: E351

Participants

Luciana P. Chamie, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Duarte M. Ribeiro, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Gladis R. Ribeiro, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Tatiana Bonetti, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Paulo C. Serafini, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this manuscript is to describe a form of DIE with deep myometrial invasion called "mantle-shaped" pattern (MSP) that is a marker for severe DIE with high prevalence of intestinal and bladder lesions

METHOD AND MATERIALS

This is prospective cross-sectional study from August 2010 to June 2015. 2737 women (mean age of 35.9 years) suspected of having DIE underwent a transvaginal sonography after bowel preparation (TVSBP) by an experienced radiologist for the diagnosis and mapping of the disease. The clinical suspicion was based on the complaining of chronic pelvic pain and infertility for more than 1 year. The imaging protocol was based on previous published data. The imaging criteria for severe DIE were also established. Among patients with positive imaging findings for DIE, the presence of the MSP was assessed along with the other sites affected.

RESULTS

From all 2737 women assessed, 1065 did not have endometriosis (46.4%) and 1468 of them demonstrated DIE lesions (53.6%). The MSP was identified in 151 women (5.5%) among DIE group. The group of DIE women without MSP exhibited 4 sites of DIE involvement, while the group with MSP had an average of 7.5 DIE sites affected. Women with MSP had 68.2% of intestinal lesions compared to 25% of those without MSP. Bladder lesions were identified in 15.2% of women with MSP compared to 1.7% of women without MSP. The posterior compartment of the pelvic cavity was the most common location for the MSP (70.9%) against the anterior compartment (30.5%). The retrocervical region was the most common location of DIE lesions in both groups.

CONCLUSION

The MSP is a form of DIE associated with deep miometrial invasion and is a marker for severe disease with high prevalence of visceral involvement, such as bladder and intestinal lesions. It is also a predictor for worse fertile prognosis and for potential residual disease after surgery. Patients with complete removal of these tissue are risky for uterine rupture during pregnancy.

CLINICAL RELEVANCE/APPLICATION

The MSP is a marker for severe DIE with high prevalence of intestinal and bladder lesions.

SSM11

Science Session with Keynote: Health Service, Policy and Research (Medical/Practice Management)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S102D

HP

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

FDA

Discussions may include off-label uses.

Participants

Annette J. Johnson, MD, MS, Winston Salem, NC (*Moderator*) Nothing to Disclose
James V. Rawson, MD, Augusta, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSM11-01 Radiology Information Security Worldwide: Recent Trends and Changes

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S102D

Participants

Oleg S. Pianykh, Newton Highlands, MA (*Presenter*) Nothing to Disclose

PURPOSE

The fundamental standards of digital medical data exchange, such as DICOM and HL7, date back to the late 1980s. And although these standards went through countless enhancements, one particular aspect – security – remained virtually untouched. The main purpose of our work was to employ a “big data” approach to reveal the most recent trends in radiology information security.

METHOD AND MATERIALS

DICOM handshake protocol was used to develop a fast, parallel-processing security-probing application. Testing each IP address for its openness to transmit medical data (with no actual PHI data transferred), the application scanned the entire worldwide space of IP addresses in only 4 weeks. Geolocation services were used to map each insecure IP identified. As a result, we compiled a comprehensive map of open DICOM/HL7 servers worldwide, with different levels of security threats. Repeating this scan for the past three years we were able to compare the state of informational security of radiology imaging networks.

RESULTS

At each run, our scans discovered nearly 3000 DICOM (PACS) servers worldwide, which were left open for external data access. DICOM protocol was used to categorize our findings by different levels of security threats, and geolocation data – by countries and regions. As a result, we compiled DICOM security ratings per country, per capita, and per IT infrastructure. We also built the first map of DICOM adoption worldwide. Finally, we repeated this analysis over the past three years to demonstrate that radiology imaging data still remains under an increased risk of breaching, with no visible improvements in its security ratings.

CONCLUSION

Medical imaging archives, left wide-open to DICOM and HL7 threats, is by far the most common security problem, which needs to be addressed with a robust, standardized, and fully implemented solution. Our results demonstrate the full scope of this problem, and the areas where it needs to be addressed. The fact that radiology security is not improving over the past years is particularly alarming, and should be addressed by the clinical community.

CLINICAL RELEVANCE/APPLICATION

Hospital security breaches have an enormously detrimental impact on clinical operations. Our results and methodology should be used to protect patient clinical records.

SSM11-02 Understanding Racial Disparities in Screening Mammography: Can Better Contact with a Primary Care Physician Heal the Divide?

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S102D

Awards

Student Travel Stipend Award

Participants

Vishala Mishra, MBBS, Boston, MA (*Presenter*) Nothing to Disclose
H. Benjamin Harvey, MD, JD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Elkan F. Halpern, PhD, Boston, MA (*Abstract Co-Author*) Research Consultant, Hologic, Inc; Research Consultant, Real Imaging Ltd; Research Consultant, Gamma Medica, Inc; Research Consultant, K2M Group Holdings, Inc
Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Constance D. Lehman, MD, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company

PURPOSE

To elucidate factors underlying racial disparities in screening mammography participation for the purpose of designing more effective patient engagement strategies.

METHOD AND MATERIALS

HIPAA-compliant and IRB approved. All women age 50 to 64 who obtained screening mammography (SM) in calendar year 2005 were tracked for 10 years after the index SM to identify women with no “missed opportunities for care” (defined as a two year

window without a mammographic screen). Comparisons were made based on patient race and level of interaction with a primary care physician (PCP). Descriptive statistics were performed with 95% confidence intervals.

RESULTS

12,277 patients were included in the study: 86.2% identified as White, 4.8% Black/African American, 3.5% Hispanic, and 5.4% other. Overall, 32.1% of women had a high level of PCP interaction, including 30.1% (29.2-30.97%) of White women, 41.3% (CI 37.3-45.2%) of Black/African American women, and 42.0% (CI 37.4- 46.7%) of Hispanic women. Black (47.6%, CI 43.6-51.6%) and Hispanic (59.5%, CI 54.9-64.1%) women were more likely than white women (42.1%, CI 41.2- 43.0%) to have a missed opportunity during the study period ($p < 0.05$). Likewise, women with low levels of PCP interaction (47.1%, CI 46.2-48.0%) were more likely than women with high levels of PCP interaction (35.0%, CI 34.2- 35.8%) to have a missed opportunity during the study period. Higher level of PCP interaction eliminated the racial disparities in SM participation between White (34.4%, CI 33.5-35.3%) and Black/African American (35.9%, CI 32.0-39.8%) women, whereas disparities persisted in Hispanic women (49.2%, CI 44.5-53.9%) despite this correction.

CONCLUSION

Interventions to increase PCP interactions are likely to reduce racial disparities in participation in screening mammography. Further research is necessary to better understand potential cultural or trust barriers in the Hispanic population that contribute to persistent screening disparities despite high levels of PCP interaction.

CLINICAL RELEVANCE/APPLICATION

Patient engagement strategies to curb racial disparities in screening mammography participation move beyond the issue of provider access to cultural or trust barriers that might be at play.

SSM11-03 USA vs Europe: Who is in the Lead with CT Radiation Doses?

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S102D

Participants

Anushri Parakh, MBBS, MD, Basel, Switzerland (*Presenter*) Consultant, Bayer AG
Andre Euler, MD, 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

The aim of the study is to assess the difference in diagnostic reference levels (DRLs) for CT between North America (dose-data sourced from American College of Radiology-Dose Index Registry (DIR)) and Europe (a regional CT dose registry in *blinded of review*).

METHOD AND MATERIALS

Dose-data for a regional European CT dose registry was collected from eight CT scanners in six different institutions over a period of two years (January 1st 2014-December 31st 2015). The 75th percentile values (DRL) for volumetric CT dose index (CTDI_{vol}), dose-length product (DLP) and size-specific dose estimate (SSDE) for the registry were gathered using a dose-tracking software (Radimetrics, Bayer Healthcare). DRLs for six protocols (head, thorax, pulmonary-angiogram, abdomen-pelvis, renal-colic and thorax-abdomen-pelvis) were compared with latest ACR-DIR dose-report from July-December 2015.

RESULTS

The total number of scans for six protocols in our regional registry were 40,293. On comparison with our study, the ACR-DIR had higher dose values for 75th percentile CTDI_{vol} and DLP values for all protocols. The largest divergent value for CTDI_{vol} was for CT thorax by 220% (5 mGy vs. 16 mGy). The least difference was for CT abdomen-pelvis, with CTDI_{vol} of 14 mGy in the European registry and 18 mGy for ACR-DIR. On comparison with our study, the ACR-DIR had higher dose values for 75th percentile SSDE values by 100% for thorax, 77% for pulmonary angiogram and 70% for renal-colic. The least difference was for abdomen-pelvis and thorax-abdomen-pelvis (0.06%).

CONCLUSION

Substantial difference exists for CT doses (particular dedicated low-dose protocols) between Europe and US, which is explained by a large transatlantic difference in practice. The large room for optimization in US institutes need to be translated into action.

CLINICAL RELEVANCE/APPLICATION

The monitored ACR data needs to be frequently benchmarked with international data to demonstrate the large potential for dose optimization in US-institutions.

SSM11-04 Repeat CT within One Month of CT in the Emergency Department for Abdominal Pain: A Secondary Analysis of Data from a Prospective, Multicenter Study

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S102D

Participants

Leslie K. Lee, MD, Boston, MA (*Presenter*) Nothing to Disclose
Andrew T. Reisner, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
William D. Binder, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Atif Zaheer, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Martin L. Gunn, MBChB, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Royalties, Cambridge University Press; Spouse, Consultant, Reed Elsevier; Spouse, Consultant, athenahealth, Inc; ;
Ken F. Linnau, MD, MS, Seattle, WA (*Abstract Co-Author*) Royalties, Cambridge University Press; Speaker, Siemens AG
Chad M. Miller, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Maurice S. Herring, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Angela C. Tramontano, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Emily C. Dowling, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Avinash R. Kambadakone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Onofrio A. Catalano, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Elkan F. Halpern, PhD, Boston, MA (*Abstract Co-Author*) Research Consultant, Hologic, Inc; Research Consultant, Real Imaging Ltd; Research Consultant, Gamma Medica, Inc; Research Consultant, K2M Group Holdings, Inc
Karen Donelan, DSc, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
G. Scott Gazelle, MD, PhD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, Marval Biosciences Inc
Pari Pandharipande, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine: 1) the frequency of repeat CT in the one month following a patient's emergency department (ED) visit and CT evaluation of abdominal pain; 2) the presence and nature of resulting changes in CT diagnoses.

METHOD AND MATERIALS

We conducted a secondary analysis of data collected from a prospective, multicenter observational study. The parent study included patients who underwent CT for abdominal pain in the EDs of 4 large academic centers (2012-14). These patients constituted our study group; their original ED CT scans were termed "index" scans. We calculated the proportion of patients that underwent repeat abdominal CT in the 1 month following their index CT scan. For each patient, results of their index and repeat CT scans were compared by two abdominal radiologists external to the parent study. Comparisons were categorized as: I) no change; II) same process, improved; III) same process, worse; IV) different process. Disagreements were adjudicated by a third abdominal radiologist. We further calculated the proportion of patients in groups I+II (no change or improved) vs. III+IV (worse or different process). For groups I+II vs. III+IV, we compared: patients' age and gender; days elapsed between CT scans; and years of professional experience of the ED physician at the time of the index CT request.

RESULTS

The parent study included 544 patients (246 female, 45%; mean age=50 years). In the 1 month after the index CT, 10% of patients (53/544, 95% CI: 7.5-13%) underwent repeat abdominal CT (25 female, 48%; mean age=52 years). The frequency of cases within each specified group was: I) 43% (23/53); II) 26% (14/53); III) 15% (8/53); and IV) 15% (8/53). Inter-rater agreement among the two initial external reviewers was good ($\kappa = 0.61$). New or worse findings were present in 30% of patients (16/53, 95% CI: 19-44%). Comparing groups I+II vs. III+IV, there was no significant difference in patients' age ($p=0.25$), gender ($p=0.45$), days elapsed between CT scans ($p=0.80$), and years of physician professional experience ($p=0.31$).

CONCLUSION

A high proportion of patients (10%) that underwent CT for abdominal pain during an ED visit had repeat CT within 1 month. Repeat CT demonstrated new or worse findings in 30% of these patients.

CLINICAL RELEVANCE/APPLICATION

10% of patients who initially underwent CT for abdominal pain in the ED underwent repeat abdominal CT within 1 month. Repeat CT demonstrated new or worse findings in 30% of patients.

Honored Educators

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

Atif Zaheer, MD - 2012 Honored Educator

SSM11-05 Recognizing the Pediatric "No Show": Demographic and Medical Factors Associated with Missed Care Events in Pediatric Radiology

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S102D

Participants

Efren J. Flores, MD, Boston, MA (*Presenter*) Nothing to Disclose
Vishala Mishra, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Swati Goyal, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Edgar L. Martinez Salazar, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Randheer Shailam, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Garry Choy, MD, MS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stuart R. Pomerantz, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company
H. Benjamin Harvey, MD, JD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To understand potential demographic and medical factors associated with imaging missed care events (MCEs) in the pediatric population.

METHOD AND MATERIALS

HIPAA-complaint and IRB approved. All pediatric patients (<18 years) who were scheduled to undergo an outpatient imaging exam at our institution between February 2014 and March 2016 were reviewed to determine the presence of an imaging MCEs (i.e., failure to show up to the scheduled imaging exam). Comparisons were made between patients with and without an MCE based on demographic variables (age, gender, self-reported race and ethnicity, language, insurance status) and a subset of ICD 9 diagnosis codes, including but not limited to child abuse or neglect, missed clinical appointments, history of non-compliance and failure to thrive. Multivariate logistic regression was performed to evaluate the independent relationship between patient characteristics and MCEs.

RESULTS

30,303 pediatric patients were scheduled for 57,493 exams during the study period. 2528 (8.3%) of the patients had at least one MCE. Demographic factors associated with MCEs included primary language other than English (OR: 1.2, $p<0.0001$), Black/African American ethnicity (OR: 1.7, $p<0.0001$ relative to White), and Obesity (OR: 2.69, $p<0.0001$). Multiple ICD9 diagnosis codes, including child abuse or neglect and/or needing observation for the same (OR: 1.8, $p<0.001$), failure to thrive (OR: 1.6, $p<0.0001$), having at least one recorded personal history of noncompliance with treatment (OR: 2.2, $p<0.001$) and missed clinical visit appointments (OR: 1.7, $p<0.01$), remained significantly associated with MCEs after correcting for potential confounders.

CONCLUSION

Certain demographic and medical factors are strongly associated with missed care events in pediatric radiology.

CLINICAL RELEVANCE/APPLICATION

Understanding factors associated with pediatric missed care events is fundamental to designing responsive, patient-centered care models that can better support the health maintenance of this vulnerable population.

SSM11-06 Health Service, Policy and Research Keynote Speaker: Should We Radiologists Own the Closed Loop for Follow-up Recommendations?

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S102D

Participants

Annette J. Johnson, MD, MS, Winston Salem, NC (*Presenter*) Nothing to Disclose

SSM12

Informatics (Clinical Workflow, Displays and Mobile Devices)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S403A

IN

AMA PRA Category 1 Credit™: 1.00
ARRT Category A+ Credit: .50

FDA

Discussions may include off-label uses.

Participants

Tessa S. Cook, MD, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose
William W. Boonn, MD, Penn Valley, PA (*Moderator*) Officer, Nuance Communications, Inc; Shareholder, Nuance Communications, Inc
Vamsi R. Narra, MD, FRCR, Saint Louis, MO (*Moderator*) Consultant, Biomedical Systems;

Sub-Events

SSM12-01 Workflow Dynamics and the Imaging Value Chain: The Effect of Designating a Non-image Interpretive Task Workflow

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S403A

Participants

John-Paul J. Yu, MD, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Matthew H. Lee, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Andrew J. Schemmel, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
B. Dustin Pooler, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Taylor Hanley, BS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Douglas Wiegmann, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Tabassum A. Kennedy, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Aaron S. Field, MD, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Separating responsibilities into NIT and IIT workflows substantially increased image interpretation time and decreased TSEs for the primary fellow. Consolidation of NITs into a separate workflow allows for more efficient task completion.

Background

Workflow disruptions are a pervasive element of complex, cognitively demanding work environments that are associated with errors, task prolongation, and "re-work" – the phenomenon of re-orienting following an interruption that can lead to workflow inefficiency. These phenomena have garnered significant interest throughout clinical medicine where the implications of workplace interruptions can lead to harm or loss of life. The relationship between interruptions and patient safety has been observed in a variety of medical settings, suggesting that significant opportunities exist to improve healthcare delivery and patient outcomes through thoughtful workflow analysis and design.

Evaluation

To assess the impact of separating non-image interpretive task (NIT) from image-interpretive task (IIT) workflows in an academic neuroradiology practice, a prospective, randomized, observational investigation of a centralized academic neuroradiology reading room was performed. The primary reading room fellow was observed over a one-month period using time-and-motion methodology, recording frequency and duration of tasks performed. Tasks were categorized into separate IIT and NIT workflows. Post-intervention observation of the primary fellow was repeated following the implementation of a consult assistant (CA) responsible for NITs. Pre- and post-intervention data were compared.

Discussion

Following separation of IIT and NIT workflows, time spent on IITs by the primary fellow increased from 53.8% to 73.2% while NITs decreased from 20.4% to 4.4%. Mean duration of image interpretation nearly doubled, from 05:44 to 11:01 (p<0.001). Mean task switching events (TSE) per hour decreased 42%, from 11.2/hr to 6.5/hr (p=0.002). Decreases in specific NITs were also observed. The CA experienced 29.4 TSEs/hr. Rates of specific NITs for the CA were 6.41/hr for phone calls/paging, 3.60/hr for in-room consultations, and 3.83/hr for protocoling. Only 46.6% of the CA's time was needed for NIT workflow.

SSM12-02 Taking Back the PACS: How Making Sense of PACS Clutter Led to the Development of the PACS Crawler Open-Source Tool

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S403A

Participants

Thomas J. Re, MD,MS, Basel, Switzerland (*Presenter*) Nothing to Disclose
Daniel Boll, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Bram Stieltjes, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Elmar M. Merkle, MD, Basel, Switzerland (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Research Grant, Guerbet SA; Research Grant, Bracco Group
Tobias Heye, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

It is time for radiology departments to take control of their PACS! Regional PACS solutions shared with other local providers can be stimulated by the data discovery enabled by tools such as PACSCrawler.

Background

Just what is the composition of imaging data sitting in your PACS? How much of a burden are those "external studies" your patients have been bringing as prior exams? What alternatives are there to storing "some-body-else's" data in your PACS? We set out to answer these questions for our institution.

Evaluation

We developed, in house, an open-source software tool, named, "PACSCrawler" based on open-source library DCM4CHE (dcm4che.org), to extract the contents of our PACS to a local SQLite database (sqlite.org) for analysis using database tools. The PACSCrawler retrieved key DICOM header information for each study stored in our PACS for the last 6 years. The DICOM tag "Institution Name" (0008,0080) was used to stratify data into internal versus external studies. The category internal studies was further subdivided into three different sites: main, geriatrics and pediatric hospitals. About 1,000,000 studies were identified from 2010-15, which required <1GB SQLite local storage; processing time was <1hr. The average percentage of external studies in PACS storage was 12% ranging from 9-15% depending on the year (12,781-22,747 studies). The number of external studies was comparable to that of our pediatric radiology division. In other words, external institution's data was as much of a burden on our system as one of our own divisions. While these external exams were arriving from over 300 different entities, 90% came from 12 local private practices and hospitals.

Discussion

While digital storage space is relatively cheap, avoiding unintended data redundancies can be one approach to cope with the ever exploding quantity of imaging studies being performed in medicine. The presented open source software allows for fast storage analysis independent of the PACS vendor. The software may help to form a regional PACS initiative by identifying potential partners, among those who contribute the majority of outside studies.

SSM12-03 Diagnostic Performance in Detecting Cerebral Infarction on Brain CT: Comparison of Liquid Crystal Displays with Different Resolutions and Luminance

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S403A

Participants

Calogero Cicero, Bassano del Grappa, Italy (*Presenter*) Nothing to Disclose
Stefano Canestrini, Vicenza, Italy (*Abstract Co-Author*) Nothing to Disclose
Claudia Cavatorta, PhD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Manuela Lualdi, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesca Neri, Trieste, Italy (*Abstract Co-Author*) Nothing to Disclose
Emanuele Pignoli, PhD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Claudio Siciliano, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Guarise, Bassano del Grappa, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It is well known that high quality image display is associated with a more efficient and accurate diagnostic performance. Among the several factors that influence image quality, spatial resolution and luminance play a critical role. In the present study we evaluated the impact of these parameters in identifying cerebral infarction on brain CT.

METHOD AND MATERIALS

Four color Nec medical displays with different spatial resolution, 2 and 3-megapixel (MP) and maximum luminance, 200 and 400 cd/m², were investigated with proper ambient lighting conditions. Thirty-two studies varying in difficulty of interpretation were selected by a senior radiologist: 16 with and 16 without brain infarction. All the images were blindly and independently evaluated, during two different sessions, by the senior radiologist and by two junior radiologists. Observers had to rate presence or absence of cerebral infarction on a five point confidence scale. The Cohen Kappa statistic (Kc) was computed in order to evaluate the reproducibility in identifying the presence of the lesions between monitors and within/between radiologists; receiver operation characteristic (ROC) analysis was used to interpret the data and the area under ROC curves (AUC) was considered as the index of diagnostic accuracy.

RESULTS

Preliminary results showed that the senior radiologist evaluations produced a satisfactory level of reproducibility between differently set displays. The observed level of reproducibility decreased for the junior radiologist with the 2 MP display when lowest luminance was set. The AUCs increased with the rise of display's spatial resolution and luminance for both the observers; the differences of observer performance between 3MP display with the highest luminance and 2MP display with the lowest luminance were statistically significant ($p < 0.05$) for the junior radiologists in both reading sessions.

CONCLUSION

Our study suggests that both high luminance and spatial resolution play a very important role in identifying cerebral infarction on brain CT.

CLINICAL RELEVANCE/APPLICATION

3MP liquid crystal displays with maximum luminance 400 cd/m² show the best accuracy in the diagnosis of cerebral infarction on brain CT.

SSM12-04 Collaborative Robotic Ultrasound: Towards Clinical Application

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S403A

Participants

Benjamin Frisch, PhD, Munich, Germany (*Presenter*) Nothing to Disclose
Oliver Zettinig, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernhard Furst, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Salvatore Virga, Garching, Germany (*Abstract Co-Author*) Nothing to Disclose
Christoph Hennersperger, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Nassir Navab, PhD, Garching, Germany (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Collaborative medical robotics pave the way for advanced and complex diagnostic US and US-guided interventions whose value will be proven by patient trials.

Background

Ultrasound (US) is a compact, widely available and customizable non-radiative imaging modality. However, the image quality and its interpretation depend on the user's abilities, leading to high interobserver variation. The acquisition of 3D datasets is limited to a comparatively narrow field of view. We introduce an US transducer mounted on a light-weight robotic arm that collaborates with the operator for 3D high-quality image acquisition and interventional support. The arm is equipped with torque sensors in all joints to ensure constant contact force of the transducer onto the skin and to detect collisions with the environment. External structured light cameras (SLCs) monitor the position of the patient, operators and tools to plan or dynamically replan the arm's trajectory. The inclusion of confidence maps allows for a real-time automatic optimization of the US image quality.

Evaluation

The first demonstrator, for vascular imaging, recognizes the patient's position with the SLCs to register an anatomical atlas, and automatically guides the US transducer to the aorta. Confidence maps optimize the acquisition of 3D US images, which allowed successful aortic diameter measurements on healthy volunteers. A second demonstrator evaluates a neurosurgical application, where the spine is monitored for targeted needle insertion. We acquire 3D images of the region of interest on a spine model embedded in a dedicated gelatin-agar phantom. A needle guide is rigidly mounted to the US transducer to allow automatic alignment of the needle to a preinterventional target trajectory defined in a registered CT volume. After insertion, correct placement in the facet joint could be validated using cone-beam CT in four phantom experiments.

Discussion

Both demonstrators confirm the feasibility of robotic US. The combination of situational awareness through sensors and external cameras, and real-time image optimization creates a system that supports an operator for imaging and intervention.

SSM12-05 Semi-Automated Analysis of Urinary Stones Using Dual-Energy CT in a Preoperative Setting: Improved Workflow and Reporting

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S403A

Participants

Juan Montoya, Rochester, MN (*Presenter*) Nothing to Disclose

Andrea Ferrero, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

Alice Huang, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

Terri J. Vrtiska, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

CONCLUSION

Results suggest that the information provided by the software could have a significant impact in the evaluation of kidney stones in a preoperative setting.

Background

The purpose of this work was to demonstrate and test an in-house developed tool for semi-automated analysis of urinary stones in dual-energy CT (DECT).

Evaluation

Fifty-eight patients that underwent unenhanced DECT prior to surgical stone removal between October 2009 and November 2015 were subject to stone analysis. Patients were scanned according to our clinical protocol for urinary stone characterization using a dual-source CT system (Somatom Flash and Somatom Force, Siemens Healthcare). In the first step of the imaging analysis, 5-mm thick combined (low/high kV) images were loaded in to the workstation and a research technologist segmented the operated kidney using a set of ROI drawing tools. Subsequently, a radiologist expert in genitourinary imaging loaded 1-mm thick, low and high energy images with the interpolated 5-mm kidney ROI. Using a ROI analysis tool, the reader specified the kidney of interest and stones were automatically segmented and analyzed using an adaptive threshold method. After the completion of the analysis, reports were loaded in a stone browser and the reader specified the stone location using an 11-segment model. For qualitative analysis, reader compared diagnostic images (1 mm axial and 2mm coronal) and clinical reports with the information provided by the software and recorded per-patient and per-stone positive or adverse findings that would modified the clinical report.

Discussion

There were 349 stones detected and analyzed by the software. Qualitative per-patient analysis indicated positive findings for two patients where two stones were detected by the software and not noted by the reader in the clinical images. There was an adverse impact in the report of 8 patients where 12 small stones (~ 1-2 mm) were not detected. Per-stone analysis indicated positive impact for the clinical report in 17 stones with common reasons being improved separation of adjacent stones and size characterization of complex large stones. Three calcifications external to the kidney were misclassified as urinary stones.

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

SSM12-06 Influence of Medical Displays with Different Spatial Resolution and Luminance on the Evaluation of

Digital Radiography Images

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S403A

Participants

Giuseppina Calareso, MD, Milano, Italy (*Presenter*) Nothing to Disclose
Francesca G. Greco, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Calogero Cicero, Bassano del Grappa, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefano Canestrini, Vicenza, Italy (*Abstract Co-Author*) Nothing to Disclose
Manuela Lualdi, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Alberto Laffranchi, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Daniele Vergnaghi, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Claudia Cavatorta, PhD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Verderio, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Chiara M. Ciniselli, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Maddalena Plebani, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Enrico Alberioli, MD, Padova, Italy (*Abstract Co-Author*) Nothing to Disclose
Davide Scaramuzza, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Guarise, Bassano del Grappa, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the influence of monochrome displays with different spatial resolution and luminance on detection performances in two different clinical settings: bone fractures and chest lesions.

METHOD AND MATERIALS

Overall, 82 digital radiography images varying in difficulty of interpretation were selected by senior radiologists (reference evaluation), including 32 cases for the bone setting (16 with and 16 without bone fractures) and 50 for chest setting (17 normal cases, 16 pneumothorax and 17 pulmonary nodules). These images were blindly and independently evaluated with 4 monochrome NEC medical displays with different performances in terms of spatial resolution, 3 and 5-megapixel (MP), and maximum luminance, 250 and 500 cd/m² by the senior radiologists and in 2 different occasions by junior radiologists. All the observers had to rate presence or absence of the lesions on a five point confidence scale. The Cohen Kappa statistic (Kc) was computed in order to evaluate the reproducibility in identifying the lesions between monitors and within/between radiologists; the accuracy in the interpretation of the images was evaluated with respect to the reference evaluation.

RESULTS

The between-monitor reproducibility showed Kc \geq 0.80 for the senior radiologists, whereas lower values were found for juniors (range: 0.66-0.89 and 0.61-0.87 for the bone and chest setting, respectively). Preliminary results for 5MP display at 500 cd/m² showed the lowest values of misclassified cases for junior radiologists with respect to the reference evaluation (range: 13%-16% and 20-26% for the bone and chest setting, respectively), and no errors were committed by senior radiologists in both settings. The number of misclassified cases with respect to the reference evaluation increased when using the 3MP display with the lowest luminance, with a percentage of misclassified cases of 6% and 10% for senior radiologists, and of 25%-28% and 30-48% for junior radiologists, for the bone and chest setting respectively.

CONCLUSION

Our preliminary evaluations suggest that an increased spatial resolution and luminance level might improve the evaluation performances of digital radiography images.

CLINICAL RELEVANCE/APPLICATION

Both high luminance and spatial resolution play an important role in the interpretation of digital radiography images especially for less experienced radiologists.

SSM13

Molecular Imaging (Urology/Prostate)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S504CD



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

FDA Discussions may include off-label uses.

Participants

Peter L. Choyke, MD, Rockville, MD (*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
Steven P. Rowe, MD, PhD, Parkville, MD (*Moderator*) Nothing to Disclose

Sub-Events

SSM13-01 68Ga-RM2 PET/MRI in Biochemically Recurrent Prostate Cancer: A Comparison with Conventional Imaging

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S504CD

Participants

Ida Sonni, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Ryogo Minamimoto, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Andreas M. Loening, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Shreyas S. Vasawala, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research collaboration, General Electric Company; Consultant, Arterys Inc; Research Grant, Bayer AG;
Andrei Iagaru, MD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, The Piramal Group

PURPOSE

68Ga-RM2 (formerly known as 68Ga-Bombesin or BAY86-7548) is a synthetic bombesin receptor antagonist that targets gastrin-releasing peptide receptors (GRPr). GRPr are highly overexpressed in prostate cancer (PC). Because of their low expression in BPH and inflammatory prostatic tissues, imaging GRPr has potential advantages over current choline- and acetate-based radiotracers. We now present data on the use of 68Ga-RM2 PET/MRI in patients with biochemically recurrent prostate cancer (BCR PC) and non-contributory conventional imaging (CI).

METHOD AND MATERIALS

We enrolled 27 men with BCR PC, 59-83 year-old (mean±SD: 68.4±6.8) in an IRB-approved prospective study. Imaging started at 40-69 minutes (mean±SD: 49.9±7.2) after injection of 3.6-4.1 mCi (mean±SD: 3.8±0.2) of 68Ga-RM2 using a TOF-enabled simultaneous PET/MRI scanner. MRI included T1-weighted, T2-weighted and DWI. SUV_{max} and SUV_{mean} measurements were recorded in normal tissues and areas of uptake outside the expected physiologic biodistribution.

RESULTS

PSA ranged 0.3-36.4 ng/mL (mean±SD: 7.2±7.9). CT, MRI, 99mTc MDP bone scan were negative. 68Ga-RM2 uptake had the highest value in the pancreas and bladder, while moderate uptake was noted in the esophagus, kidneys, blood pool, stomach, small bowel and colon. High 68Ga-RM2 uptake (SUV_{max}: 12.7 ± 7.8 [range: 2.6 – 33.5], SUV_{mean}: 5.7 ± 2.5 [range: 1.7 – 10.8]) corresponded to pelvic lymph nodes (7 patients), retroperitoneal lymph nodes (5 patients), prostate bed (3 patients), seminal vesicle (2 patients), supraclavicular lymph node (2 patients), mesenteric lymph nodes (1 patient), mediastinal lymph node (1 patient), liver (1 patient), lung (1 patient) and bone marrow (1 patient). 68Ga-RM2 PET findings were compatible with recurrent prostate cancer in 19 of the 27 participants. MRI identified findings compatible with recurrent prostate cancer in 8 of the 27 patients (lymph nodes in 6 patients, prostate bed in 1 patient, lung in 1 patient and bone marrow in 1 patient).

CONCLUSION

68Ga-RM2 produces high quality PET images for assessment of GRPr expression in patients with BCR PC. High uptake in multiple areas compatible with cancer lesions suggests that 68Ga-RM2 is a promising PET radiopharmaceutical for localization of disease in participants with BCR PC and non-contributory conventional imaging.

CLINICAL RELEVANCE/APPLICATION

68Ga-RM2 produces high quality PET images for assessment of GRPr expression in patients with BCR PC.

SSM13-02 18F-Fluoromethylcholine Dynamic PET with Multiparametric MR Imaging in Patients with High Risk Prostate Cancer

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S504CD

Participants

Ur Metzger, MD, FRCPC, Toronto, ON (*Presenter*) Consultant, AbbVie Inc
Lisa P. Lavelle, MBBCh, FFR(RCSI), Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Douglas Hussey, BSc, RT, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Kartik S. Jhaveri, MD, Toronto, ON (*Abstract Co-Author*) Speaker, Bayer AG; Speaker, Siemens AG
Sangeet Ghai, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Jaydeep A. Halankar, MD, DMRD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the qualitative and quantitative parameters of dynamic 18F-Fluoromethylcholine (FCH) PET (dPET) in patients with high risk primary prostate cancer, and correlate these with multiparametric MR (mpMR) of the prostate.

METHOD AND MATERIALS

Twenty patients with biopsy-proven hrPCa were included (age 50-82 yrs, median, 70; Gleason score 7-9, median 8; serum PSA 3-90 ng/mL, median, 18.5). All patients underwent FCH-dPET (10 min) of the pelvis prior to a whole body scan and 3T mpMR of the prostate including high resolution T2-weighted, diffusion weighted, and dynamic contrast enhanced imaging. All primary tumor sites on mpMR and FCH-PET were recorded separately by an experienced prostate MR and PET reader, respectively, noting lesion location and degree of certainty (definite tumor or equivocal lesion). On PET, SUV was measured on static images, and time activity curves (TAC) were generated from dPET data. Quantitative dPET analysis was based on a two-tissue compartment model with image-derived arterial input.

RESULTS

Twenty one tumors in 20 patients were identified on mpMR (peripheral zone, n=20). All tumors on mpMR were also identified on PET. One additional lesion considered equivocal on mpMR did not show focal FCH uptake. Ten additional foci of FCH uptake in 8 patients were identified on PET (peripheral zone, n=5), with no mpMR correlate. Median SUVmax for MR-confirmed and non-MR confirmed lesions was 7.2 ± 2.2 , and 5.7 ± 2.6 , respectively. Median dPET parameters for MR-confirmed and non-MR confirmed lesions (1/min) were $K1=0.73 \pm 0.31$ and 0.56 ± 0.18 ($p=0.04$); $K3=0.24 \pm 0.17$ and 0.24 ± 0.14 ($p=0.91$); $Ki=0.28 \pm 0.14$ and 0.27 ± 0.08 ($p=0.31$), respectively.

CONCLUSION

There is discordance in lesions identified in the prostate on mpMR and FCH-PET in patients with high-risk prostate cancer, with PET identifying >30% additional lesions. Furthermore, K1 values for MR-confirmed tumors were different from those derived from non-MR confirmed cohort of lesions. Further prospective studies with PET/MR-Ultrasound fusion biopsies of all PET and MR detected lesions are warranted.

CLINICAL RELEVANCE/APPLICATION

This study provides insight on the performance of FCH-PET in the detection of primary prostate cancer, as it correlates with multiparametric MR, along with quantitative dynamic FCH-PET data.

SSM13-03 PET/CT Imaging with 68Ga-labelled Prostate Specific Membrane Antigen-ligands in Restaging of Prostate Cancer: A Meta-analysis

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S504CD

Awards

Student Travel Stipend Award

Participants

Sara Sheikhabahaei, MD, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose
Lilja B. Solnes, MD, MBA, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Afshar-Oromieh, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Esther Mena, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Mehdi Taghipour, MD, BOSTON, MA (*Abstract Co-Author*) Nothing to Disclose
Rathan M. Subramaniam, MD, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The PSMA has emerged as a promising target for PET-imaging of patients with recurrent prostate cancer (PCa) with higher rate of tumor detection in different studies. Given the relatively small patient population in most of these studies, in this meta-analysis we aim to establish the summary estimates of the performance of 68Ga-PSMA PET/CT imaging in relation to PSA values. The lesion-based diagnostic values of 68Ga-PSMA-ligands were also evaluated where possible.

METHOD AND MATERIALS

Systematic search were performed in PubMed and EMBASE (last updated in Feb 2016). Studies investigating the performance of 68Ga-PSMA-ligands PET/CT in patients with recurrent PCa were eligible for inclusion. When the individual patient data on rate of lesion detection in relation to PSA level were not extractable, the study authors were contacted seeking for additional information. Studies with patient overlap were excluded. Studies with histopathology reference standard were included in the diagnostic accuracy analysis. The pooled results were reported along with its 95% CI.

RESULTS

A total of 8 studies including 850 patients (788 patients suspected of recurrence, 62 patients with newly diagnosed PCa to exclude metastases) who were referred to 68Ga-PSMA-ligands PET/CT were included in this individual patient data meta-analysis. At least one lesion was identified on 68Ga-PSMA-ligands PET/CT in 52%(41-62%) of patients with PSA (ng/dl) of ≤ 0.5 ng/ml (n=89), 58% (46-69%) of patients with PSA of 0.5-1 ng/ml (n=82), 80% (71-86%) of patients with PSA of 1-2 ng/ml (n=149) and 91% (88-93%) of patients with PSA ≥ 2 ng/ml (n= 535). Three studies provided the lesion-based accuracy information (967 lesions). The pooled per-lesion accuracy analysis revealed the sensitivity of 0.84 (0.71-0.91), specificity of 0.98 (0.90-1.0), negative predictive value of 0.96 (0.89-0.99) and positive predictive value of 0.92 (0.64-0.98).

CONCLUSION

Analysis of the available studies indicates that 68Ga-PSMA-ligands PET/CT are highly specific for lesions of PCa. There is a significant trend in tumor detection, from 52% to 91%, in association with PSA level ranging from <0.5 to >2 ng/dl.

CLINICAL RELEVANCE/APPLICATION

68Ga-PSMA-PET/CT is a valuable imaging with substantial diagnostic performance and high tumor detection rate even in clinically important range of low PSA levels (PSA < 0.5 ng/dl) which support its use in clinical practice in restaging of PCa with suspected recurrence.

SSM13-04 Hyperpolarized 13C-Tert-Butanol MRI Perfusion Mapping and Microvessel Density in Sunitinib-Treated Renal Cell Carcinoma Xenografts: Rad-Path Correlation in the Characterization of Intratumoral Heterogeneity and Pre- and Post-Treatment Change

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S504CD

Student Travel Stipend Award

Participants

Patricia Coutinho De Souza, DVM, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Aaron K. Grant, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Xiaoen Wang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rupal Bhatt, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gopal Varma, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
David C. Alsop, PhD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company Royalties, General Electric Company
Leo L. Tsai, MD, PhD, Boston, MA (*Abstract Co-Author*) Co-founder, Agile Devices Inc; Stockholder, Agile Devices Inc; Research Consultant, Agile Devices Inc;

PURPOSE

Hyperpolarized 13C-tert-butanol (h13C-TB) is a freely-diffusible novel MRI tracer that provides high-SNR tissue perfusion mapping. We use h13C-TB MRI to quantify perfusion within and between untreated (UT) and sunitinib resistant (SR) renal cell carcinoma mouse xenografts. Our goal was to determine if regional perfusion measured with h13C-TB correlated with local CD34 expression and microvessel density (MVD) in these tumors.

METHOD AND MATERIALS

8 mice were implanted with A498 RCC tumors. 4 (SR) were treated with sunitinib daily; the other 4 were UT. SR mice were imaged at resistance (when regrowth was seen, 14–54 days). UT mice were imaged when tumors reached 20 mm in size. MRI was performed at 4.7 T using: (1) Anatomical 1H-T2-weighted images using rapid acquisition with refocused echoes, TR/TE=3000/80ms, 128x128 matrix, 2mm slice, 3.5cm FOV, (2) h13C-TB perfusion maps using 2D balanced steady state free precession, 128x128 matrix, 8.5cm FOV, 3.3mm slice, 512ms/frame, 100 frames. Tumors were sectioned along the imaging plane, stained with immunofluorescent-labeled CD34, and scanned into virtual slides. 75 ROI (0.25mm²) were selected for each MR perfusion map (Fig B and F) and the MVD of each matching location was determined in the pathologic specimen (Fig C and G).

RESULTS

1H images of UT and SR tumors are shown in Figures A and B, respectively (outlined in blue). Superimposed perfusion maps from h13C-TB MRI (green) is shown in example UT (Fig B) and SR (Fig F) tumors. Figures C-D and G-H show CD34 expression, showing qualitative similarity to respective MR perfusion maps. Measured perfusion was greater in UT relative to SR tumors ($p < 0.05$, Fig I), but the average MVD was lower ($p < 0.05$) (Fig. J). However, within each UT or SR tumor the local MVD correlated with local perfusion (Fig K-L).

CONCLUSION

h13C-TB MRI provides high-SNR perfusion mapping even in low flow areas. There is significant correlation between local perfusion and MVD within each tumor. However, resistance tumors demonstrate lower perfusion and greater MVD relative to untreated tumors, suggesting that MVD alone is not predictive of perfusion when assessing antiangiogenic response.

CLINICAL RELEVANCE/APPLICATION

h13C-tert-butanol provides noninvasive high-SNR quantitative perfusion mapping even in treated tumors with low flow. Improved radiologic-pathologic correlation is necessary to increase our accuracy in predicting therapeutic response and resistance.

SSM13-05 Added Value of CT Textural Analysis Compared to PET-CT alone in Differentiating Benign from Malignant Adrenal Lesions?

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S504CD

Participants

Shaunagh McDermott, FFR(RCSI), Boston, MA (*Presenter*) Nothing to Disclose
Leslie K. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Canellas, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Hei Shun Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Abstract Co-Author*) Nothing to Disclose
Michael A. Blake, MBBCh, Boston, MA (*Abstract Co-Author*) Editor with royalties, Springer Science+Business Media Deutschland GmbH

PURPOSE

To assess the added value of CT textural analysis to contrast-enhanced PET-CT in differentiating benign from malignant adrenal lesions.

METHOD AND MATERIALS

We retrospectively assessed a series of 45 consecutive patients who had undergone contrast-enhanced PET-CT scan prior to a percutaneous biopsy of an adrenal lesion over a 10 year period. Final diagnosis was based on pathology or stability on imaging for at least one year. 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. The PET scan was considered positive if the adrenal lesion qualitatively showed greater FDG uptake than the reference hepatic uptake.

RESULTS

The final diagnosis was benign in 16 cases and malignant in 29 cases. The mean gray level intensity for medium filter (SSF 4) was significantly higher for benign compared to malignant adrenal lesions (4.7 vs. -8.6)($p < 0.005$). Using a mean gray level intensity cutoff of -2 on SSF 4, the sensitivity was 75% and specificity was 69% for the detection of a malignant adrenal lesion (AUC 0.76). The sensitivity and specificity for PET was 69% and 100%, respectively. Using a combined approach, if a mean gray level signal intensity cutoff of -2 was utilized in patients with an adrenal that showed greater than hepatic FDG uptake, then the overall sensitivity was 90% and the specificity was 100%.

CONCLUSION

Performing CT textural analysis on PET positive adrenal nodules increases the sensitivity of the study.

CLINICAL RELEVANCE/APPLICATION

Many patients being worked up for malignancy now undergo a PET-CT scan and the addition of CT textural analysis may increase the study's diagnostic accuracy and reduce the need for further imaging or tissue sampling.

SSM13-06 Accuracy of the of N0 Nodal Staging of the High-risk Prostatic Carcinoma based on 18F-fluorocholine-PET/MRI, Comparison with Surgical Findings

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S504CD

Participants

Jiri Ferda, MD, PhD, Plzen, Czech Republic (*Presenter*) Nothing to Disclose
Eva Ferdova, MD, Plzen, Czech Republic (*Abstract Co-Author*) Nothing to Disclose
Jan Baxa, MD, PhD, Plzen, Czech Republic (*Abstract Co-Author*) Nothing to Disclose
Milan Hora, Plzen, Czech Republic (*Abstract Co-Author*) Nothing to Disclose
Ondrej Hes, MD, PhD, Plzen, Czech Republic (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the possibilities of pelvic nodal-staging assessment of the high-risk prostatic carcinoma using 18F-fluorocholine-PET/MRI and to compare findings with surgery.

METHOD AND MATERIALS

25 men (mean age 66,8 years, range 59 -78) with by biopsy confirmed prostatic carcinoma with Gleason score 8 and more were examined before surgery using 18F-fluorocholine-PET/MRI and with finding of no positive node (N0 N-stage based on PET/MRI) were recommended to radical prostatectomy. All examination were delayed 15 min after intravenous application of 18F-fluorocholine in the dose 1,25 MBq per kilogram of body weight. The imaging included T2 STIR, DWI and dynamic gadolinium enhanced GRE T1 imaging, the PET acquisition last 15 min. All examinations were completed with whole trunk PET/MRI acquisition. The TNM staging was evaluated. In all men, the radical surgery was performed including pelvic lymph node resection. The comparison of the histopathological results were compared with those obtained by PET/MRI according nodal staging and according local T-staging.

RESULTS

25 surgeries were performed. There were found 22 true negative findings, and three false negative findings including one micrometastase. The negative predictive value of pelvic lymph node metastase reached 88,0 %(22/25) excluding micrometastase, NPV rised to 92,0% (23/25). One deviation between T2 or T3 size was noted after histopathological evaluation, one case was evaluated as T3B by PET/MRI, after histopathological evaluation the stage was set as T2C; in one case, the T2b based on PET/MRI was evaluated as T2C, no other deviation was noted nor between T2 or T3 subcategories, nor in T3A subcategory. It results in 92% (23/25) accuracy in local staging.

CONCLUSION

The 18F-fluorocholine PET/MRI derived pelvic lymph N-staging N0 and T-stage in prostatic carcinoma reaches sufficient results and provides sufficient information in the treatment decisions.

CLINICAL RELEVANCE/APPLICATION

In prostatic carcinoma, the negative pelvic nodal staging and T-staging using 18F-fluorocholine PET/MRI exhibits sufficient clinical value in the decisions to perform radical prostate surgery.

Science Session with Keynote: Musculoskeletal (Cartilage)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: E353C



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

ParticipantsMichael P. Recht, MD, New York, NY (*Moderator*) Nothing to DiscloseMichael J. Tuite, MD, Madison, WI (*Moderator*) Nothing to Disclose**Sub-Events****SSM14-01 Musculoskeletal Keynote Speaker: Cartilage Imaging-One View of the Future**

Wednesday, Nov. 30 3:00PM - 3:20PM Room: E353C

ParticipantsMichael P. Recht, MD, New York, NY (*Presenter*) Nothing to Disclose**SSM14-03 Does Cartilage Composition Change after Joint Preserving Hip Surgery for FAI - Preliminary Data of a Prospective Comparative Longitudinal Study Using Delayed Gadolinium Enhanced MRI of Cartilage (dGEMRIC) at 3 T**

Wednesday, Nov. 30 3:20PM - 3:30PM Room: E353C

ParticipantsFlorian Schmaranzer, Bern, Switzerland (*Presenter*) Nothing to DisclosePascal Haefeli, Bern, Switzerland (*Abstract Co-Author*) Nothing to DiscloseMarkus Hanke, Bern, Switzerland (*Abstract Co-Author*) Nothing to DiscloseStefan Werlen, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to DiscloseMoritz Tannast, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to DiscloseKlaus A. Siebenrock, MD, PhD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose**PURPOSE**

Delayed gadolinium enhanced MRI of cartilage (dGEMRIC) allows a 'monitoring' of glycosaminoglycan depletion of cartilage and can be used as biomarker for osteoarthritis. Longitudinal data on the change in hip cartilage composition in patients with femoroacetabular impingement (FAI) is lacking. We aimed to assess whether changes in T1 values occur 1 year after FAI surgery compared to patients with non-operative treatment and if changes correlate with clinical short-term outcome.

METHOD AND MATERIALS

IRB-approved prospective, comparative, longitudinal study of two groups (61 hips, 55 patients). After exclusion 17, 18 hips were assigned to the 'operative' (open/arthroscopic correction) respectively to the 'non-operative' (conservative treatment) group. At baseline, groups were comparable regarding radiographic osteoarthritis (Tönnis score), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and T1 values. Patients had baseline and 1-year follow-up i.v. dGEMRIC scans with the same 3 T magnet (0.4 ml/kg, 0.2 mmol gadopentate dimenglumine /kg). Radial T1 maps were reformatted from a 3D dual flip-angle volume interpolated breathhold examination (VIBE). Central, peripheral femoral (12 'hour' positions) and acetabular (10 'hour' positions) T1 values were manually measured separately from each other with the help of 2D radial high-resolution PD-w images. Baseline and 1-year follow-up WOMAC scores were obtained. Statistical analysis included paired/unpaired Student's t-Tests ($p < 0.05$).

RESULTS

Acetabular T1 values decreased significantly ($p < 0.05$) in 17/20 (85%) zones and in 21/24 (88%) of femoral zones in the operated group. In the non-operative group, no acetabular zone and 2/24 (8%) femoral zones presented with a significant drop. After 1 year the WOMAC significantly improved (58 ± 42 to 33 ± 42 ; $p = 0.007$) for the operative group, while there was no significant change (55 ± 45 to 48 ± 50 ; $p = 0.825$) for the non-operative group.

CONCLUSION

FAI surgery led to a decline in cartilage composition on MRI after 1 year despite significant clinical improvement. This decline may result from postoperative inflammation and/or may reflect altered biomechanic stress within the cartilage and requires longer follow-up.

CLINICAL RELEVANCE/APPLICATION

dGEMRIC may improve our understanding of hip osteoarthritis and has great potential to improve surgical treatment planning for FAI.

SSM14-04 Quantitative Measurement of Medial Femoral Knee Cartilage Volume - Analysis of The OA Biomarkers Consortium FNII Project Cohort

Wednesday, Nov. 30 3:30PM - 3:40PM Room: E353C

ParticipantsLena Schaefer, Boston, MA (*Abstract Co-Author*) Nothing to DiscloseMing Yin, Boston, MA (*Abstract Co-Author*) Nothing to DiscloseMeera Sury, Boston, MA (*Abstract Co-Author*) Nothing to DiscloseScott Jamieson, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

John A. Lynch, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Michael C. Nevitt, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey W. Duryea, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Stacy E. Smith, MD, Weston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Objective and efficient methods to determine knee cartilage volume are useful for large osteoarthritis (OA) trials. We previously developed and validated a fast and responsive quantitative software tool to measure cartilage volume on MRI scans. The purpose of the present study is to further validate this method in a larger patient cohort and to assess predictive validity in a case-control study.

METHOD AND MATERIALS

The OA Biomarkers Consortium FNIH Project is a case-control study of knee OA progression nested within the Osteoarthritis Initiative (OAI), including 600 subjects in four subgroups based on radiographic and pain progression over 48 months in knees with OA. We used logistic regression to assess the association of change in cartilage volume with progression status. Our software tool measured cartilage volume in the central weight-bearing portion of the medial femur. We evaluated different sized areas of cartilage segmentation and their ability to differentiate the case control status of the cohort. The readings were performed on sagittal double echo steady state (DESS) MRI scans at the baseline and 24-month visits.

RESULTS

Change in medial femoral cartilage volume was associated with radiographic progression (OR=4.47; 95% CI=2.75-7.25). This correlation was significant but less prominent with combined radiographic and pain progression (OR=1.84; 95% CI=1.50-2.25). Smaller areas of cartilage segmentation were also able to predict the case-control status with similar results. The average reader time for the largest area was less than 20 minutes per scan. Smaller areas could be assessed with substantially less reader time, since smaller regions require fewer slices to be segmented.

CONCLUSION

We demonstrated that our software tool to measure cartilage volume in focal regions of the medial femur is ideal for existing and future large studies of knee OA and showed its clinical validity in a case-control setting. Smaller areas of segmented cartilage deliver the same associations with similar ORs as larger regions. This implies that comparable performance can be achieved with substantially less reader time, and that the method could be used for studies requiring assessment of several thousand MRI scans.

CLINICAL RELEVANCE/APPLICATION

By showing its clinical validity in a case-control setting we demonstrated that our tool to measure cartilage volume is fast and responsive and useful for future clinical studies of OA therapies.

SSM14-05 Presence and Severity of Type 2 Diabetes Mellitus are Associated With Cartilage Matrix Degeneration Measured With 3T MRI T2 Relaxation Time: Data from the Osteoarthritis Initiative

Wednesday, Nov. 30 3:40PM - 3:50PM Room: E353C

Awards

Student Travel Stipend Award

Participants

Alexandra S. Gersing, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Nattagan Chancheck, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Benedikt J. Schwaiger, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Gabby B. Joseph, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Michael C. Nevitt, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Charles E. McCulloch, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Link, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Consultant, General Electric Company; Research Consultant, InSightec, Ltd; Research Grant, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Consultant, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

PURPOSE

To assess the cross-sectional association of presence and severity of type 2 diabetes mellitus (DM) with cartilage degeneration, measured using 3T MRI-based T2-values.

METHOD AND MATERIALS

In this study, 100 subjects with DM (age 60.6±8.5y; 57 females) and risk factors for osteoarthritis (OA) or mild radiographic OA (Kellgren-Lawrence (KL) score ≤2) were frequency-matched to 200 subjects without DM (age 60.9±8.1y; 114 females) on age, sex, BMI and KL score. For a subgroup analysis, DM subjects with severe disease were defined as subjects with present diabetes-related renal and ophthalmological complications at any time point until 48 months (N=28). Knee MRI examinations were assessed for structural joint abnormalities using the Whole-Organ Magnetic Resonance Imaging Score (WORMS). Our outcomes at baseline were cartilage composition as assessed with T2-maps averaged over all compartments, as well as in the patella and medial tibia and in the bone layer of the laminar analysis in these regions. Multivariable linear regression models adjusting for age, sex, baseline BMI and KL score were used to calculate associations with DM status.

RESULTS

Cartilage T2 values of the patella were significantly higher in subjects with DM in comparison to subjects without DM (mean diff. 1.1msec [95% confidence interval (CI) 0.6, 1.5]; P=0.023) and cartilage T2 of the bone layer of the medial tibia and patella (mean diff. 1.2msec [95% CI 0.5, 1.9], P=0.003 and mean diff. 1.1msec [95% CI 0.2, 2.0], P=0.022, respectively). Subjects with more severe DM overall showed significantly higher T2 values compared to controls (bone layer averaged: over all compartments, mean diff. 2.2 [95% CI 0.3, 3.4], P=0.044; medial tibia, mean diff. 1.4msec [95% CI 0.3, 2.6], P=0.001). However, no significant differences in structural knee abnormalities (WORMS of cartilage, meniscus and bone marrow) were found between controls and DM subjects with various disease severity (P>0.05 in all cases).

CONCLUSION

Compared to controls, subjects with DM showed significantly higher cartilage T2 values with even higher T2 values in subjects with more severe disease. These results suggest more advanced biochemical cartilage degradation in DM patients.

CLINICAL RELEVANCE/APPLICATION

MR-based knee cartilage T2 measurements allow monitoring of the effect of DM on joint health and underline the need for preventative treatment of patients with DM in order to slow or prevent cartilage deterioration.

SSM14-06 T1-rho MRI Detects Cartilage Improvement Following Surgical Treatment for Cam-Type FAI

Wednesday, Nov. 30 3:50PM - 4:00PM Room: E353C

Participants

Kawan S. Rakhra, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

Helen Anwander, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Gerd Melkus, PhD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

Paul E. Beaulé, MD, Ottawa, ON (*Abstract Co-Author*) Consultant, Wright Medical Technology, Inc Consultant, Getinge AB Consultant, MEDACTA International SA Consultant, MicroPort Scientific Corporation

PURPOSE

The goal of this study was to determine if the T1-rho MRI profile of hip hyaline cartilage improves in patients with cam-type femoroacetabular impingement following surgical osteochondroplasty.

METHOD AND MATERIALS

The study included 17 subjects with cam-type FAI diagnosed clinically and radiologically by MRI. T1-rho MRI(1.5T) of the symptomatic hip, pre- and post-operatively(2 years), was performed. Each subject underwent arthroscopic osteochondroplasty. The superior hip hyaline cartilage was segmented as a bilayer. The cartilage was subsequently divided into 2 zones(anterosuperior, posterosuperior) and further into equal thirds(medial, middle, lateral) zones in the transverse plane, generating 6 sub zones. The mean T1-rho relaxation value for the entire bilayer, and for the anterosuperior and posterosuperior zones, with and without further division into thirds, was performed and compared between the pre- and post-operative scans using a paired t-test.

RESULTS

The global mean T1-rho relaxation value(msec) postoperatively(30.62 ± 3.77) was significantly lower than pre-operatively(33.04 ± 2.99), $p=0.0467$. For the anterosuperior zone, the mean T1-rho relaxation value(msec) postoperatively(29.62) was significantly lower than pre-operatively(34.01), $p=0.008$. For the posterosuperior zone, the mean T1-rho relaxation value(msec) postoperatively(32.47) was not significantly different from pre-operatively(32.80), $p=0.823$. Further subdivision of the anterosuperior zone into thirds, found that the T1-rho relaxation values(msec) were significantly lower post-operatively than pre-operatively in both the lateral(27.61 vs 31.57 , $p=0.006$) and middle(29.41 vs 33.46 , $p=0.021$) subzones. None of the subzones posterosuperiorly demonstrated any significant difference between pre- and post-operative states.

CONCLUSION

There is significant reduction in the T1-rho relaxation values following osteochondroplasty, namely in the anterosuperior zone where cam-FAI is known to preferentially cause chondral disease. The change in T1-rho suggests an increase in proteoglycan content, equating with improved cartilage health.

CLINICAL RELEVANCE/APPLICATION

T1-rho MRI cartilage mapping can monitor biochemical changes in hyaline cartilage and be used to evaluate the impact of joint preserving surgical treatments.

SSM15

Nuclear Medicine (Comparative Methodologies and Emerging Technologies)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S505AB

CT NM

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

FDA Discussions may include off-label uses.

Participants

Nathan C. Hall, MD, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose
Adam J. Bobbey, MD, Columbus, OH (*Moderator*) Nothing to Disclose

Sub-Events

SSM15-01 Comparative Performance of Two Tc-99m Radiopharmaceuticals for Intraoperative Identification of Sentinel Lymph Nodes in Breast Cancer

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S505AB

Awards

Student Travel Stipend Award

Participants

Aurela I. Clark, MD, Lexington, KY (*Presenter*) Nothing to Disclose
Elizabeth Cheatham, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose
Peter A. Hardy, PhD, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose
M. Elizabeth Oates, MD, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Surgical staging of regional lymph nodes with intraoperative lymphatic mapping and sentinel lymph node (SLN) biopsy is the standard of care for patients with early stage breast cancer. Tc-99m filtered sulfur colloid (SC) is the traditional radiopharmaceutical for guiding intraoperative SLN biopsy. In May 2013, the FDA approved Tc-99m tilmanocept (TM) (Lymphoseek), a low molecular weight, mannose receptor-targeted radiopharmaceutical. While published data suggest that TM may reduce the number of "hot" lymph nodes needed for accurate staging, the higher cost of TM is paramount to its clinical acceptance.

METHOD AND MATERIALS

Retrospective analysis compared two cohorts of female patients with breast cancer: 52 TM (age range 21-79, mean 58.5 yr) and 50 SC (age range 35-88, mean 60.3 yr) who were operated on by one of two experienced surgeons. Primary measures were number of "hot" SLN removed, intraoperative gamma probe counts on those SLN, and determination of positive (metastatic) SLN.

RESULTS

The number of SLN removed was similar in both cohorts (mean TM: 2.13 vs. SC: 3.22, $p < 0.10$). There was no difference in the sensitivity of the radiopharmaceuticals in determining metastatic involvement (mean TM 0.08 vs SC 0.18, $p < 0.14$). At least one "hot" SLN was identified in every patient. In patients with more than one SLN removed, the second SLN demonstrated lower counts in both cohorts.

CONCLUSION

In comparing the number of excised "hot" lymph nodes, there was no statistical difference between the TM and SC cohorts. There was equivalent sensitivity of both radiopharmaceuticals for determining the presence of regional lymphatic metastases. Based on these results, it is difficult to justify the higher cost of TM.

CLINICAL RELEVANCE/APPLICATION

Currently, the contract price for TM is approximately four times that of SC. The prices of TM and SC will increase in 2016; there will continue to be an approximately 3.6-fold difference in cost. Reimbursements for SC and TM are now bundled into the payment for the procedure. Given that TM has not been shown to result in higher sensitivity for detection of metastatic regional spread to SLN, its clinical relevance becomes less favorable, particularly in the face of increasing prices and bundled reimbursements.

SSM15-02 First Clinical Study with a New Respiratory Gating Device Aiming to Improve 4D PET/CT Studies: SPIRO PET: Phase I Study

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S505AB

Participants

Frederic Courbon, MD, PhD, Toulouse, France (*Presenter*) Research Grant, General Electric Company
Cyril Jaudet, PhD, Brussel, Belgium (*Abstract Co-Author*) Nothing to Disclose
Olivier Caselles, PhD, Toulouse, France (*Abstract Co-Author*) Grant, General Electric Company
Thomas Filleron, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Lawrence Dierickx, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Slimane Zerdoud, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Severine Brillouet, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Mathilde Bauriaud, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
David Didierlaurent, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Delphine Vallot, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We have previously demonstrated that SPI can measure physiological breathing signal while processing trigger signals with a high temporal accuracy. The primary objective : to assess the feasibility (patient's tolerance), to perform clinical gated PET-CT study with SPI device. The secondary objectives : to compare the accuracy (inhalation peaks detection, time lags, the baseline drift and reproducibility of the time binning) of RPM and SPI .

METHOD AND MATERIALS

A prospective phase I clinical study (AFSSAPS and the ethic committee approval n°UEC/DA2012 on patients referred to our center for a 18-FDG-PET-CT study for either lung cancer staging, solitary pulmonary nodule viability assessment or BTV definition for treatment planning. After whole body PET-CT, a 4D PET CT acquisition centered over the torso is carried on. The SPI-mask is placed over the mouth and nose and the RPM box is placed over the abdomen. The patient is asked to breath normally during the acquisition. Heart pulse rate, blood oxygen saturation (%SpO2) levels, blood pressure are monitored. PET gated acquisition duration is 12 minutes followed by a 4D CT 120 kV - 30 mA, 256x256x2mm30sec,

RESULTS

46 patients were included, all the patients went through the training phase (5minutes) 5 patients were removed from the study because of metastatic extension, and one because a blood glucose level > 1.9g/L. No serious adverse events are to be reported. Among the remaining 40 pts only one is considered as failure of the SPI device because of patient discomfort during the gated PET-CT acquisition, part for this patient. The tolerance was excellent for the 39 other patients. Among them all respiratory cycles were detected by SPI, 3 were missed with the RPM (p < 0.0001) SPI improve significantly the inhalation peaks detections and reduce the time lags between the inhalation peak detection and triggers. Reproducibility is also improved as the baseline drift (inspiration end) is also smaller (p<0.0018)

CONCLUSION

This first clinical study confirms that this novel respiratory tracking device (SPI) is well tolerated and that it improves PET-CT synchronisation in prospective mode.

CLINICAL RELEVANCE/APPLICATION

It is our assumption that the improvement provided by SPI is particularly adapted for the new PET-CT system with increased spatial resolution, improved quantitation accuracy, reduced CT induced radiation exposure.

SSM15-03 Respiratory Phase Matching in Whole-Body PET/CT Using Fast Spiral CT

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S505AB

Participants

James Hamill, PhD, Knoxville, TN (*Presenter*) I am employed by Siemens Healthcare

Osama R. Mawlawi, PhD, Houston, TX (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Siemens AG

Joseph Meier, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Patient motion affects the alignment of PET and CT images, sometimes leading to errors in image interpretation and PET attenuation correction. We propose and evaluate a novel method for aligning PET and CT images in normal PET/CT protocols. The CT radiation dose is low and the alignment is applied in all bed positions in the chest and abdomen.

METHOD AND MATERIALS

Our protocol includes a non-gated low-dose spiral CT scan during free breathing, followed by listmode PET, also in free breathing. A respiration monitoring device collected waveform data during CT and PET. We reconstructed eight bins of gated PET (4D PET). All phases of respiration were represented by the 4D PET series, but each axial slice in CT matched just one phase. Our novel method created a matched 3D PET series by selecting, slice by slice, the phase in 4D PET that matched CT in that slice, based on the respiratory waveform measured during CT. PET and CT were aligned even though breathing motion affected the CT image. PET/CT data were acquired in step and shoot and continuous bed motion modes on Siemens mCT and mCT Flow PET/CT systems with 22 cm axial coverage. We tested the method with a phantom that had a stationary line source and one that moved during CT and PET. The alignment of PET and CT, measured in mm, and PET's spatial resolution, were evaluated for static PET, optimally gated 3D PET (HD Chest), 4D PET, and matched 3D PET. We will present matched 3D PET/CT images from 20 whole-body oncological FDG PET patients.

RESULTS

The average alignment error in the phantom study with slow CT was 9 mm for static PET, 4 mm for HD Chest, and 0.3 mm for matched 3D PET. The sharpest image resolution was seen in the HD Chest image and in two of the eight gates in 4D PET, though resolution was degraded in the other gates. In patient studies, increased PET image noise was noted, as in conventional 4D PET, but alignment of PET and CT was improved and the CT dose was unchanged from conventional PET/CT.

CONCLUSION

The matched 3D PET images were spatially matched quite closely to free-breathing CT.

CLINICAL RELEVANCE/APPLICATION

Good alignment of PET and CT normally requires additional patient radiation dose for 4D CT, extra scan time for triggered CT, or breath control. Our method is simple and uses a fast spiral CT.

SSM15-04 Whole Body Hybrid PETMRI: Comparison Between Contrast Enhanced and Non-Enhanced MRI Protocols for the Evaluation of Malignancies

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S505AB

Participants

Filiz Celebi, MD, Istanbul, Turkey (*Presenter*) Nothing to Disclose

Numan C. Balci, MD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare between non-contrast (NC) and contrast enhanced (CE) MRI protocols in Whole Body Hybrid PETMRI.

METHOD AND MATERIALS

53 Patients with known primary tumor underwent whole body hybrid PETMRI for initial staging with the use of NC and CE MRI protocols for simultaneous PET and MRI acquisitions. NC PETMRI protocol consisted of diffusion weighted ($b=0$ s/mm² and 800s/mm²) and T1-weighted Turboflash in axial, T2 weighted HASTE sequence in coronal planes ($\Sigma=25$ minutes). CE PETMRI was performed with the acquisition of axial serial contrast enhanced 3D FS VIBE images in the upper abdomen, whole body coronal fat saturated 3D VIBE Dixon and axial 3D FS VIBE for the brain ($\Sigma=30$ minutes). Total numbers of malignancies were determined on PETMRI images and differences between two protocols were analyzed with the use of Wilcoxon signed-rank test.

RESULTS

All malignancies that were seen on NC MRI were also present on CE MRI protocol. The mean numbers of malignancies on NC MRI and CE MRI were 13.2 + 18.5 and 12 + 18.3 respectively. There was significant difference for the total number of malignancies ($p=0.007$) Significant differences in number malignancies were observed in favor of contrast enhanced protocol in the abdomen ($p=0.001$) in the brain ($p=0.01$) and in the bone. There were no differences between two protocols for the number of malignancies in head and neck ($p=0.317$), thorax ($p=0.204$), and lymph nodes ($p=0.799$).

CONCLUSION

Whole body hybrid PETMRI with the use of CE MRI is superior to NC MRI protocol for the detection malignancies.

CLINICAL RELEVANCE/APPLICATION

To establish most optimal protocol for whole body hybrid PETMRI.

SSM15-05 The 10x Challenge for PET: A Radical Concept for Lower Dose and/or Faster Acquisitions

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S505AB

Awards

Student Travel Stipend Award

Participants

Michelle I. Knopp, Columbus, OH (*Presenter*) Nothing to Disclose

Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

Ajay Siva, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

Philip Bardos, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

Talha Saif, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

While major radiation dose reductions have been accomplished for CT, FDG PET tracer dosing has remained unchanged in the last two decades despite major advances. With introduction of next generation solid state, digital PET detectors, we escalated our effort to lower dose levels into a moon shot challenge to reduce the FDG dose or acquisition time by a factor of 10.

METHOD AND MATERIALS

We perform clinical trials on a next generation digital dPET/CT (Vereos) in a pre-commercial release version and intra-individual comparisons with current generation, photomultiplier tube, time of flight (TOF) cPET/CT (Gemini). The TOF timing resolution of 325ps dPET is best in class compared to 525ps in cPET. Prior to clinical testing, our team performed extensive phantom testing and recon development to enable selective clipping of list mode PET datasets for in silico simulation of acquisition / dose reductions. Our standard of care PET imaging protocol is 14 mCi FDG, time of flight and 90s per bed position imaged 75min p.i. After simulations, we decided to generate 10x initially by performing 1/10 acquisition time scans using 9s per bed position on both the cPET and dPET systems. Images were qualitatively analyzed by blinded readers and quantitatively by 3D ROI placement on target and background lesions.

RESULTS

25 1/10 acquisition time wholebody scans were acquired on dPET, 7 on cPET in addition to the 90s scans. We were also able to recon a simulated 1/10th acq.time image set that showed less than 10% variability from the real. The reduced county density led to increased noise levels, however target lesion detection achievable with slightly below borderline quality. We quickly realized that reconstruction has to be reoptimized if not radically changed. Subsequently, the noise level was considerably reduced and ROI SUV values found to be within 15% of the 10x benchmark.

CONCLUSION

The 10x challenge for dose or acquisition time reduction appears reachable with digital detection technology and reconstruction redesign. A 5x reduction goal is already being validated.

CLINICAL RELEVANCE/APPLICATION

This study demonstrates that substantial PET tracer dose reductions are achievable by leveraging new detector and reconstruction technologies.

SSM15-06 Post-Radioembolization Assessment of Yttrium-90 Microsphere Delivery Systems using Conventional PET/CT and Next-generation Digital PET/CT Technologies

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S505AB

Participants

Chadwick L. Wright, MD, PhD, Lewis Center, OH (*Presenter*) Nothing to Disclose
Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael Jedlicka, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Richard L. Anderson, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Piotr J. Maniawski, MSc, Cleveland, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV

PURPOSE

In the event of a misadministration of Yttrium-90 (90Y) microspheres during interventional radioembolization, evaluation of the delivery system for retained 90Y activity is often necessary. The purpose of this study is to assess the technical feasibility of next generation digital photon counting PET (dPET) detector technology for imaging ultra-low residual doses of 90Y activity within the delivery system and compare to conventional photomultiplier-tube based PET (cPET) technology.

METHOD AND MATERIALS

A pre-commercial release dPET/CT system (Vereos TF, Philips) and cPET/CT (Gemini TF, Philips) were used to image six 90Y delivery systems (typically < 37 MBq of 90Y) following interventional radioembolization to detect and localize any residual 90Y activity. Both dPET and cPET images were acquired in list-mode using a single bed position for 60 m and then for 7 m. In order to determine the optimal imaging time, list-mode clipping of the 60 m dPET and cPET data sets were performed to simulate shorter total acquisition times (i.e., 50, 40, 30, 20, 10 and 7 m). Intra-individual comparison of the dPET and cPET image characteristics for the true acquisitions and the list-mode clipping simulations were performed by a blinded 3 reader panel.

RESULTS

Detection of ultra-low levels of 90Y activity within the delivery system was feasible with both cPET and dPET systems. Residual 90Y activity was consistently detected in the microsphere source vial and some activity was in the catheter tubing. Although more 90Y internal pair-production events were detected with 60 m acquisitions, there was no difference in image quality or 90Y detectability when compared with true 7 m acquisitions for cPET and dPET. List-mode clipping of the PET data sets also confirmed that the clipped 7 min simulations were visually indistinguishable from true 7 min PET acquisitions.

CONCLUSION

This study demonstrates the feasibility of precisely imaging ultra-low levels of 90Y activity within a microsphere delivery system using cPET and dPET systems. It also appears feasible that total image acquisition time may be further reduced (i.e., < 7 m) without a significant impact on visual detection of residual 90Y activity.

CLINICAL RELEVANCE/APPLICATION

In case of a 90Y misadministration event, it is feasible to quickly and precisely detect residual 90Y activity within the delivery system using conventional and digital PET approaches.

Neuroradiology (Advances in Imaging Technology)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: N226



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

FDA Discussions may include off-label uses.

Participants

Albert J. Yoo, MD, Dallas, TX (*Moderator*) Research Grant, Penumbra, Inc; Research Grant, Neuravi Ltd;
Takashi Yoshiura, MD, PhD, Kagoshima, Japan (*Moderator*) Nothing to Disclose

Sub-Events**SSM16-01 Photon-counting CT for Carotid Angiography: First Human Results**

Wednesday, Nov. 30 3:00PM - 3:10PM Room: N226

Participants

Rolf Symons, MD, Washington, DC (*Presenter*) Nothing to Disclose
Tyler E. Cork, BS, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Reich, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammad Hadi Bagheri, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Amir Pourmorteza, PhD, Bethesda, MD (*Abstract Co-Author*) Researcher, Siemens AG
David A. Bluemke, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Research support, Siemens AG

PURPOSE

Beam hardening near the base of the skull and cervical vertebrae can degrade carotid CT angiography (CTA) image quality due to decreased arterial enhancement. Photon-counting detectors (PCDs) obtain spectral information which can be used to reduce-beam hardening artifacts potentially improving CTA image quality in areas susceptible to beam hardening. This study aimed to evaluate the image quality of PCD carotid CTA with conventional energy-integrating detector (EID) CTA.

METHOD AND MATERIALS

Radiation dose-matched conventional EID and photon detector (PCD) carotid CTAs were acquired at vendor recommended guidelines. 416 region of interests in 16 human volunteers were assessed to determine mean CT attenuation, image noise, and contrast-to-noise ratio (CNR) bilaterally in the common carotid artery (CCA), internal carotid artery (ICA) cervical segment (C1), ICA petrous segment (C2), ICA cavernous segment (C3), ICA supraclinoid segment (C4), vertebral artery (VA) foraminal segment (V2), VA atlantic segment (V3), VA intradural segment (V4), basilar artery (BA), and the anterior, middle and posterior cerebral arteries (ACA, MCA, and PCA). EID and PCD images were analyzed by 2 independent neuro-radiologists blinded to the detector. Intraclass correlation coefficient (ICC) was used to assess inter-reader reproducibility. Image quality of EID versus PCD images was assessed with repeated measurements analysis of variance, and Wilcoxon signed-rank test.

RESULTS

PCD image quality scores were better for ICA C2 and C3 segments, and VA V2 segment with significantly less subjective beam hardening (all $P < 0.01$) and good reproducibility (all $ICC > 0.75$). Compared with the common carotid artery, mean attenuation in ICA C2 and C3 segments significantly decreased for EID while attenuation remained stable for PCD ($-11.8 \pm 5.3\%$ vs $0.1 \pm 10.9\%$ and $-14.5 \pm 12.0\%$ vs $0.1 \pm 10.3\%$, respectively, $P < 0.001$). PCD CNR for the ICA C2 and C3 segment was higher than EID CNR (24.6 ± 7.3 vs 19.1 ± 6.3 and 24.6 ± 8.0 vs 18.4 ± 7.3 , both $P < 0.05$).

CONCLUSION

Photon-counting carotid CTA shows potential in improving image quality in areas susceptible to beam hardening close to the skull base and cervical vertebrae.

CLINICAL RELEVANCE/APPLICATION

Photon-counting CT may improve carotid CTA image quality in areas susceptible to beam hardening on conventional energy-integrating CT. Photon-counting CT provides spectral information which can be used to further enhance contrast-to-noise ratio.

SSM16-02 Evaluation of Projection and Dual-Energy Based Methods for Metal Artifact Reduction in Neuro CT Using A Phantom Study

Wednesday, Nov. 30 3:10PM - 3:20PM Room: N226

Awards**Student Travel Stipend Award****Participants**

Zaiyang Long, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Michael R. Bruesewitz, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
David R. De Lone, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
James M. Kofler JR, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG
Joel G. Fletcher, MD, Rochester, MN (*Abstract Co-Author*) Grant, Siemens AG; ;
Ahmed Halaweish, PhD, Rochester, MN (*Abstract Co-Author*) Employee, Siemens AG

Lifeng Yu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Both projection and dual-energy (DE) based methods have been used for metal artifact reduction (MAR) in CT. The two methods can also be combined. The purpose of this work was to evaluate the three MAR methods using phantom experiments for both spine and dental prostheses.

METHOD AND MATERIALS

A spine phantom with pedicle screws and a dental phantom with metal fillings were constructed using 3D printing (Objet 350 Connex3, Stratasys). Both phantoms were placed in water tanks to mimic patient attenuation. A syringe containing iodine solution was placed in the spine phantom to allow evaluation of iodine contrast-to-noise ratio (CNR). Phantoms were scanned on a dual-source CT scanner (Flash, Siemens) using both single-energy (SE) and DE protocols with the same total CTDIvol. Monoenergetic images were synthesized from DE CT at 130 keV (Mono+, Siemens). SE data were processed using a projection-based method (iMAR, Siemens). For the combined method, the low- and high- energy DE images were processed using iMAR and then Mono+ to generate 130 keV images. Iodine CNR was measured for the spine phantom. CT numbers in 15 regions of interest (ROI) in the water background near the metal (artifact ROIs) and 3 ROIs without metal contamination (reference ROIs) were measured. The mean absolute differences between the artifact and reference ROIs were used as a quantitative measure of artifact severity. Two radiologists ranked the overall image quality for the three MAR methods.

RESULTS

For spine, the original SE, SE iMAR, original DE (50% linear mix of low- and high kV images), DE Mono+, and DE iMAR Mono+ showed median (quartile 1, quartile 3) CT number differences of 34.3 (26.1, 102.7), 24.7 (11.8, 64.0), 72.2 (51.5, 113.9), 10.6 (5.4, 17.6) and 7.9 (6.0, 17.4), respectively. For dental, the corresponding values were 67.1 (28.9, 139.5), 24.8 (18.5, 152.2), 66.2 (33.0, 81.2), 40.0 (28.0, 87.8), and 8.7 (7.1, 27.2). Both radiologists rated DE iMAR Mono+ > DE Mono+ > iMAR for spine. One radiologist rated DE Mono+ the best while the other rated DE iMAR Mono+ the best for dental.

CONCLUSION

DE Mono+ iMAR performed the best for spine metal artifact reduction, while iMAR introduced evident artifacts for dental prosthesis.

CLINICAL RELEVANCE/APPLICATION

The optimal acquisition technique needs to be prescribed for patients with metal implants. This study provided quantitative guidance for this task for patients with spine and dental prosthesis.

SSM16-03 SSFP-DWI of the Ex-vivo Human Brain at 7 Tesla: Technical Feasibility and Potential Applications

Wednesday, Nov. 30 3:20PM - 3:30PM Room: N226

Participants

Agustin Cardenas, MD, Bethesda, MD (*Presenter*) Nothing to Disclose
Joelle E. Sarlls, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Abhik Ray-Chaudhury, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Mary Kay Floeter, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To discuss the technical feasibility and potential applications of the SSFP pulse sequence in ex-vivo 7T MRI scans.

METHOD AND MATERIALS

Tissue preparation Seven ex-vivo cerebral hemispheres were prospectively imaged. Specimens were positioned in a plexiglas imaging container filled with fomblin. Air bubbles were removed with vacuum suction. The holder was placed in a 32 channel birdcage receiver coil. Scanning was done in a 7T MRI (Siemens, Erlangen, Germany). **Anatomical data** A pair of opposite-phased 3D Balanced SSFP sequences (TRUFI) was acquired. Parameters of the acquired images were as follows: TE 3.8 ms, TR 7.6 ms, flip angle of 35 degrees, voxel size: 0.3 x 0.3 x 0.5 mm. An average 3D image was created to decrease susceptibility artifacts. **DWI data** A 3D SSFP-DWI pulse sequence was applied. Image parameters: TE 25 ms, TR 34 ms, flip angle 30 degrees, Voxel size: 1 mm isotropic. DWI data was acquired in 49 directions. **Image processing:** TORTOISE software package was used for processing of the raw diffusion data. Deterministic tractography was performed in DTI studio. **Histology** Samples of the motor cortex, visual cortex, cerebellum and optic radiations were obtained to correlate with the findings shown on SSFP DWI and TRUFI.

RESULTS

Anatomical Several anatomic structures and landmarks that are beyond the resolution of 3T scanners were clearly depicted in our study, such as the dentate nucleus, claustrum, external and extreme capsules, cortical anatomy of the visual cortex or the tail of the caudate nucleus, among others. **DWI** White matter tracts that are poorly depicted or beyond the resolution of DEC maps acquired at 3T, such as the optic tracts or oculomotor nerves (CN III) were clearly visible. Furthermore, we were able to identify a subdivision of the posterior thalamic radiation, which is not possible to detect in 3T scans either, and to correlate this finding with histology.

CONCLUSION

SSFP pulse sequence is a strong tool to evaluate ex-vivo human brains at 7T. It provides excellent resolution and signal to noise ratios. In these types of scans there is no need to use the classic EPI-DWI sequence. This acquisition provides state-of-the-art anatomical images and high quality DTI data.

CLINICAL RELEVANCE/APPLICATION

Our study shows that the state-of-the-art images acquired with SSFP DWI pulse sequence in 7T scans might be a reliable tool to better understand white matter anatomy and to target tissue sampling in ex-vivo human brains.

SSM16-04 Structural, Functional, and Diffusion MRI of the Cervical Spinal Cord at Ultra-High Field

Participants

Alan C. Seifert, PhD, New York, NY (*Presenter*) Nothing to Disclose
Joo-Won Kim, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Junqian Xu, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Despite their critical roles in regulating basic physiological functions and linking the cerebrum to the body, the human spinal cord and brainstem receive disproportionately little attention in neuroimaging. Limited spatial resolution at 3 T remains a critical barrier to advancing neuroimaging of the small but important gray matter (GM) nuclei and white matter (WM) fasciculi in these structures. Ultra-high field (≥ 7 T) MRI, which provides increased signal-to-noise ratio (SNR) and sensitivity to the blood oxygenation level-dependent (BOLD) effect, heralds a new era of MRI research in the spinal cord and brainstem.

METHOD AND MATERIALS

We have evaluated structural, functional, and diffusion MRI performance at 7 T using a custom brainstem and cervical spinal cord radiofrequency coil. A 37-year-old female volunteer was scanned using sagittal T1- (TR = 500 ms, TE = 4.3 ms, $0.9 \times 0.9 \times 3$ mm³), proton density- (TR = 5000 ms, TE = 45 ms, $0.3 \times 0.3 \times 1.5$ mm³), and T2-weighted (TR = 5000 ms, TE = 101 ms, $0.3 \times 0.3 \times 1.5$ mm³) sequences to demonstrate the potential for imaging acceleration and superior-inferior coverage of the brainstem and cervical spinal cord. A 34-year-old male volunteer was also scanned using 2D axial diffusion ($0.58 \times 0.58 \times 5$ mm³, pulse-oximetry gating, TE = 68 ms, 54 diffusion encodings), resting-state and motor task functional ($1.2 \times 1.2 \times 3$ mm³, TR = 2570 ms, TE = 19.8 ms), and high-resolution anatomical ($0.3 \times 0.3 \times 1.5$ mm³, TR = 300 ms, four TEs = 3.3, 14.3, 18.7, and 23.0 ms, combined by root sum-of-squares) sequences in the cervical spinal cord.

RESULTS

Simultaneous coverage of the brainstem and cervical spinal cord is achieved. Anatomical images, fractional anisotropy (FA) and axial diffusivity (AD) maps, and functional temporal signal-to-noise ratio (tSNR) maps show clear gray/white matter contrast in the cervical spinal cord. FA and AD are higher in WM, while tSNR is higher in GM. Motion task fMRI showed activation in C4-5 (lifting arm at shoulder) and C7-8 (finger tapping).

CONCLUSION

Increased SNR, BOLD sensitivity, and coverage of the head and neck enable advanced MRI studies of the cervical spinal cord and brainstem.

CLINICAL RELEVANCE/APPLICATION

Quantification of WM tract integrity and delineation of functional activation in the cervical spinal cord and brainstem enable studies of pain modulation and balance in neurodegenerative diseases.

SSM16-05 Near-Infrared Spectroscopy of the Resting Brain: Using Light for Bedside Functional Brain Imaging

Awards

Student Travel Stipend Award

Participants

Allen Ardestani, MD, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Matthew J. Austin, MD, Buena Park, CA (*Abstract Co-Author*) Nothing to Disclose
Paul Linesch, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Franklin G. Moser, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Resting-state fMRI is emerging as a potentially significant diagnostic and prognostic tool in managing neuropsychiatric illness, though practical and financial constraints imposed by the use of MRI have limited its clinical translation. In addressing those limitations, the purpose of this study is to demonstrate the capability of near-infrared spectroscopy (NIRS) to quantify dynamic resting-state network interactions.

METHOD AND MATERIALS

In twelve healthy adults, neurovascular NIRS signals were recorded from frontal and posterior components of the Default Mode Network (DMN) as well as from the functionally complementary Dorsal Attention Network. Using an array of fiber optic light sources and detectors embedded within an elastic head cap, cortical oxygenation trends were measured during both resting and stimulus conditions and were analyzed for connectivity using a seed-based methodology.

RESULTS

Both the topography and modulation of the RSNs derived using NIRS closely matched those reported in the fMRI literature. Within the DMN, correlations between medial prefrontal cortex and both lateral parietal and posterior cingulate cortices were strongest at rest and were significantly attenuated during presentation of an audio-visual stimulus (Fisher test, $p < 0.001$). Correlations within components of the Dorsal Attention Network changed in an opposite direction (Fisher test, $p < 0.001$). Resting-state activity between these two RSNs were significantly anti-correlated (Fisher test, $p < 0.001$). These interactions recapitulate those that have been established using fMRI.

CONCLUSION

It is technically feasible for NIRS to detect RSN dynamics that have been widely implicated in a variety of clinical entities. While a handful of prior NIRS studies have demonstrated some organized patterns of resting-state activity, the present findings constitute the first successful quantification of functional RSN modulation analogous to that achieved with fMRI.

CLINICAL RELEVANCE/APPLICATION

As an inexpensive bedside technique without radiation or motion restrictions on patients, NIRS could expand functional imaging to

As an inexpensive bedside technique without radiation or motion restrictions on patients, MRIS could expand functional imaging to patient populations in which other modalities would be technically impractical or prohibitively costly.

SSM16-06 Three-Dimensional MR-Myelography: Development of Technique for Visualization and Diagnostic Evaluation Cerebrospinal Fluid Structures of the Head

Wednesday, Nov. 30 3:50PM - 4:00PM Room: N226

Participants

Olga Bogomyakova, Novosibirsk, Russia (*Abstract Co-Author*) Nothing to Disclose
Narine Mesropyan, Novosibirsk, Russia (*Abstract Co-Author*) Nothing to Disclose
Yuliya Stankevich, MD, Novosibirsk, Russia (*Abstract Co-Author*) Nothing to Disclose
Mikhail Amelin, Novosibirsk, Russia (*Abstract Co-Author*) Nothing to Disclose
Andrey Tulupov, MD, PhD, Novosibirsk, Russia (*Presenter*) Nothing to Disclose

PURPOSE

The aim of the study was to develop and optimize the non-invasive three-dimensional magnetic resonance myelography technique for visualization and diagnostic evaluation cerebrospinal fluid structures of the head.

METHOD AND MATERIALS

We used a three-dimensional cholangiopancreatography (3D-MRCP) mode settings modification to obtain a three-dimensional magnetic resonance myelography (3D-MYUR). Parameters of technique: TR = 10000 ms, TE = 1280 ms, FA = 90° matrix - 512x512, slice thickness of 1 mm, the number of sections 120, the number of averages - 1, the duration of the study - 140, slice orientation - frontal with the further reconstruction of the sagittal and axial images.

RESULTS

The resulting highly T2-weighted, high-resolution sequence allows to visualize the quality cerebrospinal fluid structure with a bright signal from the cerebrospinal fluid against a background of fairly good signal suppression of the soft tissue in three dimensions. Application of the method showed good detection of cerebrospinal fluid cysts of various localization, relationship cerebrospinal fluid structures and spaces with the paranasal sinuses in the case of nasal liquorrhea stenosis thin liquor structures (cerebral aqueduct). Methods 3D-MYUR has high sensitivity due to thin slices and high contrast between the fabric and the liquid. In a study of 23 patients with suspected communicating hydrocephalus according to routine MRI applications of this technique revealed subcompensated aqueduct stenosis in 7 patients. In this case, the sensitivity was 85.72%, specificity - 93.75%.

CONCLUSION

Optimized method of three-dimensional myelography can be successfully used for imaging of cerebrospinal fluid structures and assess their permeability, determining the presence of thin membranes, partitions and fistulas.

CLINICAL RELEVANCE/APPLICATION

The use of this technique may provide additional diagnostic information for neurosurgeons to determine the tactics of patients when planning surgical treatment.

Neuroradiology/Head and Neck (Thyroid and Parathyroid)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: N227B



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

FDA Discussions may include off-label uses.

Participants

Reza Forghani, MD, PhD, Cote-saint-Luc, QC (*Moderator*) Consultant, Real Time Medical, Inc; Shareholder, Real Time Medical, Inc; Committee member, Real Time Medical, Inc; Consultant, General Electric Company; ;
David R. De Lone, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SSM17-01 Patients' Pain and Satisfaction after Thyroid Core-needle Biopsy

Wednesday, Nov. 30 3:00PM - 3:10PM Room: N227B

Participants

Jeong Jae Kim, Seongnam-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yeo Koon Kim, Seongnam-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose
Eun Ju Chun, MD, PhD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Il Choi, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The core needle biopsy (CNB) has been proposed as a complementary tool for thyroid nodules with inconclusive cytology by fine-needle aspiration (FNA). The purpose of this study was to compare the patients' pain and satisfaction between the two procedures.

METHOD AND MATERIALS

The patients who had underwent thyroid FNA (n=90, 13 males, age 52.9±13.4) or CNB (n=80, 18 males, age 51.4±11.2) were consecutively included. The degree of pain was surveyed using 0 to 10 scales in both groups at three time points (during procedure, after procedure, and 20 minutes after procedure). The telephone surveys were made after 2 weeks after procedures for the remaining pain and overall satisfaction. The rate of inconclusive diagnosis (insufficient specimen[IS] and atypia of undetermined significance[AUS]) in cytopathology were recorded. Student's t test was used for the comparative analysis.

RESULTS

The pain scores were not significantly different between the two groups (mean scores±standard deviation, FNA vs. CNB; during procedure, 2.88±1.46 vs. 2.54±1.79, after procedure, 1.41±1.54 vs. 1.49±1.79, 20 minutes after procedure, 0.74±0.82 vs. 0.90±1.13, all p>0.05). There was no case of acute complication in both groups. After 2 weeks after procedure, the remaining pain was reported in 6 patients (score 3 and 4) in FNA group, and 4 patients (score 3 and 4) in CNB group. Overall satisfaction scores after 2 weeks were also not different between the two groups (FNA 8.00±1.92, CNB 8.25±1.69, p=0.41). The rate of inconclusive diagnosis were 36.6% in FNA group (15 IS and 18 AUS) and 1.2% in CNB group (no IS, 1 AUS) (p<0.001).

CONCLUSION

CNB showed comparable patients' pain and overall satisfaction to FNA, and significantly lower rates of inconclusive pathologic diagnosis. This finding suggests that CNB may replace the role of FNA as first approach to obtain pathologic diagnosis of thyroid nodules.

CLINICAL RELEVANCE/APPLICATION

Considering the comparable level of patients' pain and satisfaction and lower rate of inconclusive pathologic results of CNB, CNB may have a potential to be the first approach to obtain pathologic diagnosis of thyroid nodules.

SSM17-02 Diagnostic Value of Shear Wave Elastography (SWE) Technique as Non-Invasive Tool in Diagnostic Assessment Between Benign and Malignant Thyroid Nodules

Wednesday, Nov. 30 3:10PM - 3:20PM Room: N227B

Participants

Davide Ippolito, MD, Monza, Italy (*Presenter*) Nothing to Disclose
Maria V. Schiavone, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Cammillo R. Talei Franzesi, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Sara Spiga, PhD, San Gavino Monreale, Italy (*Abstract Co-Author*) Nothing to Disclose
Davide Leni, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Sandro Sironi, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance of shear-wave ultrasound elastography (SWE) in the assessment of thyroid nodules, to differentiate malignant from benign nodules, being the fine-needle aspiration biopsy (FNAB) the standard of reference.

METHOD AND MATERIALS

A total of 161 patients (59.79±13.14 y, 119 females, 42 males), referring to our centre for thyroid nodules evaluation, underwent

ultrasound examination combined with Shear Wave Elastography before US-guided fine-needle aspiration of thyroid nodules. The investigation was performed (TOSHIBA Aplio 500) by using a linear high-resolution 15-4 MHz transducer, Mean SWE elasticity index (EI mean) of nodules was measured and obtained data were expressed in kPa and m/s. Results of SWE examination were compared to cytological analysis or post-surgical histopathology.

RESULTS

A total of 169 nodules from 161 patients were analyzed. Eight nodules (4%) were malignant and 161 (96%) were benign. The obtained data showed a mean value of elasticity index of 29.7kPa in malignant nodules and 30.4 kPa in benign nodules. SWE absolute values were not significantly different between benign and malignant nodules. While the evaluation of the ratio between nodule stiffness and thyroid parenchyma stiffness, in each of the patients, demonstrated that the strain ratio cut-off value of 1.57 offers high values of specificity (100%) and sensitivity (50%) ($P<0.05$), in prediction of malignant thyroid nodules.

CONCLUSION

Our results showed that strain ratio is more specific than conventional elastography score system to differentiate malignant from benign thyroid nodules; while absolute value of quantitative elasticity index measured by shear wave elastography was not significantly different from malignant and benign nodules.

CLINICAL RELEVANCE/APPLICATION

Strain ratio represents a good index in assessment of malignant thyroid nodules; it can be used routinely combined with US examination to increase the diagnostic efficacy in thyroid nodules assessment.

SSM17-03 Management for Small Thyroid Nodules: A Comparative Study Applying Six Guidelines for Thyroid Nodules

Wednesday, Nov. 30 3:20PM - 3:30PM Room: N227B

Participants

Jung Hyun Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kyunghwa Han, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun-Kyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hee Jung Moon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Young Kwak, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate and compare the diagnostic performances of six guidelines for thyroid nodules in predicting the outcomes of small thyroid cancer and in differential diagnosis of small thyroid nodules.

METHOD AND MATERIALS

From March 2007 to February 2010, 4,696 thyroid nodules in 4,585 patients measuring 1-2cm that were diagnosed as benign or malignancy based on surgery or US-FNA were included. US examinations of the thyroid nodules were retrospectively reviewed, and categorized according to the categories of six guidelines for thyroid nodules reported in literature. Medical records of the patients were reviewed for cytopathology results and patient outcome during follow-up. Multivariate regression analysis was used to analyze predictors for distant metastasis and recurrence/persistence in patients with small thyroid cancer. Diagnostic performances of each guideline were calculated and compared.

RESULTS

Of the 4,696 thyroid nodules, 3,652 (77.8%) were benign and 1,044 (22.2%) were malignancy. Eight-hundred seventy-three patients diagnosed as small thyroid cancer were followed, of which 12 had distant metastasis and 66 had recurrences/persistence of disease. Positive findings of the guidelines did not show significant association to distant metastasis or recurrence/persistence of disease (all $P>0.05$). Sensitivity and NPV was highest in TIRADS-Kwak, 98.8% and 98.6%, respectively, while specificity, PPV, and accuracy was highest in Kim criteria, 83.1%, 59.6%, and 84.0%, respectively ($P<0.001$).

CONCLUSION

Positive features of the six guidelines for thyroid nodules were not associated with patient outcomes in small thyroid cancer. With its high specificity and accuracy, the Kim criteria may be an effective guideline to use in management of small thyroid nodules.

CLINICAL RELEVANCE/APPLICATION

Positive features of the six guidelines for thyroid nodules were not associated with patient outcomes in small thyroid cancer. With its high specificity and accuracy, the Kim criteria may be an effective guideline to use in management of small thyroid nodules.

SSM17-04 Role of Core-needle Biopsy as a Gatekeeper in Patients with Initially Detected Thyroid Nodules

Wednesday, Nov. 30 3:30PM - 3:40PM Room: N227B

Awards

Student Travel Stipend Award

Participants

Chong Hyun Suh, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jung Hwan Baek, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We evaluated the diagnostic yield and diagnostic accuracy of CNB and FNA in a large population of patients with initially detected thyroid nodules.

METHOD AND MATERIALS

This observational study was approved by our institutional review board, and all patients provided written informed consent. The

CNB and FNA registry and medical records at our institution were searched for patients who underwent CNB or FNA for initially detected thyroid nodules between January 2013 and December 2013 and had not previously undergone CNB or FNA for these nodules. We compared the non-diagnostic result rate, malignancy rate, complication rate, and diagnostic accuracy. We performed adjustment for significant difference in the baseline characteristics of the patients with the use of propensity score matching and inverse probability weighting. In addition, subgroup analyses were performed according to nodule size ≥ 1 cm.

RESULTS

The CNB group included 2,114 nodules from 1,927 consecutive patients and the FNA group included 2,625 nodules from 2,708 consecutive patients. CNB group were significantly larger in nodule size than FNA group and there were significant difference in nodule composition, margin, echogenicity, and calcification. After matched 1:1 with 1,615 patients, there were no longer any significant difference between the CNB group and the FNA group for any covariate. Non-diagnostic result rate was significantly lower in CNB group (5.2%) than in FNA group (12.1%) ($p < 0.001$). Malignancy rate was significantly higher in CNB group (23.7%) than in FNA group (11.8%) ($p < 0.001$). Complication rate was slightly higher in CNB group (0.33%) than in FNA group (0.074%) ($p = 0.048$). The sensitivity in CNB group (75.9%) was significantly higher than in FNA group (55.6%) ($p < 0.001$), however, the specificities were similar (100%, 99.9%, respectively). Propensity score matching and inverse probability weighting showed unchanged results. Subgroup analyses also showed consistent results.

CONCLUSION

The significantly lower non-diagnostic result rate and higher malignancy rate in CNB group than in FNA group were observed consistently in propensity score analysis and subgroup analysis. CNB seems to be a promising diagnostic tool for patients with initially detected thyroid nodules.

CLINICAL RELEVANCE/APPLICATION

CNB could be a promising diagnostic tool for patients with initially detected thyroid nodules.

SSM17-05 Multiparametric Magnetic Resonance Imaging for Predicting Aggressive Histological Features in Papillary Thyroid Carcinoma

Wednesday, Nov. 30 3:40PM - 3:50PM Room: N227B

Participants

Shudong Hu, MD, PhD, Zhenjiang,, China (*Abstract Co-Author*) Nothing to Disclose

Cheng Tao, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

PURPOSE

The purpose of this study was to evaluate the ability of multiparametric MRI (mpMRI) to predict aggressive histological features in papillary thyroid carcinoma (PTC).

METHOD AND MATERIALS

We evaluated a cohort of 68 patients with pathologically confirmed PTC who underwent mpMRI including T2 weighted imaging (T2WI), diffusion weighted imaging (DWI-MRI), and dynamic contrast material enhanced (DCE-MRI) before thyroidectomy. Tumor aggressiveness was defined by the histopathological phenotype. The T1 and T2 signal intensity ratio (SIR) of each thyroid nodule was calculated by measuring the mean signal intensity divided by that of paraspinal muscle. DCE-MRI parameters (Ktrans and Ve) and apparent diffusion coefficient (ADC) values were calculated. The SIRs, ADCs value, Vp, Ve and volume transfer coefficient (Ktrans) were then compared between PTCs with and without features of tumor aggressiveness. The diagnostic accuracy of the ADCs value and pharmacokinetic parameters were estimated using receiver operating characteristic curve (ROC) between the 2 groups.

RESULTS

The ADCs value ($p < 0.0001$) and Vp ($p < 0.0001$) were significantly lower for PTCs with than PTCs without features of tumor aggressiveness, but no significant difference was found in the T2 SIR ($p = 0.54$) and Ktrans ($p = 0.86$). The cutoff value of ADC to discriminate PTCs with and PTCs without tumor aggressiveness was determined at 1.20×10^{-3} mm²/s with a sensitivity of 86%, specificity of 100%, area under curve (AUC) of 0.85. The Vp cutoff value that provided the best combination of high sensitivity of 86% and specificity of 100% to distinguish between patients with and patients without features of tumor aggressiveness.

CONCLUSION

The ADC value and DCE-MRI parameter Vp before surgery have good potential to assess aggressiveness histological features in PTC.

CLINICAL RELEVANCE/APPLICATION

Multiparametric MR parameters (the ADCs value and Vp) accurately predict the aggressiveness of PTC.

SSM17-06 Diagnostic Performance of SRU and ATA Thyroid Nodule Classification Algorithms as Tested with a 1 Million Virtual Thyroid Nodule Model

Wednesday, Nov. 30 3:50PM - 4:00PM Room: N227B

Awards

Student Travel Stipend Award

Participants

Mitchell W. Boehnke, MD, Aurora, CO (*Presenter*) Nothing to Disclose

Nayana U. Patel, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose

Kristin McKinney, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose

Toshimasa J. Clark, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The Society of Radiologists in Ultrasound (SRU 2005) and American Thyroid Association (ATA 2009 and ATA 2015, respectively)

have published algorithms regarding thyroid nodule management, in particular whether biopsy should be performed. There exist limited data on these algorithms' diagnostic performance. Using a published risk estimation model we tested the performance of these algorithms in differentiating benign and malignant nodules.

METHOD AND MATERIALS

1,000,000 thyroid nodules were modeled in MATLAB. Size, composition, echogenicity, margins, calcifications, and presence of taller-than-wide morphology were modeled after published data. First, malignancy risk was estimated per Kwak's model and assigned as a binary variable: calculated risk of N ($N \in [0,1]$) indicates malignancy if (pseudorandom variable $M \in [0,1]$). Second, all nodules were assessed using SRU 2005, ATA 2009, and ATA 2015 algorithms. With the binary malignancy variable as condition positivity and recommendation for FNA from each algorithms as test positivity, sensitivity, specificity, PPV and NPV were calculated for each algorithm.

RESULTS

1,000,000 thyroid nodules were modeled, mean size 16.6 mm, median 14.6 mm. Nodule characteristics mimic those described by Kwak et al. Risk of nodules' malignancy ranges from 2.0-98% (mean 12.8%, median 6.8%). 12.8% nodules were assigned as malignant. FNA was recommended for 41% of nodules by SRU 2005, 66% of nodules by ATA 2009, and 82% by ATA 2015. Sensitivity and specificity of the algorithms is significantly different ($\chi^2 < 0.0001$): 49% and 60% for SRU; 81% and 36% for ATA 2009; and 95% and 20% for ATA 2015. The figure shows true/false positivity/negativity, positive/negative predictive value, sensitivity, and specificity for each algorithm.

CONCLUSION

SRU 2005, ATA 2009 and ATA 2015 algorithms are used routinely in clinical practice to determine need for thyroid nodule biopsy. We demonstrate significant differences in these algorithms' diagnostic performance. The current iterations of each algorithm result in a compromise between sensitivity or specificity.

CLINICAL RELEVANCE/APPLICATION

Society of Radiologists in Ultrasound and American Thyroid Association nodule management algorithms demonstrate significant differences in diagnostic performance, with all resulting in a compromise between sensitivity or specificity.

SSM18

Neuroradiology (Spine Imaging)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: N229



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

FDA Discussions may include off-label uses.

Participants

Brent D. Griffith, MD, Troy, MI (*Moderator*) Nothing to Disclose
Jeffrey R. Wesolowski, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SSM18-01 T2 Cone Edema and Engorged Filum Terminale Vein are Diagnostic MRI Findings for Diagnosing Lumbar Spinal Dural Arteriovenous Fistulas

Wednesday, Nov. 30 3:00PM - 3:10PM Room: N229

Participants

Jason L. Martin, BS, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Adam A. Dmytriw, MD, MSc, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Timo Krings, MD, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Spinal dural arteriovenous fistulas (SDAVFs) are the most frequent spinal vascular malformation. Magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA) can be used to localize SDAVFs, but digital subtraction angiography (DSA) remains the gold standard. Most operators opt for thoracic spinal angiograms, and if no SDAVF is found, decide whether to examine cervical or lumbar regions next. As more levels are examined, the risk of complications increases and fluoroscopy time increases. The purpose of this study was to determine MRI findings that rule regional SDAVFs (cervical, thoracic, lumbar) in or out, to help guide angiography and minimize fluoroscopy time and endovascular complications.

METHOD AND MATERIALS

MRI, MRA and angiogram records of patients with SDAVFs from 2000-2014 were examined. MRI findings and vertebral levels of involvement were documented, as well as T2 cone edema and T1 contrast-enhanced (T1C+) engorged filum terminale vein (EFTV). Diagnostic parameters for detecting lumbar SDAVFs were calculated using two-by-two tables. Epicenters of findings were calculated by averaging the levels of involvement, and compared using ANOVA and Tukey's test. Other variables were compared using student's t-test or z-test to compare proportions.

RESULTS

Fifty-one SDAVFs were examined, 8 cervical (15.69%), 30 thoracic (58.82%) and 13 lumbar (25.49%). T2 cone edema was 100% sensitive (58.93-100%) and 29.03% specific (14.25-48.04), with a positive likelihood ratio (LR) of 1.41 (1.13-1.76) and perfect negative LR of 0 (incalculable CI). EFTV on T1C+ was 61.54% sensitive (31.64-86.00%) and 97.37% specific (86.14-99.56%), with a positive LR of 23.38 (3.22-169.57) and negative LR of 0.40 (0.20-0.79). EFTV on T2 was 53.85% sensitive (25.22-80.67%) and 100% specific (90.66-100%), with a perfect positive LR (infinity, incalculable CI) and a negative LR of 0.46 (0.26-0.83).

CONCLUSION

The presence of T2 cone edema can be used to rule out lumbar SDAVFs, and the presence of T1C+ or T2 EFTV may be used to rule in lumbar SDAVFs. Planning for spinal angiography accordingly may help reduce procedure time and complications.

CLINICAL RELEVANCE/APPLICATION

MRI and MRA can differentiate lumbar SDAVFs reliably and is recommended in preoperative evaluation, to limit fluoroscopy time, limit endovascular complications and increase the success of embolization.

SSM18-02 The Baseline and Temporal Imaging Features of Spinal Tuberculosis

Wednesday, Nov. 30 3:10PM - 3:20PM Room: N229

Participants

Anant Krishnan, MBBS, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Olivia Francies, MBChB, London, United Kingdom (*Presenter*) Nothing to Disclose
Christen Barras, MBBS, PhD, Parkville, Australia (*Abstract Co-Author*) Nothing to Disclose
Miranda Harvie, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Frances Sanderson, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Amrish Mehta, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To demonstrate the baseline and temporal imaging features of spinal tuberculosis (TB) to assess the utility of MRI in guiding the timescale of treatment.

METHOD AND MATERIALS

This was a retrospective spinal MR study of 97 TB cases, identified from the TB Register and local records of two hospitals, over an 8 year period. Two neuroradiologists assessed the cases in consensus using a standardised scoring system to report the site and

extent of bony involvement, paravertebral soft tissue and intraspinal disease, the presence of cord compression or signal change, and occurrence of kyphosis, malalignment or vertebral collapse. The resolution of imaging abnormalities was assessed relative to treatment duration.

RESULTS

Of the 97 patients, MRI scans were performed within 1 month of the onset of therapy in 69 cases. Follow up imaging data was found for 72 patients. Initial and serial follow up MR imaging was available for 55 patients. At baseline, a single site of disease was involved in nearly 70% of cases, most commonly involving the thoracic spine, followed by lumbar and cervical regions. The vertebral body was involved in over 80%, with significant proportion of cases involving the endplates (71%) and intervertebral discs (56.5%). A kyphotic deformity with or without collapse was present in over 40% of cases. Associated paravertebral soft tissue or abscesses were demonstrated in over 97% of the population, though psoas involvement was only seen in 23% of patients. Intraspinal involvement was common, particularly with extradural disease (82.6%). Spinal cord compression was seen frequently with nearly two thirds of cases resulting in varying degrees of spinal cord compression. Over time, resolution of a number of the abnormalities was observed. While the marrow signal abnormalities, spinal cord compression and intraspinal disease were seen to resolve, there remained persistent abnormalities in intervertebral disc abnormalities and paravertebral tissue at 2 years after treatment. Vertebral fatty marrow conversion, a common treatment related effect, increased linearly over time. Persistent changes included paravertebral tissue, disc and marrow abnormalities, increasing vertebral collapse and spinal cord compression.

CONCLUSION

MR imaging features lag behind clinical response and should not be used to guide treatment times

CLINICAL RELEVANCE/APPLICATION

MRI is useful in diagnosing spinal TB but not determining how long treatment should continue.

SSM18-03 Quantitative Image Analysis of Epidural Metastases on Computed Tomography: A 12-year Retrospective Study

Wednesday, Nov. 30 3:20PM - 3:30PM Room: N229

Participants

Lauren M. Kim, MD, Bethesda, MD (*Presenter*) Nothing to Disclose
Divya Narayanan, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jiamin Liu, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Puskar Pattanayak, MBBS, FRCR, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Evrin B. Turkbey, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Summers, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Royalties, iCAD, Inc; ;

PURPOSE

Metastatic epidural spinal cord compression is defined as a radiologic critical finding because any delay in reporting may result in substantially increased morbidity. Epidural metastases are most commonly characterized on MRI only when symptomatic, however asymptomatic cancer patients are most commonly surveilled on CT. In this study, we characterized the imaging features of 319 epidural metastases on CT over a 12-year period with the greater aim of developing radiologic practices to optimize their visualization, and thereby detection, on CT.

METHOD AND MATERIALS

A RIS search identified patients diagnosed with an epidural metastasis on spine MRI who had also undergone a body CT within 30 days. 3 radiologists independently reviewed these body CTs to determine whether the epidural metastases were plainly visible on CT. A board-certified radiologist then manually segmented the plainly visible epidural lesions, and quantitative image and statistical analysis was performed to determine whether any imaging feature significantly impacted the reporting on CT.

RESULTS

From 2001 to 2013, there were 240 body CTs (127 patients) performed within 30 days of a spine MRI diagnosis of an epidural metastasis. Within these 240 CTs, 319 epidural lesions were deemed plainly visible, but only 129 (40%) had been reported. The only imaging feature which demonstrated a statistically significant correlation with respect to positive reporting was lesion volume (weighted t-test analysis; $p < 0.05$). There was no statistically significant correlation with respect to spine level (thoracic v. lumbar), display slice thickness, number of slices, percent spinal canal stenosis, lesion attenuation, relative contrast (lesion:spinal canal), and contrast-to-noise ratio (lesion:spinal canal). Mean attenuation of all epidural lesions was 94 HU, mean CNR was 1.7, and mean standard deviation of spinal canal attenuation was 40 HU.

CONCLUSION

Epidural metastases commonly go unreported, at a 40% sensitivity, especially when the lesions are small. Our quantitative image analysis shows that the low contrast of epidural lesions makes them inherently difficult to see.

CLINICAL RELEVANCE/APPLICATION

Quantitative image analysis can help inform radiologic practice to improve detection performance. Our study suggests that magnified views of the spine on soft tissue-range window settings may optimize visualization, and thereby detection, of epidural metastases on CT.

SSM18-04 Coronal Oblique Orientation Offers Improved Visualization of Neuroforamina in Cervical Spine Magnetic Resonance Imaging

Wednesday, Nov. 30 3:30PM - 3:40PM Room: N229

Participants

Wolfgang Freund, MD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Stephan Klessinger, Biberach, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank Weber, MD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Gero Hoepner, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose

Reinhard Meier, MD, PhD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Arthur P. Wunderlich, PhD, Ulm, Germany (*Presenter*) Nothing to Disclose

PURPOSE

Angulated projections are standard in conventional radiography of the cervical spine but rarely used in magnetic resonance imaging (MRI). Improved visualization of neuroforaminal pathology is necessary to discern the degree and cause of neuroforaminal stenosis. Preliminary tests of coronal oblique slices had shown promising results in the first imaging centre.

METHOD AND MATERIALS

After a positive decision of our ethics committee, the imaging technique was used in two other imaging centres, and subjects were included prospectively until the planned study cohort of 40 patients and 10 healthy controls was complete. T2-weighted sagittal, coronal oblique and transversal slices were deidentified, generating 150 "cases" consisting of only one spatial orientation. Four readers blinded to the diagnosis individually read the cases. Criteria were site, cause and grading of the neuroforaminal stenosis and the level of confidence, also reading time. We compared the results to the previous preliminary study (intrarater agreement) and computed interrater agreement and t-tests, taking $p < .05$ as statistically significant.

RESULTS

The sensitivity/specificity to detect the relevant neuroforaminal stenosis was .47/.60 for transversal, .57/.90 for sagittal and .55/.70 for coronal oblique scans. The combination of the usual two planes (transversal and sagittal) increased sensitivity to .65 and the addition of the coronal oblique scans further increased it to .68. The readers felt significantly more confident in attributing the cause of pathology on coronal oblique planes. Reading transversal planes was significantly more time consuming than reading other planes.

CONCLUSION

Correct diagnostic workup of neuroforaminal pathology is important preoperatively since the results influence the surgical technique. Coronal oblique planes in cervical spine MRI increase sensitivity and confidence in attributing the cause of neuroforaminal obstruction. They are easy to interpret and demand less reading time than transversal planes.

CLINICAL RELEVANCE/APPLICATION

Coronal oblique images provide additional information, thereby increasing sensitivity for neuroforaminal pathology. Their addition to the MRI workup of cervical spine is recommended.

SSM18-05 Visibility Improvement of the Artery of Adamkiewicz by High-Dose Intravenous CT Angiography: Qualitative and Quantitative Analysis

Wednesday, Nov. 30 3:40PM - 3:50PM Room: N229

Participants

Koji Yamashita, MD, PhD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Akio Hiwatashi, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Osamu Togao, MD, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazufumi Kikuchi, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryotaro Kamei, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Kondo, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Michinobu Nagao, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The detection of the artery of Adamkiewicz (AKA) using intravenous CT angiography (CTA) have been reported to be useful for non-invasive preoperative evaluation. However, there results may often not be sufficient for such patients in clinical practice. Selective spinal angiography is the most reliable method to confirm the anatomic location of AKA, while it is time-consuming and the total dose of contrast agent is often unpredictable. Our purpose was to evaluate the qualitative and quantitative diagnostic ability of the identification of AKA with high-dose intravenous CTA compared with in those with conventional CTA.

METHOD AND MATERIALS

Patients who suspected to have vascular diseases and underwent CTA were included. These patients were divided into higher dose (HD) and normal dose of contrast agent (ND) groups. All CT images were obtained with 256-section multi-detector CT. The scanning parameters were as follows: rotation time 1 s; 128×0.625 -mm collimator; tube voltage 100 kV; 1088 ± 198 mAs. CT value of 400 Hounsfield units (HU) localized in the descending aorta at the level of tracheal bifurcation were used to trigger the acquisition with using bolus tracking technique. Coronal planes were reconstructed with a 1 mm thickness. ROI analysis using a PACS was performed for CT value measurement. ROIs were placed at the bifurcation of intercostal, subcostal or lumbar arteries which gave off AKA (AKAroi), and thoracic or abdominal aorta at the same level (AOroi). The mean CT values of AOroi and AKAroi were compared between HD and ND groups using Mann-Whitney U test. The diagnostic accuracy of AKA was also assessed with an observer test.

RESULTS

The study consisted of 20 HD group (M:F = 14:6, mean age: 51.1 ± 21.2 years), and 10 ND group (M:F = 7:3, mean age: 62.0 ± 18.8 years). Both the CT values of AOroi and AKAroi were significantly higher in HD group (mean AOroi \pm SD = 661 ± 146 HU, mean AKAroi \pm SD = 516 ± 109 HU) in comparison with ND group (mean AOroi \pm SD = 541 ± 115 HU, mean AKAroi \pm SD = 391 ± 145 HU; $p < .05$, respectively). In addition, we found a trend toward improved inter-observer agreement.

CONCLUSION

Our results indicate that CTA in the HD group clearly visualizes AKA with qualitative and quantitative analysis.

CLINICAL RELEVANCE/APPLICATION

High-Dose intravenous CTA provides detail anatomical information less invasively than intra-arterial CTA or selective spinal angiography, and helps implement a subsequent appropriate treatment.

SSM18-06 Identification and Measurement of Cervical Spinal Cord Atrophy in Neuromyelitis Optica Spectrum Disorders (NMOSD) and Correlation with Clinical Characteristics and Cervical Spinal Cord MRI Data

Wednesday, Nov. 30 3:50PM - 4:00PM Room: N229

Participants

Francois LERSY, STRASBOURG, France (*Presenter*) Nothing to Disclose
Vincent Noblet, PhD, Illkirch, France (*Abstract Co-Author*) Nothing to Disclose
Aikaterini Fitsiori, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Louis Dietemann, MD, Entzheim, France (*Abstract Co-Author*) Nothing to Disclose
Jerome De Seze, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Stephane Kremer, MD, PhD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The spinal cord is one of the two main targets of neuromyelitis optica (NMO). Numerous studies have assessed cervical spinal cord atrophy in multiple sclerosis, while only a few studies have focused on NMO. The aim of this study was to highlight cervical spinal cord atrophy in NMO patients as compared to controls and to assess correlations between atrophy and clinical characteristics and cervical spinal cord MRI data.

METHOD AND MATERIALS

This prospective study investigated 15 patients with a diagnosis of NMOSD and 15 healthy controls. The whole cervical spinal cord was explored by MRI with a sagittal T2 3D sequence. The cross-sectional area (CSA) was estimate at every level of cup.This measurement was then averaged on the whole cervical spinal cord, providing a single measurement for every subject, denoted as mean CSA.

RESULTS

Mean CSA was 68.5 mm² in the population of NMO patients and 72.8 mm² in the population of healthy subjects. NMO patients had significantly smaller cervical spinal cord area than healthy controls (Ttest = 0.009). Cervical spinal cord atrophy was associated with clinical signs of medullary involvement (Ttest = 0.0006).There was a tendency toward a relation between cervical spinal cord atrophy and the Expanded Disability Status Scale (EDSS) (Ttest = 0.07). This correlation seems statistically significant (Ttest < 0.05) at the level of the upper cervical spinal cord (C2-C3)

CONCLUSION

This study provides the first evidence of cervical spinal cord atrophy in NMOSD by studying the entire cervical spinal cord. Upper cervical spinal cord atrophy was substantially correlated to clinical disability and seems more involved in the development of clinical disability in NMOSD patients in comparison to the lower cervical spinal cord.

CLINICAL RELEVANCE/APPLICATION

This study provides the first evidence of cervical spinal cord atrophy in NMOSD by studying the entire cervical spinal cord.This measurement is helpful in understanding clinical disability and monitoring disease progression. The knowledge of the extent of cervical spinal cord atrophy improves the understanding of the physiopathology of the disease. Moreover, it seems useful in the case of clinical trial to evaluate the effect of treatments that aim to prevent neuroaxonal loss and irreversible disability.

SSM19

Science Session with Keynote: Pediatrics (Interventional Radiology)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S102AB

IR PD

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

Participants

John M. Racadio, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose
C. Matthew Hawkins, MD, Decatur, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSM19-01 Pediatrics Keynote Speaker: Central Venous Access in Pediatric Patients

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S102AB

Participants

C. Matthew Hawkins, MD, Decatur, GA (*Presenter*) Nothing to Disclose

SSM19-02 Large Single Center Experience of Pediatric PICC and Tunneled Central Lines: Risk Factors for Complications

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S102AB

Awards

Student Travel Stipend Award

Participants

Conrad C. Gibby, MD, Houston, TX (*Presenter*) Nothing to Disclose
Daniel J. Ashton, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Sheena Pimpalwar, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
J. Alberto Hernandez, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Gregory C. Gardner, MD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose
Kamlesh U. Kukreja, MD, Bellaire, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Peripherally inserted central venous catheters (PICCs) and Tunneled Central Venous Catheters (TCVCs) are frequently used in infants and children. Studies to assess infectious, thrombotic, and malfunction complication rates suffer from low sample sizes. The aim of this study is to define the incidence of PICC complications and identify associated patient specific characteristics associated with them in a large, single center hospital system.

METHOD AND MATERIALS

A retrospective surveillance study was conducted at a large children's hospital of the EMR and PACS. 2282 line insertions (age 0-18 years, average 6.5 years) were identified of patients undergoing image-guided PICC or TCVC placement from January 2014 through December 2015. Age of patient, weight, indication for line placement, line days, whether sedation was used, site of access, catheter size and number of lumens were recorded. Complication endpoints were infection, thrombosis, malposition, and line malfunction. Fisher's exact test was used to determine which characteristics were independent factors for complications.

RESULTS

Complication rate total was 16.5%. We stratified by age, 0-1 year (581), 1-3 years (371), 3-8 years (467), and 8-18 years (867). Complication rate increased in 0-1 year compared to 1-3 year ($p=0.006$), 1-3 year compared to >8 years ($p=0.000$), and 3-8 compared to >8 years ($p=0.000$). Catheter diameters included 1.9 Fr single lumen (SL) (8), 2.6 Fr double lumen (DL) (113), 3 Fr SL (1423), 4 Fr DL (551), 5 Fr DL (179), and 6 Fr DL (5), for a total of 1447 SL and 835 DL. A higher complication rate ($p=0.000$) was seen in DL catheters (212/835, 25%) compared to SL catheters (165/1447, 11%). There were also more infections ($p=0.000$) in DL (75/835, 9%) versus SL (36/1447, 2.5%) catheters.

CONCLUSION

Overall complication risk is increased with younger patient age. There is also an overall increase in all complication endpoints with increased lumens, specifically an increased risk for infections. Understanding this can help in decision making to promote patient safety in pediatric populations.

CLINICAL RELEVANCE/APPLICATION

Despite relatively low complication rates of PICC lines in children overall, there are multiple independent patient characteristics to consider when evaluating clinical need for long term vascular access.

SSM19-03 Pediatric Central Venous Catheters In Patients Less Than Two Years Of Age: Do Complication Rates Differ Between Tunneled IJ, Tunneled Femoral, and PICCs?

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S102AB

Participants

Jessica A. Brown, MS, Houston, TX (*Presenter*) Nothing to Disclose
Daniel J. Ashton, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Shireen Hayatgaibi, MA, MPH, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of the study was to evaluate central venous catheters (CVC) in children less than two years of age and determine if the vascular access location affected complication rates when comparing tunneled internal jugular (IJ) vein, tunneled femoral vein, and peripherally inserted central catheters (PICC).

METHOD AND MATERIALS

A total of 798 CVCs were performed by IR during the time frame. A retrospective cohort study was conducted on children less than two years of age who underwent CVC placement by Interventional Radiology (IR) from 01/01/2014 to 12/31/2015. The data was collected from EMR and PACS imaging system, then entered into REDCap database and analyzed with a Fisher's exact test. Information was gathered regarding patient demographics, technical details of the procedure, complications, and follow-up to catheter removal.

RESULTS

198 of the CVCs were placed via IJ with a greater rate of complications, 56(28%), compared to the 322 PICCs with 59(18%) complications ($p=0.006$). 278 CVCs were femoral with 37(13%) complications, which was not statistically difference compared to PICCs ($p=0.118$). Of the complications, infections in the IJs accounted for 16(8.1%), femoral 10(3.6%), and PICCs 17(5.3%), with no statistically significant difference between the groups. 116(58.6%) of the IJs were lumen size 3 French or less, compared to 245(88.1%) for femoral, and 273(85%) for PICCs. 82(41.4%) of IJs were 4 or 5 French, compared to 33(11.9%) femoral, and 48(15%) in PICCs. Oncology patients accounted for 51(25.6%) IJs, compared to 5(1.8%) femoral, and 40(12.5%) in PICCs.

CONCLUSION

In a cohort of pediatric patients less than two years of age, the CVC access site does affect complication rates. IJ CVCs had a greater overall complication rate when compared to PICCs. It is important to note that with an increased complication rate the IJ group also had a greater proportion of 4 and 5 French catheter lumens and Oncology patients, but without a significant difference in infection rates compared to PICCs. As an increasing number of IJs are being performed on this patient population by IR, it is important to understand the increased risk of complications when compared to PICCs.

CLINICAL RELEVANCE/APPLICATION

PICCs demonstrated a lower complication rate compared to tunneled IJ central catheters and are recommended as first-line, when appropriate, for central venous access in children less than two years of age.

SSM19-04 Timing of First Arteriovenous Fistula Cannulation in Children on Hemodialysis

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S102AB

Participants

Susanne Regus, Erlangen, Germany (*Presenter*) Nothing to Disclose

Werner Lang, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Due to reduced complication rates in comparison to central venous (CVC) or peritoneal catheters (PC), nowadays arteriovenous fistulas (AVFs) are the preferred hemodialysis access. Recommendations for the first access cannulation range from 6 to 12 weeks, which could lead to temporary or even permanent preference for CVC while awaiting the maturation of the newly created AVF. The aim of this study was to evaluate the influence of first cannulation of AVFs on primary (PP) and secondary (SP) patency rates in children on hemodialysis.

METHOD AND MATERIALS

This was a retrospective cohort study of 42 pediatric patients (21 endstage renal disease and 21 pre-emptive) with a median age of 14 years (7-17). All of them received an AVF between February 1993 and May 2014. The creation of all AVFs was performed at a single center by exclusively one vascular surgeon with many years of professional experience.

RESULTS

Primary failure was observed in 6 (14.3%) of 42 AVFs (all radiocephalic fistulas) at a mean time of 4.7 days (0-10) after creation. Excluding primary failures, the PP/SP at 1, 3, 6, 12, 18 and 24 month were 100%/100%, 91%/99%, 86%/98%, 76%/95%, 55%/85% and 44%/77%, respectively. There was a significant reduction in PP when first cannulation was performed within the first 30 days after creation compared to the first cannulation later than 30 days ($p = 0.004$). We observed no significant difference in the outcome of PP/SP comparing the first cannulations time dated within the first 45 days after creation to those beyond 45 days ($p = 0.091/0.883$).

CONCLUSION

Prolonged maturing times longer than 45 days seems to have no benefit on patency rates. Given these results CVC placement as bridging HD access while awaiting access usage of the AVF, does not seem necessary and should be avoided.

CLINICAL RELEVANCE/APPLICATION

is there a optimal maturing interval for arteriovenous forearm fistula in children?

SSM19-05 Lock, Stock and Coaxial: Effect of Needle Type on Complication Rates in Percutaneous Ultrasound-Guided Liver Biopsy

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S102AB

Participants

Shireen Hayatgaibi, MA, MPH, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

Daniel J. Ashton, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

Heather Cleveland, BS, Houston, TX (*Presenter*) Nothing to Disclose

Kamlesh U. Kukreja, MD, Bellaire, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To measure the effect of needle type on the rate of complications after percutaneous ultrasound-guided liver biopsy in children.

METHOD AND MATERIALS

Pediatric patients who underwent a non-targeted percutaneous ultrasound-guided liver biopsy were retrospectively identified from the electronic medical record. Relevant demographic, procedure note, post-procedure note and follow-up information were entered into a REDCap database (Vanderbilt, TN). Complications were categorized according to Society of Interventional Radiology (SIR) complication criteria by a pediatric interventional radiologist. Complication rates for the needle type and size were compared using Fisher's exact test in Minitab.

RESULTS

The final study population comprised 755 biopsies who underwent a non-targeted percutaneous ultrasound-guided liver biopsy between 01/01/2013 and 12/31/2015 (age range: 0 – 18 years, mean: 7.9 years). 436 biopsies were performed using a 16 gauge or 18 gauge BioPince needle (Plano, TX). 319 biopsies were performed using a 16 gauge or 18 gauge Quick-Core needle (Bloomington, IN). Overall, 44 complications were detected (5.8% of all biopsies) in 44 patients. 19 (43.2%) complications were categorized as SIR A (minor), 18 complications (40.9%) as SIR B (minor) and 7 complications (15.9%) as SIR C (major). There was no statistically significant difference in complication rates among needle sizes, 16 gauge (5.5%) and 18 gauge (6.3%) groups ($p=0.639$). There were less complications ($p=.004$) according to needle type, 16 complications (3.7%) in the BioPince group and 28 complications (8.8%) in the Quick-Core group. This difference was further evident in the 16 gauge needle size group ($p=0.002$), there were 10 complications with the BioPince 16 gauge (3.2%) and 14 complications with the Quick-Core 16 gauge (11.4%). Median number of samples with BioPince was 2 samples per biopsy and 5 samples per biopsy with Quick-Core. Only one sample, taken with BioPince 16 gauge needle was categorized by pathology as insufficient for diagnostic yield.

CONCLUSION

In a cohort of pediatric patients undergoing percutaneous ultrasound-guided liver biopsy, needle type decreased the rate of complications due to a reduced number of samples taken per biopsy.

CLINICAL RELEVANCE/APPLICATION

Needle type is an important variable that can decrease the number of samples taken per biopsy, lessening complication rates for non-targeted percutaneous ultrasound-guided liver biopsies.

SSM19-06 Use of Alcohol As a Scolicidal and Sclerosing Agent In Percutaneous Treatment of Hydatid Liver Disease In Pediatric Patients: Mid-Long Term Results

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S102AB

Participants

Fatih Oncu, MD, Konya, Turkey (*Presenter*) Nothing to Disclose
Serdar Arslan, MD, Konya, Turkey (*Abstract Co-Author*) Nothing to Disclose
Suleyman Bakd?k, Konya, Turkey (*Abstract Co-Author*) Nothing to Disclose
Ismet Tolu, KONYA, Turkey (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate safety and effectiveness of use of alcohol as a scolical and sclerosant agent and mid-term/long-term results of percutaneous treatment hydatid liver cysts in children

METHOD AND MATERIALS

Fourty-four patients (22 female and 22 male patients; age range, 4-16 years; mean age, 12 years) with 85 liver hydatid cysts underwent percutaneous treatment with albendazole prophylaxis. There were 73 (85.9%) type I, 7 (8.2%) type II and 5 (5.9%) type III lesions according to the Gharbi classification. The cysts were treated with %98 ethanol as the cytotoxic and sclerosing agent by PAIR or catheterization methods under sonographic and fluoroscopic guidance. Follow-up sonography were performed every 3 months in the first year, every 6 months in the second year and in the following years carried out once a year.

RESULTS

The percutaneous procedures were completed with 100% technic success in all patients. Percutaneous treatment of hepatic hydatid disease was successful in 41 patients (93.1%). Two patients were referred for surgical treatment and one patient underwent additional percutaneous treatment. There were no major complications during or after the procedure. Minor complications (hypersensitivity reaction, fever) occurred in two (4.5%) patients. Total hospital stay was between 1 and 3 days. Follow-up period was 6-60 months (mean, 17.3 months).

CONCLUSION

Percutaneous treatment of hydatid liver cysts is an effective, safe and minimal invasive method in children. Furthermore use of alcohol alone as a scolical and sclerosing agent in hydatid liver cyst treatment provides sufficient radiological outcome.

CLINICAL RELEVANCE/APPLICATION

Percutaneous treatment of hydatid liver cysts is the best treatment option versus surgical procedure in children. Because of lower mortality, complication, recurrence rates and short hospital stay.

Physics (Radiation Therapy and Cancer Imaging)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S404CD



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

FDA Discussions may include off-label uses.

Participants

Lei Xing, PhD, Stanford, CA (*Moderator*) Nothing to Disclose
Bulent Aydogan, PhD, CHICAGO, IL (*Moderator*) Nothing to Disclose

Sub-Events

SSM20-01 High Definition Oncological FDG PET CT: Tomorrow's Imaging Using Yesterday's Technology

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S404CD

Participants

Katherine Binzel, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Preethi Subramanian, MS, BEng, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michelle I. Knopp, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

While clinical, time of flight PET imaging is currently typically reconstructed using voxel sizes of 3mm or more and matrix sizes of 200 or less, advances in reconstruction, both hardware and software, facilitate smaller voxel and larger reconstruction matrix sizes. We hypothesized that those high definition approaches developed for next generation digital PET could be utilized and improve conventional PET imaging.

METHOD AND MATERIALS

32 FDG oncologic whole body PET scans acquired on a current generation time of flight PET/CT (Gemini 64 TOF, Philips) with a median dose of 13 mCi and 90s/bed acquisition were newly reconstructed using a High Definition (2x2x2 mm³ voxel size, PSF and Gaussian filter approach) (HD) after performing a re-optimization of reconstruction parameters and compared by blinded individual and intra-individual comparison to the default 4x4x4 voxel recon (SD). Reader quality assessment and ROI analysis for lesion uptake was performed.

RESULTS

Initial HD recon results presented with unacceptable noise levels. After recon optimization using separate data sets and reducing the number of subsets from 33 to 15, noise levels were greatly reduced and used for this study. Image quality, lesion conspicuity, lesion delineation and confidence in diagnosis were all found to be significantly higher (at least $p < .05$) for the HD then SD reconstruction. ROI analysis revealed significantly higher SUV_{max} in smaller or heterogeneous lesions, consistent with improved recovery coefficients found on independent phantom testing. Otherwise, SUV_{max} was unchanged.

CONCLUSION

Higher definition, smaller voxel volume reconstruction appear readily feasible even on older generation time of flight PET systems, however reconstruction parameters need to be optimized. Blinded, intra-individual assessment led to significant improvements in lesion conspicuity, delineation, perceived image quality and diagnostic confidence. High Definition reconstruction can and should be implemented even on current generation time of flight PET systems and appear lead to reduced partial volume effects during reconstruction and thus improved image quality, both visually and quantitative.

CLINICAL RELEVANCE/APPLICATION

Smaller voxel reconstruction appear readily feasible even on older TOF PET systems after appropriate optimization leading to improved image quality, lesion conspicuity and quantitative accuracy.

SSM20-02 Thermoacoustic Range Verification for Proton Therapy - Overlay of Bragg Peak Location onto Ultrasound Image with Perfect Coregistration

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S404CD

Participants

Sarah K. Patch, PhD, Milwaukee, WI (*Presenter*) Nothing to Disclose
Michel Kireeff Covo, PhD, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
Alan Jackson, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
Yazeed Qadadha, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Kerri Campbell, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
Ra Albright, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
P Bloemhard, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
Ap Donoghue, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
CR Siero, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
TL Gimpel, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
SM Small, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
BF Ninemire, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose

Michael Johnson, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
Larry Phair, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The potential of particle therapy due to focused dose deposition in the Bragg peak has not yet been fully realized due to inaccuracies in range verification. The purpose of this work was to correlate the Bragg peak location with target structure, by overlaying thermoacoustic localization of the Bragg peak onto a standard ultrasound image.

METHOD AND MATERIALS

Pulsed delivery of 50 MeV protons was accomplished by a fast chopper installed between the ion source and the inflector of the 88" cyclotron at Lawrence Berkeley National Lab. 2 Gy were delivered in 2 us by a beam with peak current of 2 uA. Thermoacoustic emissions were detected by a cardiac array and Verasonics V1 ultrasound system, which also generated a grayscale ultrasound image. 1024 thermoacoustic pulses were averaged before filtering and one-way beamforming focused signal onto the Bragg peak location with perfect co-registration to the ultrasound images. Data was collected in a room temperature water bath and gelatin phantom with a cavity designed to mimic the intestine, in which gas pockets can displace the Bragg peak. Experiments were performed with the cavity both empty and filled with olive oil.

RESULTS

In the waterbath overlays of the Bragg peak agreed with Monte Carlo simulations to within 1 mm. Agreement within 1.4 mm was achieved in the gelatin phantom, although relative stopping powers were estimated only to first order from CT scans. Thermoacoustic emissions were detected after travel from the Bragg peak through 29 mm and 65 mm of phantom material when the cavity was empty and full of olive oil, respectively.

CONCLUSION

Thermoacoustic range verification is feasible with a commercial clinical ultrasound array, but at doses exceeding the clinical realm. Further optimization of both transducer array and injection line chopper will be required to enable range verification within a 2 Gy dose limit, which could potentially enable online adaptive treatment.

CLINICAL RELEVANCE/APPLICATION

Thermoacoustic range verification has the potential to localize the Bragg peak with millimeter accuracy in tumors that can be imaged with ultrasound during treatment.

SSM20-03 Detecting Respiratory Signal for Image-Guided Radiation Therapy based on 3D Movements of the Diaphragm from Planning 4D MDCT Images

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S404CD

Participants

Jang-Hwan Choi, Daejeon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Yoonseon Song, Daejeon,, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung-Hoon Chae, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Nam Kang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sooyeul Lee, PhD, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

The proposed method was able to accurately detect the respiratory signal from any angle of the CBCT gantry using the structural information-based 2D/3D registration.

Background

Diaphragm motion is shown to be an effective surrogate for tumor motion estimation. However, extracting diaphragm motion is challenging, especially from lateral cone-beam CT (CBCT) projections where various organs overlap. Moreover, for some tumors exhibiting hysteresis, the diaphragm location may be insufficient to track tumor position. Here, we propose a method to effectively identify respiratory rates in all projection directions based on structural information from the diaphragm for planning 4D multi-detector CT (MDCT) and treatment CBCT for image-guided radiation therapy.

Evaluation

In-vivo respiratory gated MDCTs of the whole chest of two lung cancer patients were acquired. To simulate kV CBCT projections in all directions around the patient, digitally rendered radiographs (DRR, i.e. pseudo projection) were computed at every 10% of the respiratory cycle. Diaphragm tracking based on 2D/3D registration was performed as follows: DRRs of volume in 3D regions of interest were generated from MDCT images at every 20% of the respiratory cycle. Structural SIMilarity (SSIM) index was then computed between DRRs and a pseudo projection in pixel areas influenced by diaphragm motion. Finally, respiratory rate was identified based on SSIM rank. Method accuracy was evaluated on a motion-controlled diaphragm phantom with actual kV projections.

Discussion

The method successfully identified the respiratory rate in *in-vivo* (98.8% accuracy) and phantom studies (100% accuracy). The method performed robustly for projections at every 10% of the respiratory cycle using DRRs at every 20%. Treatment projections with finer respiratory cycles should be identifiable as SSIM was sensitive to slight movements of the diaphragm phantom. SSIM between the x-ray and corresponding DRRs was close to 1 in the phantom study. Thus, our DRRs were a good surrogate for an actual projection. After correctly identifying the respiratory rate, we could localize tumors in 3D based on their positions in the corresponding MDCT images with the same or adjacent rates.

SSM20-04 In Vitro Study of Cerenkov Radiation Enhanced External Beam Radiotherapy

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S404CD

Participants

Zi Ouyang, Lowell, MA (*Presenter*) Nothing to Disclose
Michele Moreau, Lowell, MA (*Abstract Co-Author*) Nothing to Disclose
Sayeda Yasmin-Karim, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Wilfred Ngwa, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study investigates the feasibility of exploiting the Čerenkov radiation (CR) present during external beam radiotherapy (EBRT) for significant therapeutic gain, using titanium dioxide (titania) nanoparticles (NPs) as a photosensitizer.

METHOD AND MATERIALS

CR is light emission when charged particles travel faster than the phase velocity of light in a dielectric medium. The hypothesis is that CR existed in EBRT can be used for titania photocatalysis. The products—reactive oxygen species—can inflict increased damage to cancer cells. Furthermore, higher incident radiation energy produces more CR, and hence more cancer cell damage. To test this hypothesis, *in vitro* experiments were performed. 1000 human prostate cancer cells (PC-3) per well were seeded in 48-well plates. Cells were treated with 0 or 1 $\mu\text{g/g}$ titania NPs 18 hours after being seeded. 2 Gy of 6 MV radiation was delivered to the experiment group 8 hours after NP treatment. An MTS assay was done about 72 hours after irradiation. Similar experiment was repeated using 220 kVp radiation.

RESULTS

In the 6 MV experiments, cells treated with NP only or radiation only did not show significant change in viability; cells treated with both 1 $\mu\text{g/g}$ of titania NPs and 2 Gy of radiation had significantly reduced viability—about 75% compared to the control group. Similar results were not observed in the 220 kVp experiments.

CONCLUSION

Using very low concentration of titania NPs in EBRT has the potential to provide therapy enhancement. Lower energy radiation being not able to show the enhancement further confirms the effect is due to the Čerenkov radiation.

CLINICAL RELEVANCE/APPLICATION

By using titania as a photosensitizer, external beam radiotherapy results can be improved at very low costs.

SSM20-05 Quantitative Texture Classification for Differentiating Fat-poor Angiomyolipoma from Renal Cell Carcinoma: Development of Feature Classification in MDCT Images

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S404CD

Participants

Han Sang Lee, MS, Daejeon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Helen Hong, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Dae Chul Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seunghyun Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Junmo Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Our method can be applied to the differentiation of various types of RCC, e.g. clear cell-type, papillary, and oncocytomas, and can be used in early diagnosis of small renal masses.

Background

Differentiating benign fat-poor angiomyolipoma (fp-AML) from malignant renal cell carcinoma (RCC) is an important task for early diagnosis of renal cancer. Since fp-AML has similar intensity distribution and heterogeneity with RCC, classifying them is considered to be a challenging problem. In this research, we propose a texture-based classification method for differentiating fp-AML from clear cell-type RCC in contrast-enhanced CT images.

Evaluation

Our method was tested on a dataset consisting of 30 volumetric renal CT scans from thirty patients from ten with AML without gross fat, and twenty with RCC. CT examinations were performed on MDCT scanners at 100s to 120s delay after contrast injection, to acquire axial plane images with a slice thickness of 1.0-3.0 mm, and a resolution between 0.66 x 0.66 mm to 0.77 x 0.77 mm. For each scan, a region of interest (ROI) for a renal mass was marked by a radiologist. From the tumor ROI of training set, 117 features consisting of 22 with gray-level histogram, 14 with gray-level co-occurrence matrix (GLCM), 22 with gray-level run-length matrix (GLRLM), and 59 local binary patterns (LBP), were extracted. Then, feature selection was performed to select useful features with high separability with the ReliefF method. Throughout the feature selection process, 70 features with 16 gray-level histogram, 7 GLCM, 12 GLRLM, and 35 LBP features were selected. Finally, a support vector machine (SVM) was trained with the training features and labels to classify the unseen test features. In evaluation, 5-fold cross validation was performed and our results were quantitatively evaluated by average accuracy rates, sensitivity, specificity, positive predictive values (PPV), and negative predictive values (NPV) of 84.0%, 55.2%, 98.5%, 95.1%, and 81.5%, respectively.

Discussion

Our feature extraction can provide complementary information for separating fp-AML and RCC in MDCT images. Our feature selection can improve the classification performance by enhancing separability of features. This work was supported by the National Research Foundation of Korea grant funded by the Korean Government (MEST) (NRF-2015R1A2A2A04003460)

SSM20-06 Measurement of Variability in CT Imaging-based Quantification of Tumor Heterogeneity

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S404CD

Participants

Daniele Marin, MD, Durham, NC (*Presenter*) Research support, Siemens AG
Yuese Zheng, MSc, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

Justin B. Solomon, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Jared D. Christensen, MD, Durham, NC (*Abstract Co-Author*) Advisory Board, Riverain Technologies, LLC
Carolyn R. Lowry, BS, 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 characterize the impact of technical sources of variability on CT quantification of tumor heterogeneity.

METHOD AND MATERIALS

A digital library of lung nodules with different texture characteristics was created using the Lung Image Database Consortium (LIDC). A broad spectrum of heterogeneity features was extracted from the lung nodules. A 3D clustered lumpy background (3D-CLB) was used to create synthetic nodules of realistic texture. 24 physical phantoms of lung lesions were fabricated using a multi-material 3D printer (Objet Connex3, Stratasys). Lung nodules varied in their shapes (spherical, lobulated, speculated), textures (homogeneous, heterogeneous), and size characteristics. Lesions were embedded into an anthropomorphic chest phantom (Multipurpose Chest Phantom N1, Kyoto Kagaku) and scanned on one clinically-available CT (Definition Flash, Siemens). CT acquisitions were performed at three radiation dose levels (CTDIvol = 0.67, 1.42, 5.80 mGy). Images were reconstructed at 0.6 and 5.0 mm section thickness using FBP and a range of clinically-applicable iterative reconstruction (IR) algorithms and kernels. Segmentation of quantitative imaging features was performed using a semi-automated lesion segmentation program (Seg3D). Heterogeneity features derived from gray level co-occurrence matrix were measured (energy, contrast, correlation, homogeneity, variance, entropy, and dissimilarity). Precision (coefficient of variance) and accuracy (root mean squared error) of image-based measurements of heterogeneity were measured.

RESULTS

Coefficient of variance of all texture features for all lesions varied significantly across different scanning conditions, ranging from 13% to 77%. High variability was also observed for the root mean squared error, which ranged from 0.03 to 1.8. The root mean squared error was significantly lower for the combination of higher radiation dose, thin section thickness, and high IR strengths. Counterintuitively, variability in measurements of texture features was higher for homogeneous compared to heterogeneous lesions.

CONCLUSION

Variability related to CT imaging acquisition and reconstruction techniques is a clinically important source of bias and variance during quantification of tumor heterogeneity.

CLINICAL RELEVANCE/APPLICATION

Technical sources of variability during quantification of tumor heterogeneity may hamper the clinical utility of these imaging-based measurements for patient management.

Radiation Oncology (Outcomes and Quality of Life)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: S105AB



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

Participants

Edward Y. Kim, MD, Seattle, WA (*Moderator*) Research support, Eisai Co, Ltd; Research support, Novartis AG; Research support, Johnson & Johnson; Research support, Bayer AG; Research support, Threshold Pharmaceuticals, Inc ; Research support, Eli Lilly and Company; Research support, MabVax Therapeutics Inc;
Ralph P. Ermoian, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events**SSM21-01 Identifying Patients who Require Gastrostomy Tube Placement during Definitive Chemo-Radiation for Locally Advance Oropharyngeal Cancer**

Wednesday, Nov. 30 3:00PM - 3:10PM Room: S105AB

Participants

Einsley-Marie Janowski, MD, PhD, Washington, DC (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Malnutrition is a significant treatment-related morbidity for patients with oropharyngeal cancer undergoing definitive chemo-radiation. Therefore, some clinicians recommend prophylactic gastrostomy tube (G-tube) placement prior to radiation. At our institution, we take a more conservative approach, placing G-tubes on an as needed basis. Here, we evaluate patient- and treatment-related factors associated with G-tube placement during chemo-radiation for locally advanced oropharyngeal cancers to aid in early identification of patients that may benefit from prophylactic G-tube placement.

Materials/Methods: From May 2006 to January 2013, patients were treated with definitive chemo-radiation at our institution for locally advanced oropharyngeal cancer. The medical records from these patients were reviewed for demographics, performance status (PS), placement of G-tubes, disease characteristics, treatment regimen, outcomes, and acute and late toxicities. Univariate and multivariate analysis (MVA) using Cox regression analysis was used to identify factors associated with G-tube placement during therapy as well as dysphagia chronically. Predictors of overall survival (OS) and progression free survival (PFS) were also identified. **Results:** Eighty two patients with a median age at diagnosis of 58.1 (range, 41-87) were treated. Seventy four (90%) of the patients were male, and 71 (87%) were Caucasian, with an ECOG PS = 1 in 94% and a Charlson Comorbidity Index (CCI) of =2 in 79% of patients. Ultimately, 19% of patients underwent G-tube placement during treatment. The only patient related factor associated with G-tube placement was lower baseline PS ($p=0.043$). Chronic dysphagia correlated with prior G-tube placement, but did not achieve significance ($p = 0.058$). However, higher pre-treatment CCI ($p=0.002$) and non-cisplatin based chemotherapy ($p=0.002$) were both associated with patient reported chronic dysphagia. With a median follow up of 36 months, the overall survival and progression free survival were $74.6 \pm 3\%$ and $73.9 \pm 3\%$, respectively. On univariate analysis, G-tube placement was associated with a worse mean OS of 58 months versus 79 months ($p=0.004$). G-tube placement was not significant on MVA for OS, but was significant for reduced PFS. **Conclusion:** While G-tube placement was not significantly correlated with chronic dysphagia, it was associated with a reduction in progression free survival, and this may be attributable to toxicity-related treatment interruptions. While the majority of patients can avoid G-tubes, early G-tube placement in patients with poor performance statuses should be considered for this patient population.

SSM21-02 Obesity in Patients Undergoing External Beam Radiation Therapy for Prostate Cancer is Associated with Genitourinary Toxicity

Wednesday, Nov. 30 3:10PM - 3:20PM Room: S105AB

Participants

David Byun, New York, NY (*Presenter*) Nothing to Disclose
Laura Happersett, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Xin Pei, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sean M. McBride, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Marisa A. Kollmeier, MD, Rockville Centre, NY (*Abstract Co-Author*) Nothing to Disclose
Michael J. Zelefsky, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): There is a paucity of information exploring obesity's influence on radiotherapy-related toxicity for localized prostate cancer. The purpose of this study is to evaluate whether obese patients undergoing external beam radiation therapy (EBRT) for treatment of prostate cancer will have an increase in treatment-related toxicity. **Materials/Methods:** Between 1995 and 2009, 3,713 patients were treated with EBRT for prostate cancer using our institution's proprietary treatment planning system. With 3,178 files archived, only 535 electronic files were readily accessible for analysis. Due to concomitant use of brachytherapy, 285 patients were excluded, while the remaining 250 patients met inclusion criteria for analysis. Of the cohort, neoadjuvant hormonal therapy was prescribed in 143 patients. Abdominal adiposity was measured by contouring the waist circumference between the 4th and 5th level of the lumbar spine, which is an established surrogate measure for obesity. For Cox regression analysis, bladder neck was contoured for dosimetric calculation along with collection of relevant comorbidities (i.e. diabetes, smoking status) and treatment outcomes. Treatment-related toxicity was graded based on the Common Terminology Criteria for Adverse Events. **Results:** Mean age was 70.4 years (range 49 - 89) with median follow-up time of 81.0 months and total prescription dose of 86.4 Gy. The mean waist circumference was 102.2 cm with a range of 69.7 - 159.9 cm. Kaplan-Meier analysis showed significant increases in risk for long-term genitourinary (GU) toxicity in waist circumferences over 120 centimeters ($P = 0.04$), while no association was found for gastrointestinal (GI) toxicity ($P = 0.50$). Multivariate analysis of waist circumference as a continuous variable demonstrated that with incremental increase in circumference, there was an increased risk of long-term GU toxicity of grade 2 or higher [hazard ratio (HR) 1.02, $P = 0.05$] as well as an increased GU toxicity associated with neoadjuvant hormonal therapy (HT) (HR 1.03, $P = 0.009$).

In addition, diabetes was associated with a significant increase in urinary toxicity (HR 2.21, P = 0.02), while bladder neck dosimetry analysis did not yield a significant correlation. Analysis of late GI toxicity events did not show a significant association between obesity and GI toxicity, or between obesity and other relevant comorbidity variables. Further, biochemical recurrence and distant metastasis were not associated with abdominal obesity. Conclusion: Obese patients with prostate cancer have an increased risk of long-term genitourinary toxicity following curative radiation therapy to the prostate. Further evaluation of the relationship between obesity and genitourinary toxicity should be conducted.

SSM21-03 Outcomes and Complications of Radiation Therapy in Patients with Familial Adenomatous Polyposis

Wednesday, Nov. 30 3:20PM - 3:30PM Room: S105AB

Awards

Student Travel Stipend Award

Participants

Meng Gan, Salt Lake Cty, UT (*Presenter*) Nothing to Disclose

Shane Lloyd, MD, Salt Lake City, UT (*Abstract Co-Author*) Consultant, Sirtex Medical Ltd

Dustin Boothe, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose

Jonathan Frandsen, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Familial adenomatous polyposis (FAP) is an autosomal dominant condition due to mutations in the APC gene highly associated with colorectal and other cancers. There are no large published series on the effectiveness and complications of radiation therapy (RT) in patients with FAP. Materials/Methods: We queried the Hereditary Gastrointestinal Cancer Registry which tracks patients with familial cancer syndromes enrolled on trials at a referral center for genetics and cancer research. Fourteen patients were identified with FAP who received radiation therapy. Outcomes assessed included treatment toxicity, local recurrence, and secondary malignancies. Common Terminology Criteria for Adverse Events (CTCAE) version 4 was used to grade adverse events. Results: Median age at treatment was 44. Mean length of follow up was 8.4 years after RT. Treated sites included rectal cancer (n=3, median RT dose 45 Gy), intra-abdominal desmoid (n=3, median RT dose 49 Gy), prostate cancer (n=2), breast cancer (n=1), melanoma (n=1), medulloblastoma (n=1), gastric cancer (n=1), and glioma (n=1). Eight patients received concurrent systemic therapy. 2 of 4 patients with desmoid tumors and 1 of 3 patients with rectal cancer recurred locally within 5 years. Overall 35.7% of patients experienced recurrence after RT. Secondary infield tumors occurred in 2 patients: a medulloblastoma was diagnosed in a patient treated for glioma, and a desmoid tumor was diagnosed in a patient treated for rectal cancer. While all 9 patients treated with abdominal or pelvic RT had previously undergone prophylactic colectomies, rates of GI toxicity were acceptable with one patient experiencing grade 2 diarrhea. Overall, 21% experienced CTCAE grade 1, 29% grade 2, and 7% grade 3 toxicity. The most common toxicity was dermatitis, seen in 50% of patients. Conclusion: In this cohort, RT was well tolerated with adverse effects consistent with non-FAP patients. Rates of secondary in-field tumors were increased likely due to prior predilection from FAP itself, although an increased role of radiation cannot be ruled out.

SSM21-05 Prognosis of Patients Who Received Palliative Intent Radiotherapy for Bone Metastases in Recent Years

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S105AB

Participants

Yasushi Hamamoto, MD, Toon-City, Japan (*Presenter*) Nothing to Disclose

Noriko Nishijima, Toon-City, Japan (*Abstract Co-Author*) Nothing to Disclose

Kei Nagasaki, Toon-City, Japan (*Abstract Co-Author*) Nothing to Disclose

Hiroimitsu Kanzaki, Toon-City, Japan (*Abstract Co-Author*) Nothing to Disclose

Toshiharu Manabe, Imabari-City, Japan (*Abstract Co-Author*) Nothing to Disclose

Teruhito Mochizuki, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

With the development of systemic cancer therapy, unignorable proportion of patients who receive palliative intent radiotherapy (PIRT) for bone metastases have become to live longer. To consider individualization of PIRT for recent year patients, reinvestigation of survival time after PIRT is necessary. In this study, we examined prognostic factors after PIRT.

METHOD AND MATERIALS

Between December 2009 and June 2015, 100 patients received the initial PIRT for bone metastases in our institution. Of these, 83 patients (range 50-86 years, median 69 years; male : female = 56:27; performance status (PS) 0-1 : PS 2-4 = 45:38; breast cancer : other cancer = 10:73) were followed up until death (80%) or for more than six months (20%). Clinical records concerning the initial PIRT of these 83 patients were examined. Follow-up time was 0.4 - 36.6 months (median 4.7 months).

RESULTS

The overall survival rates at 2-years from the initial PIRT were 19% for all 83 patients, 17% for lung cancer, 28% for breast cancer, 18% for digestive tract cancer, 0% for liver/biliary tract/pancreas cancer. On univariate analysis, statistically significant factors for survival were gender (p=0.0491) and PS (PS0-1 vs. PS2-4) (p=0.0007). Age (<75 vs. 75<) and primary sites (breast vs. other cancer) were not statistically significant factors (p=0.8032 and p=0.0544, respectively). On multivariate analysis, both gender and PS were statistically significant favorable factors for survival. The overall survival rates at 2-years from the Initial PIRT were 33% for female (12% for male) and 26% for PS0-1 patients (11% for PS2-4 patients).

CONCLUSION

Recently, individualized PIRT seemed to be necessary for bone metastases. Based on our series, female and good PS patients seemed to need PIRT with comparatively high total doses and small fraction size.

CLINICAL RELEVANCE/APPLICATION

Female and good performance status seemed to be favorable prognostic factors for patients who received radiotherapy to bone metastases in recent years.

SSM21-06 Improved Pain Control Following Conformal Palliative Radiotherapy for Painful Bone Metastases

Wednesday, Nov. 30 3:50PM - 4:00PM Room: S105AB

Participants

Kara Romano, MD, Charlottesville, VA (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): High quality care for patients with advanced cancer and bone metastases requires treatment that is effective while avoiding excess health care costs. Palliative radiotherapy (RT) for bone metastases has traditionally been delivered with conventional, non-conformal radiation therapy (NCRT), such as with AP:PA portals. NCRT is simpler and potentially less expensive than the more complex delivery of conformal radiation therapy (CRT), but may lead to more normal tissue irradiated and more acute toxicity. We evaluated short-term outcomes of patients treated with CRT versus NCRT. We hypothesize that CRT decreases acute toxicity compared to NCRT. **Materials/Methods:** We retrospectively evaluated a cohort of patients who received palliative RT (CRT on a TomoTherapy unit or NCRT on a TrueBeam/Trilogy unit) at our institution for axial skeletal bone metastases from 2012 to 2014. Patient and treatment characteristics were obtained including: technical details, concurrent chemotherapy, acute toxicity and subjective pain during treatment and in the acute post-treatment period (defined as = 60 days after completion). Acute toxicity was scored according to CTCAE v4.0 criteria. Statistical analyses were conducted using t-tests, Chi-square tests, and multivariate logistic regression (MVA). **Results:** A total of 179 patients and 267 treatment plans were identified (145 CRT, 122 NCRT). No significant differences were observed between CRT and NCRT groups for: total dose, number of fractions, number of vertebral bodies treated, treatment site, and concurrent chemotherapy. In MVA models, technique (CRT vs NCRT) was not associated with toxicity rates (any, = Grade 2, or = Grade 3 events). Only a higher number of vertebral bodies in the treatment field was significantly associated with a higher rate of acute toxicity post-treatment ($p = 0.015$), and only a higher total dose was significantly associated with a higher rate of acute toxicity during treatment ($p = 0.0141$). CRT was associated with higher rates of improvement of pain during treatment (31% vs. 14%; p) and a non-significant trend toward fewer patients reporting significant worsening of pain after treatment (2.7% vs. 7.4%; $p = 0.08$). **Conclusion:** Our results suggest that CRT is associated with improved pain control, with no difference in acute toxicity, when compared to NCRT for painful bone metastases. These findings suggest a potential role for CRT in bone metastasis management, which must be balanced against cost considerations. Conclusions are limited by retrospective, nonrandomized study design, with multiple potential confounders including differences in concurrent therapy, patient selection for RT technique, and subjective reporting of pain. Larger studies are needed to further evaluate the role of CRT for bone metastases and to explore differences in patient reported outcomes between RT techniques.

Vascular Interventional (MRA)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: E352



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

FDA Discussions may include off-label uses.

Participants

Elizabeth M. Hecht, MD, New York, NY (*Moderator*) Nothing to Disclose
Jeremy D. Collins, MD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

SSM22-01 Accuracy of Non-contrast Quiescent-Interval Single-Shot (QISS) Lower Extremity MR Angiography versus CT Angiography for Diagnosis of Peripheral Artery Disease: Comparison with Digital Subtraction Angiography

Wednesday, Nov. 30 3:00PM - 3:10PM Room: E352

Awards

Student Travel Stipend Award

Participants

Akos Varga-Szemes, MD, PhD, Charleston, SC (*Presenter*) Consultant, Guerbet SA
Julian L. Wichmann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Pal Suranyi, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Muscogiuri, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; Consultant, Guerbet SA; ; ;
Damiano Caruso, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Ricardo Yamada, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Sheldon Litwin, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Christian Tesche, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Moritz H. Albrecht, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Taylor M. Duguay, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Shivraman Giri, PhD, Chicago, IL (*Abstract Co-Author*) Employee, Siemens AG
Rozemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Todoran, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the image quality and diagnostic accuracy of non-contrast quiescent-interval single-shot (QISS) MR angiography (MRA) versus iodine-contrast CT angiography (CTA) in patients with peripheral artery disease (PAD), with invasive digital subtraction angiography (DSA) as the reference standard.

METHOD AND MATERIALS

Thirty patients (66±7 years) with PAD underwent lower extremity CTA with third-generation dual-source dual-energy CT (SOMATOM Force, Siemens AG, Forchheim, Germany) and 1.5T MRA (MAGNETOM Avanto, Siemens AG, Erlangen, Germany) using a prototype non-contrast QISS sequence (FOV 400x260mm², TR/TE 3.5/1.4ms, flip angle 90°, acquisition length 144mm). DSA was performed within <50 days. The abdominal aorta and lower extremity run-off were imaged. Eighteen arterial segments were analyzed. Subjective image quality (5-point Likert scale) and stenosis (≤ or >50%) were evaluated by two observers and compared by Mann-Whitney U-testing. Sensitivity and specificity of MRA and CTA for >50% stenosis detection were calculated using the McNemar-test.

RESULTS

Of 540 segments, 15 (2.8%) and 41 (7.6%) inconclusive segments were excluded from MRA and CTA analysis, respectively (P=0.0006). DSA results were available for 410 of the remaining segments. Vascular intraluminal signal was higher (4.4 vs 4.2, P<0.0001), while image noise was lower (3.9 vs 4.1, P<0.0001) with MRA compared to CTA. The sensitivity and specificity of MRA for >50% stenosis were 84.9% and 97.2%, respectively, not significantly different from the DSA reference standard (P=0.0543), and similar to those of CTA (87.3% and 95.4%, respectively). Inter-observer agreement for stenosis detection was excellent for MRA (κ>0.81) and CTA (κ>0.81).

CONCLUSION

Non-contrast QISS MRA provides high diagnostic accuracy compared to DSA, while being less prone to image artifacts than CTA. QISS better visualizes heavily calcified segments with impaired flow. QISS MRA obviates the need for contrast administration in PAD patients.

CLINICAL RELEVANCE/APPLICATION

QISS MRA provides the non-contrast evaluation of the lower extremity arteries with comparable image quality and accuracy to CTA, and is potentially beneficial for patients with severe renal disease.

SSM22-02 Utility of 4D-Flow Magnetic Resonance Angiography in Assessment of Patients for Uterine Fibroid Embolization

Participants

Christopher D. Malone, MD, San Diego, CA (*Presenter*) Nothing to Disclose
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;
Anne C. Roberts, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Albert Hsiao, MD, PhD, San Diego, CA (*Abstract Co-Author*) Founder, Arterys, Inc Consultant, Arterys, Inc Research Grant, General Electric Company

PURPOSE

To assess the utility of 4D Flow MRA in the assessment of patients with uterine fibroids either before or after uterine fibroid embolization (UFE).

METHOD AND MATERIALS

With HIPAA-compliance and IRB-approval we retrospectively reviewed all pelvic MRIs performed with 4D Flow between September 2015 and March 2016. Four patients without fibroids and 12 patients with fibroids were analyzed; 7 had yet to undergo UFE, 2 underwent UFE after MR, and 3 underwent UFE before MR. All fibroid patients were assessed as either right or left dominant based on multiphase contrast-enhanced MRI. Blood flow (mL/min) within the distal abdominal aorta, bilateral common, external and internal iliac arteries was measured in triplicate using Arterys software. Ratios of ipsilateral internal and external iliac flow (I/E) and the ratio of dominant and nondominant internal iliac flow (I/I) were calculated. Statistical significance was determined using t-tests.

RESULTS

The I/E ratio was markedly increased in patients with uterine fibroids compared to controls, with flow of the internal iliac artery exceeding that of the external in 4 of 12 patients (0.80 ± 0.38 , range 0.24-1.92, vs. 0.47 ± 0.1 , $p=0.001$). I/E ratio was lower in patients who were status post UFE with decrease in fibroid size compared to those pre-procedure (0.57 ± 0.26 vs. 0.87 ± 0.39 , $p=0.05$). Pre-UFE patients whose fibroids showed a definite lateral dominance demonstrated significantly higher I/I ratios compared to control patients (1.86 ± 0.56 vs. 1.14 ± 0.12 , $p=0.02$). In 2 patients who later had UFE, higher amounts of embolic material were used on the dominant side compared to the nondominant.

CONCLUSION

4D Flow MRA can complement routine MRI sequences in assessment of fibroid burden and response to UFE by enabling measurement of total and fractional iliac blood flow. In addition, flow ratios between dominant and nondominant internal iliac arteries may help to anticipate the amount of embolic needed during UFE.

CLINICAL RELEVANCE/APPLICATION

Quantification of total and fractional iliac blood flow may be a promising biomarker to assess fibroid burden before and after UFE.

SSM22-03 Clinical Performance of a Comprehensive Non-contrast MR Angiography Protocol with 4D flow MRI in the Pre-Transplant Evaluation of the Portal and Hepatic Vasculature

Wednesday, Nov. 30 3:20PM - 3:30PM Room: E352

Participants

Jeremy D. Collins, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Eric J. Keller, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Edouard Semaan, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Riad Salem, MD, MBA, Chicago, IL (*Abstract Co-Author*) Research Consultant, BTG International Ltd Research Grant, BTG International Ltd
Maria Carr, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Susanne Schnell, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Michael Markl, PhD, Chicago, IL (*Abstract Co-Author*) Institutional research support, Siemens AG; Consultant, Circle Cardiovascular Imaging Inc;
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

To assess the utility of a non-contrast MR angiography (NCMRA) protocol combined with 4D flow MRI at 3T to quantify portosystemic shunt (PSS) flow, hepatic vascular anatomy, and portal vein (PV) patency in the pre-liver transplant evaluation.

METHOD AND MATERIALS

Prospective assessment of 40 patients (15 women, 52 ± 10 yrs) with cirrhosis and portal hypertension were recruited under an IRB-approved protocol. All subjects underwent MR imaging at 3.0T. The NCMRA protocol was comprised of quiescent interval single shot (QISS) MR venography (MRV) and QISS MRA, native TrueFISP, and 3D short tau inversion recovery (STIR), followed by non-contrast (NC) 4D flow MRI with a tri-directional velocity encoding gradient (VENC) of 50 cm/sec and a flip angle (FA) of 7. Conventional contrast-enhanced MRA (CEMRA) was performed with arterial and venous phases following administration of 0.03 mmol/kg Gadofosveset trisodium. Post-contrast 4D flow MRI was performed with a FA of 15. The visibility of the vasculature was graded by a single blinded observer; the presence of PSS $<$ or ≥ 10 mm and hepatic arterial variants were noted. PV patency and presence of thrombus was noted. The PSS fraction (%) was calculated from 4D flow MRI data by dividing variceal flow by main PV flow. Quantitative data between groups was compared using a paired student's t-test.

RESULTS

The NCMRA protocol enabled assessment of the liver and portal vasculature in 37 subjects (93%). Taken separately, QISS MRV performed the best enabling assessment of the vascular anatomy in 29 (73%) of subjects (Table 1). 26 of 28 (93%) and 18 of 18

(100%) of PSS ≥ 10 mm in size were identified at NCMRA. Variant hepatic arterial anatomy was identified correctly in 10 of 11 subjects (91%), failing in one patient with an irregular breathing pattern. The PV was patent in all subjects; mural PV thrombus was identified at NCMRA in 1 patient. The PSS fraction was higher for NC 4D flow MRI acquisitions ($48 \pm 41\%$ vs $43 \pm 38\%$, $p=0.04$).

CONCLUSION

NCMRA demonstrated excellent performance in the pre-transplant assessment of the PV and hepatic vasculature. The addition of 4D flow MRI enabled quantification of hepatic and portal hemodynamics without contrast.

CLINICAL RELEVANCE/APPLICATION

Non-contrast MR angiography with 4D flow MRI provides a comprehensive assessment of the hepatic vasculature and is useful in determining the extent of shunting through portosystemic collaterals.

SSM22-04 High-Resolution MR Lymphangiography: How To Make Visible the Invisible

Wednesday, Nov. 30 3:30PM - 3:40PM Room: E352

Participants

Francesco Gentili, MD, Siena, Italy (*Presenter*) Nothing to Disclose
Francesco G. Mazzei, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Duccio Guerrieri, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Gloria Bettini, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Susanna Guerrini, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Nevada Cioffi Squitieri, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Gennaro, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Maria A. Mazzei, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Volterrani, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Lymphaticovenous anastomosis (LVA) is a super-microsurgery technique that improves lymphatic drainage in patients with lymphedema. Magnetic Resonance Lymphangiography (MRL) is an innovative diagnostic method, that shows great promise for the evaluation of lymphedema and lymphatic vessels, combining morphological and functional informations in a single examination, although it is sometimes difficult to distinguish lymphatic tissue from nonlymphatic tissue with a high water content. This study illustrates the feasibility of MRL for imaging of lymphatic vessels in patients with lymphedema, its accuracy in distinguishing lymphatic vessels from veins, and its utility for planning LVA treatment.

METHOD AND MATERIALS

The present study includes 16 patients (13 female) with a mean age of 30 years (range 18–70). All the patients underwent MRL, histologically confirmed after super-microsurgery treatment. MRL was performed with a 1.5 T MR unit (Signa Twin Speed Hdx; General Electric Healthcare), after the injection of gadobenate dimeglumine (Gd-BOPTA) with a little dose of lidocaine, and the mixed agent was injected intracutaneously into the dorsal aspect of each extremity in the region of the four interdigital webs. The average time of the examination was about 45min.

RESULTS

All patients completed the examination without any significant complication. A concomitant venous contamination was detected in each patient. Pathological lymphatic vessels were clearly visualised and recognised because of their tortuous and beaded appearance, whereas, the adjacent veins were straight with focal bulging only at the level of venous valve. Moreover the enhancement timing and the maximum enhancement of the two different structures were different ($p < 0.05$): because of the higher flow, the veins washed-out in the later sequences but the lymphatic vessels remained enhanced and this feature was probably due to lymph stasis. The mean diameter of affected lymphatic vessels was similar to the adjacent veins but major than lymphatic vessels in the healthy limb (rarely visualized).

CONCLUSION

Contrast MRL is easy and safe to use and combines extensive informations on the anatomy and functionality of lymphatic vessels and veins in a single process and so may be useful in the therapeutic planning for the super-microsurgery treatment of lymphedema.

CLINICAL RELEVANCE/APPLICATION

MRL may become the gold standard technique for LVA.

SSM22-05 Positive Contrast Enhanced Magnetic Resonance Imaging with New Exceedingly-small Superparamagnetic Iron Oxide Nanoparticles with Renal Clearance

Wednesday, Nov. 30 3:40PM - 3:50PM Room: E352

Participants

Michael G. Kaul, Hamburg, Germany (*Presenter*) Nothing to Disclose
He Wei, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Oliver T. Bruns, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Eric Hansen, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Markus Heine, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Moungi G. Bawendi, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Harald Ittrich, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Superparamagnetic particles have been used as contrast agents mainly for T2 weighted MRI. Because of their larger size in comparison to Gadolinium based contrast agents the particles are not excreted by the kidneys but are metabolized and stored in the liver and spleen. We examined a new kind of SPIO producing a T1 contrast with exceedingly-small hydrodynamic diameter being

able to be excreted renally. We performed first examinations in T1 dynamic contrast enhanced MRI and MRA in a mouse model.

METHOD AND MATERIALS

The particles consist of a ~3 nm maghemite core with a ~2nm hydrophilic zwitterion coating resulting in a size smaller than 5 nm. MRI was performed with a preclinical MRI using a volume resonator after approval of the local animal care committee. Mice were anesthetized. During a 30 minute T1-weighted dynamic 3D gradient echo sequence we injected a dose of 0.2 mmol/kg in the tail vein. Scan parameters were: FOV 51 mm, matrix 256 * 152, 10 slices with 220 μ m thickness TR 6ms, TE 2ms, flip angle 30°, 40 dynamics resulting a temporal resolution of 46 sec and a nearly isotropic spatial resolution of 195 * 195 * 220 μ m³. ImageJ and in-house developed plugins were used to produce dynamic contrast enhanced (DCE)-MRI and MRA and to perform regions of interest based analysis.

RESULTS

A significant signal enhancement in T1-weighted imaging was observed directly after injection in the major vessels (aorta, vena cava and liver vessels) and in tissues of liver and kidneys. DCE-MRI analysis revealed after 5 minutes the bladder started to show a signal enhancement with a continuously filling rate of approx. 3 μ L/min. Blood plasma half time was approx. 20 minutes. Image quality was sufficient to produce excellent MRA.

CONCLUSION

The new class of SPIO can be used for angiographic MRI and potentially for perfusion studies.

CLINICAL RELEVANCE/APPLICATION

This new agent has the potential to replace vascular imaging contrast agents containing Gadolinium. Iron of the conventional SPIO is stored in body. The new class of exceedingly small SPIO shows a renal clearance and therefore a reduced accumulation in body.

SSM22-06 Feasibility of Quiescent Interval Single-Shot (QISS) Non Contrast MRA at 3 Tesla for the Diagnosis of Chronic Lower Limb Arterial Disease

Wednesday, Nov. 30 3:50PM - 4:00PM Room: E352

Participants

Yasser Ragab, MD, PhD, Cairo, Egypt (*Presenter*) Nothing to Disclose

Mahmoud M. Osman, MD, Jeddah, Saudi Arabia (*Abstract Co-Author*) Nothing to Disclose

Ossama A. Ibrahim, BMBCh, FRCR, Jeddah, Saudi Arabia (*Abstract Co-Author*) Nothing to Disclose

Ahmed Elmarakbi, MD, jedda, Saudi Arabia (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the diagnostic performance of ECG-gated non-contrast-enhanced quiescent interval single-shot (QISS) magnetic resonance angiography at a magnetic field strength of 3 Tesla in patients with peripheral arterial occlusive disease (PAOD).

METHOD AND MATERIALS

19 patients with advanced PAOD (Rutherford classification stage 3 and higher) referred for peripheral magnetic resonance angiography (MRA) were included. Imaging was performed on a 3 T whole body MR. Image quality and stenosis diameters were compared to contrast-enhanced MRA (CE-MRA) as standard of reference. Two blinded readers rated the image quality and the degree of stenosis for both ECG gated HR-QISS and CE-MRA in 26 predefined arterial vessel segments on 5-point Likert scales

RESULTS

Compared with CE-MRA, HR-QISS technique showed high sensitivity (93%), specificity (95%), positive (95.1%), and negative predictive value (96%) for the detection of significant ($\geq 50\%$) stenosis. Interreader agreement for stenosis assessment of both HR-QISS and CE-MRA was excellent (κ -values of 0.94 and 0.95, respectively). As compared to CE-MRA, image quality of HR-QISS was significantly lower for the distal aorta, the femoral and iliac arteries (each with $p < 0.01$), while no significant difference was found in the popliteal ($p = 0.07$) and lower leg arteries ($p = 0.9$).

CONCLUSION

Within our study group of symptomatic patients, non-contrast QISS MRA has been shown to be technically comparable to CE MRA. QISS provides good early results for the detection of significant peripheral arterial stenotic disease. Accordingly, QISS MRA may prove valuable in patients with renal dysfunction by avoiding the use of gadolinium-based contrast agents in peripheral MRA

CLINICAL RELEVANCE/APPLICATION

QISS is a new sequence in MRA which has been suggested as a means of avoiding the use of gadolinium-based contrast agents in the assessment of peripheral arterial disease. These contrast agents have been linked to the development of nephrogenic systemic fibrosis in patients with poor renal function

SSM23

Vascular Interventional (Gastrointestinal Interventions)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: E450B



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

FDA Discussions may include off-label uses.

Participants

Hyeon Yu, MD, Chapel Hill, NC (*Moderator*) Nothing to Disclose
Naganathan B. Mani, MD, Chesterfield, MO (*Moderator*) Nothing to Disclose

Sub-Events

SSM23-01 Minimally Invasive Low Voltage Pulsed Electric Fields of the Fundus of the Stomach as a Weight-loss Intervention

Wednesday, Nov. 30 3:00PM - 3:10PM Room: E450B

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 low voltage electric fields can ablate enteroendocrine cells--the cells that make ghrelin as well as other hormones in the fundus of the stomach that could be important in the regulation of body weight.

METHOD AND MATERIALS

16 week old diet-induced obese (DIO) C57BL/6J mice and their aged matched control mice were treated with 60, 90, 120 and 150 volts per mm delivered at 1 hertz for a total of 100 pulses with each pulse lasting 60-80 microseconds. In the treated group, a 10 mm tweezerrode was used to deliver the pulsed electric fields to the glandular part of the stomach. Animals in both groups were subsequently observed daily for weight and food-intake while on high fat diet. At 3 days and at 10 days, the stomach was removed and processed for histology, immunohistochemistry and Western blotting. Sequential five-micron sections were immunostained for ghrelin, myeloperoxidase and smooth muscle actin. Images of these immunostained slides were then analyzed to estimate proportion of ghrelin positive cells and myeloperoxidase positive cells in the treated segments compared to the untreated segments. Additionally, estimated volume of smooth muscle layer in the stomach wall was measured in both treated and untreated segments. Western blots were performed to quantitate ghrelin levels.

RESULTS

Electric field treatment with 120 volts per mm produced the best results in the sections examined. The ablated zone in these mice demonstrated nearly complete absence of ghrelin positive cells when compared to the sham and non-treated segments of the stomach ($P<0.05$); this was consistent with ghrelin Western blotting ($P<0.05$). The ablated zone revealed histologic signs of inflammation, however, there was preservation of the lamina propria and the longitudinal and circumferential smooth muscle cell layers remained intact. While on high-fat diet, the control groups gained 6 ± 2.4 gr, and the treated mice lost -2 ± 1.1 gr ($P<0.05$).

CONCLUSION

In this feasibility study, low voltage electric fields applied to the stomach are safe and can be used to selectively ablate enteroendocrine cells in the fundus of the stomach to cause weight loss.

CLINICAL RELEVANCE/APPLICATION

The obesity epidemic is one of the primary causes of morbidity and mortality. The need for a safe, cost-effective, and minimally invasive intervention is of paramount importance given the massive scope of this epidemic.

SSM23-02 Partially-Covered Stent Placement versus Surgical Gastrojejunostomy for the Palliation of Malignant Gastroduodenal Obstruction Secondary to Pancreatic Cancer

Wednesday, Nov. 30 3:10PM - 3:20PM Room: E450B

Participants

Jiaywei Tsauo, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ho-Young Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kun Yung Kim, MD, Jeonju-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung-Hoon Park, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Jung Jun, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Tae Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the outcomes of partially-covered self-expandable metallic stent (SEMS) placement with surgical gastrojejunostomy (GJ) in patients with gastroduodenal obstruction caused by pancreatic cancer.

METHOD AND MATERIALS

The medical records of 107 patients with gastroduodenal obstruction caused by pancreatic cancer who underwent fluoroscopic partially-covered SEMS placement ($n = 75$) or surgical GJ ($n = 32$) at our institution were reviewed.

RESULTS

The technical (100% vs. 100%; $P > 0.999$) and clinical (98.7% vs. 96.9%; $P = 0.511$) success rates were similar between the SEMS and GJ group. The mean GOOSS score was higher in the SEMS group at 1 week after treatment (2.3 ± 0.5 vs. 1.2 ± 0.4 ; $P < 0.001$) but was similar between the two groups at 1 month (2.7 ± 0.5 vs. 2.8 ± 0.5 ; $P = 0.242$). The median hospital stay was shorter in the SEMS group than in the GJ group (7 days vs. 14 days; $P < 0.001$). The overall complication (22.7% vs. 28.1%; $P = 0.547$) and reintervention (21.3% vs. 25.0%; $P = 0.677$) rates were similar between the two groups. The median patency (99 days vs. 138 days; $P = 0.102$) and survival (106 days vs. 140 days; $P = 0.245$) were also similar between the two groups.

CONCLUSION

The outcomes of partially-covered SEMS placement seem to be more favorable than surgical GJ in patients with gastroduodenal obstruction caused by pancreatic cancer.

CLINICAL RELEVANCE/APPLICATION

Partially-covered SEMS placement has similar technical and clinical success, complication, and reintervention rates compared with surgical GJ. Partially-covered SEMS placement is more advantageous than surgical GJ with regard to the time to restore oral intake and length of hospital stay. Partially-covered SEMS placement has similar patency and survival compared with surgical GJ.

SSM23-03 Radiation-Induced Esophageal Strictures Treated with Fluoroscopic Balloon Dilation: Long-term Clinical Outcomes and Factors Influencing Recurrence in 62 Patients

Wednesday, Nov. 30 3:20PM - 3:30PM Room: E450B

Participants

Kun Yung Kim, MD, Jeonju-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ho-Young Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung-Hoon Park, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Chul Cho, BS, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jiaywei Tsauo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Jung Jun, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Tae Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the long-term outcomes of balloon dilation in patients with radiation-induced esophageal stricture (RIES) and to identify factors associated with its recurrence.

METHOD AND MATERIALS

A retrospective study was performed in a single, tertiary-referral, university hospital in 62 consecutive patients who had undergone fluoroscopic balloon dilation for RIES between December 1998 and December 2015. The outcomes were assessed with reference to the following variables: success rates; complications; procedural details, recurrence, patency; and survival. Univariate and multivariate Cox proportional hazards regression analyses were performed to identify independent predictors of recurrence.

RESULTS

120 balloon dilation sessions were performed in 62 patients (mean, 1.9 sessions per patient; range, 1 to 15 sessions). During the follow-up period (mean, 38.1 months; range, 2.2 to 156 months), clinical success was achieved in 53 (85.5%) patients after single ($n = 37$) or multiple ($n = 16$) dilation sessions. Complications occurred in 26.7% of the dilation sessions with 2 cases requiring invasive treatment. The primary patency rates at 1, 2, 3, and 5 years were 60%, 56%, 52%, and 52%, respectively. Secondary patency rates at 1, 2, 3, and 5 years were 87%, 85%, 85%, and 80%, respectively. Multivariate logistic regression analysis identified an interval from radiation therapy (RT) to stricture of ≥ 6 months (hazard ratio [HR], 0.205; $P < 0.001$), strictures located at the cervical esophagus (HR, 5.846; $P < 0.001$), and stricture length of ≥ 2 cm (HR, 2.923; $P = 0.006$) as significant predictors of recurrence.

CONCLUSION

Balloon dilation is safe and effective for treating RIES, with favorable long-term outcomes. An interval from RT to stricture of ≥ 6 months, strictures located at the cervical esophagus, and stricture length of ≥ 2 cm appear to be associated with recurrence.

CLINICAL RELEVANCE/APPLICATION

Fluoroscopic balloon dilation is valuable as an initial therapeutic option and relatively simple, safe, and easy procedure for patients with RIES.

SSM23-04 Fluoroscopic Removal of Retrievable Self-Expandable Metal Stents in Patients with Malignant Esophageal Strictures: Using Three Different Removal Techniques

Wednesday, Nov. 30 3:30PM - 3:40PM Room: E450B

Participants

Min Tae Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ho-Young Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung-Hoon Park, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Pyeong Hwa Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kun Yung Kim, MD, Jeonju-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jiaywei Tsauo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung-hwan Yoon, SEOUL, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate clinical outcomes of fluoroscopic removal of retrievable self-expandable metal stents (SEMSs) for malignant esophageal strictures, to compare clinical outcomes of three different removal techniques, and to identify predictive factors of successful removal by standard technique (primary technical success).

METHOD AND MATERIALS

137 stents were removed in 128 patients with malignant esophageal strictures. Primary, overall technical success, removal-related complications were evaluated. Logistic regression models were constructed to identify predictive factors of primary technical success.

RESULTS

Primary technical success rate was 78.8% (108/137). Complications occurred in six (4.4%) cases. Stent location in the upper esophagus ($P=0.004$), stricture length over 8 cm ($P=0.030$), and the proximal granulation tissue ($P<0.001$) were negative predictive factors of primary technical success. If the proximal granulation tissue existed, eversion technique was more frequently used ($P=0.002$).

CONCLUSION

Fluoroscopic removal of retrievable SEMs for malignant esophageal strictures using three different removal techniques appeared to be safe and easy. Standard technique is safe and effective in majority of patients. The proximal granulation tissue, stent location in the upper esophagus, and stricture length over 8 cm were negative predictive factors of primary technical success.

CLINICAL RELEVANCE/APPLICATION

Fluoroscopic removal of retrievable SEMs using three different removal techniques is safe and easy in patients with malignant esophageal strictures.

SSM23-05 Efficacy and Safety of A Newly Designed, Externally Full Covered Self-expandable Metallic Stent with Anti-migration Feature for the Treatment of Malignant and Benign Esophageal Strictures

Wednesday, Nov. 30 3:40PM - 3:50PM Room: E450B

Participants

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

PURPOSE

The purpose of this study was to investigate the efficacy and safety of the new self-expandable metallic stent (SEMS) for the treatment of malignant and benign esophageal strictures.

METHOD AND MATERIALS

With approval from our institutional review board, the records of 81 patients who underwent the new externally full covered SEMS placement in esophagus between October 2010 and June 2015 were retrospectively reviewed. The stent has a double step flange at each end to prevent stent migration and has an externally covered membrane to prevent membrane separation. Data were retrospectively reviewed for patient characteristics, technical and clinical success, stent dysfunction, survival, and complications were analyzed.

RESULTS

Technical and clinical success was achieved in all patients (100%). The dysphagia score improved from 3.3 ± 0.6 to 1.1 ± 0.7 after treatment ($P < 0.001$). In malignant strictures, stent dysfunction occurred in 14 patients (20.0%): migration in five (7.1%), tumor overgrowth in eight (11.4%), and food impaction in one (1.4%). In benign strictures, stents dysfunction occurred in 5 patients (45.5%): migration in four (36.4%), tissue granulation in 1 (9.1%). The major complication occurred in 6 patients (8.6%) with malignant strictures and 1 patient (9.1%) with benign strictures, including aspiration pneumonia ($n=4$), tracheoesophageal fistula ($n=2$), intractable vomiting ($n=1$). There was no membrane separation in both groups. The median survival was 135 days in malignant strictures, and was 670 days in benign strictures. Patients within benign group had a longer survival, but had higher stent migration rate than those on malignant group ($P < 0.05$).

CONCLUSION

The new stent was safe and effective for the palliation of malignant esophageal strictures, and resulted in relatively low migration and tumor overgrowth rates compared to those reported previously. Also, it could be a treatment option in refractory benign stricture, but stent migration rate was relatively high.

CLINICAL RELEVANCE/APPLICATION

Double step flange and externally covered membrane design in new stent could contribute solving problems what the current stent has.

SSM23-06 Fluoroscopic Balloon Dilation for the Treatment of Adhesive Small Bowel Obstruction: A 15-Year Single Institution Experience

Wednesday, Nov. 30 3:50PM - 4:00PM Room: E450B

Participants

Jiaywei Tsauo, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ho-Young Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kun Yung Kim, MD, Jeonju-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung-Hoon Park, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Jung Jun, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Tae Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the safety and effectiveness of fluoroscopic balloon dilation (FBD) for the treatment of adhesive small bowel obstruction (ASBO).

METHOD AND MATERIALS

Data of 44 patients (Sex: 26 males and 18 females; mean age: 53.7 ± 13.0 years) treated for ASBO with FBD at our institution

Data of 44 patients (Sex, 20 males and 10 females; mean age, 55.7 ± 15.0 years) treated for ASBO with FBD at our institution between January 2000 and February 2016 were obtained from a prospectively maintained electronic database.

RESULTS

Technical success was achieved in 39 (88.6%) patients. Thirty-five (79.5%) patients had partial obstruction and nine (20.5%) had complete obstruction. The mean length of the stricture was 3.0 ± 1.8 cm. The median procedure time was 32.0 minutes (interquartile range [IQR], 21-47 minutes). Technical failure due to inability to negotiate the guidewire through the stricture occurred in five (13.6%) patients. Clinical success was achieved in 34 (87.2%) patients after one (n = 32) or two (n=2) sessions of FBD. There were no major complications directly related to FSP. The median hospital stay was 11 days (IQR, 4-19 days). The median follow-up period was 1406 days (IQR, 594-2236 days). Recurrence occurred in nine (26.5%) patients in a median time of 47 days (IQR, 20-212 days). Eight (23.5%) patients died of comorbid conditions in a median time of 346 days (IQR, 202-703 days).

CONCLUSION

FBD appears to be safe and effective for the treatment of ASBO. However, recurrence seems to be a major drawback of FBD in ASBO treatment. Future prospective studies are warranted to determine the role of FBD in the management of ASBO.

CLINICAL RELEVANCE/APPLICATION

FBD appears to be safe and effective for the treatment of ASBO. Recurrence seems to be a major drawback of FBD in ASBO treatment. Future prospective studies are warranted to determine the role of FBD in the management of ASBO.

MSCU42

Case-based Review of Ultrasound (An Interactive Session)

Wednesday, Nov. 30 3:30PM - 5:00PM Room: S406A

US

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

Participants

Deborah J. Rubens, MD, Rochester, NY, (Deborah_rubens@urmc.rochester.edu) (*Director*) Nothing to Disclose

Sub-Events

MSCU42A Vascular Ultrasound

Participants

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

Honored Educators

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

Leslie M. Scoutt, MD - 2014 Honored Educator

MSCU42B Pearls and Pitfalls in Interventional US

Participants

Michael D. Beland, MD, Providence, RI (*Presenter*) Consultant, Hitachi, Ltd

LEARNING OBJECTIVES

1) Understand the wide range of applications of ultrasound for interventional guidance. 2) Identify methods to increase the likelihood of a successful procedure using interventional ultrasound. 3) Avoid some of the more common potential pitfalls encountered in interventional ultrasound.

ABSTRACT

Through an interactive case-based format, participants will be exposed to some of the wide range of potential applications of ultrasound for interventional guidance. Techniques will be suggested to increase the likelihood of a successful procedure using interventional ultrasound. Opportunities to avoid some of the more common potential pitfalls encountered in interventional ultrasound will be described.

MSCU42C Abdominal Ultrasound

Participants

Deborah J. Rubens, MD, Rochester, NY, (Deborah_rubens@urmc.rochester.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the technical parameters to optimize to improve ultrasound diagnosis in the abdomen. 2) Identify discrete ultrasound features to discriminate between various pathologic entities. 3) Characterize disease processes in visceral organs and the retroperitoneum.

ABSTRACT

This session will highlight a variety of disease processes in the visceral organs and in the retroperitoneum, using grayscale, color and spectral Doppler ultrasound. Technique and potential pitfalls will be highlighted as they contribute to diagnostic acumen of the sonologist. Cases will include neoplastic, infectious and vascular processes in multiple organs. Differential diagnosis will be stressed with multiple companion case examples.

MSES44

Essentials of Trauma Imaging

Wednesday, Nov. 30 3:30PM - 5:00PM Room: S100AB

ER

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

FDA

Discussions may include off-label uses.

Participants

Sub-Events

MSES44A Imaging of Pediatric Skeletal Trauma

Participants

Rutger A. Nievelein, MD, PhD, Utrecht, Netherlands (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the important hallmarks of normal development of the pediatric skeleton relevant for the radiological evaluation of skeletal trauma. 2) Learn about the key issues in imaging of pediatric skeletal trauma. 3) Discuss the most important differential diagnoses including non-accidental injury.

ABSTRACT

Due to differences in anatomy, biomechanics, and physiology, the presentation of traumatic lesions in children will differ from that in adults. This is reflected in the types of fractures specific to the pediatric age group and its healing propensity. Conventional radiography is still the corner stone of imaging in pediatric skeletal trauma, although US, CT and MRI may be used for specific indications such as complex injuries and suspected involvement of ligaments and/or internal articular structures. This lecture will focus on the important hallmarks of normal skeletal development, the age-specific distribution and types of pediatric fractures, as well as several differential diagnostic considerations (including non-accidental injury). Furthermore, imaging strategies in pediatric skeletal trauma will be discussed.

Active Handout: Rutger A. J. Nievelein

http://abstract.rsna.org/uploads/2016/16000917/MSES44A_HANDOUT.pdf

MSES44B Imaging Male Pelvic Trauma

Participants

Matthew T. Heller, MD, Gibsonia, PA, (hellmt@upmc.edu) (*Presenter*) Author, Reed Elsevier; Consultant, Reed Elsevier

LEARNING OBJECTIVES

1) List the most common injuries of the male pelvis. 2) Select the most appropriate imaging modality and summarize protocol optimization. 3) Describe the key imaging findings of male pelvic trauma and their role in management.

ABSTRACT

Emergency imaging plays a critical role in triage of male pelvic trauma patients. Evaluation of testis rupture and other scrotal injuries are accurately assessed with ultrasound. Characterization of bladder rupture as intraperitoneal versus extraperitoneal is efficiently diagnosed with CT cystography. Suspected urethral injuries are best depicted with retrograde urethrography. MR is useful in the evaluation of penile injuries. Choosing the most appropriate imaging modality and protocol optimization are essential components of prompt diagnosis and initiation of treatment.

MSES44C Blunt Traumatic Aortic Injuries

Participants

Ferco H. Berger, MD, Toronto, ON, (fhberger@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Apply and choose the correct imaging protocol after blunt chest trauma. 2) Detect features indicating injury to the aorta after blunt trauma, including more subtle injuries. 3) Explain the trauma mechanisms and associated injuries. 4) Develop confidence in being a team player in the trauma team.

ABSTRACT

Blunt trauma to the chest can cause injury to the aorta and its major branching arteries. These injuries are still the second most lethal condition in blunt trauma patients, after head injuries, and need urgent detection and treatment. In this presentation, aortic injuries resulting from blunt trauma mechanisms will be discussed. These almost invariably result from high-impact trauma, usually with rapid deceleration forces. Patients sustaining blunt traumatic aortic injury (BTAI) usually have many concomitant injuries, that will distract from scrutinizing the aorta. Advancements in CT protocols, imaging findings, classification systems and practice guidelines dealing with BTAI will be discussed. The goal is to increase confidence in diagnosing BTAI and making recommendations for further treatment, increasing our value in the trauma team.

Active Handout: Ferco H. Berger

http://abstract.rsna.org/uploads/2016/16001403/MSES44C_BTAI_Handout.pdf

MSES44D Interventional Radiology in Trauma Patients

Participants

Brian J. Schiro, MD, Miami, FL, (briansc@baptisthealth.net) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the role of interventional radiology in the evaluation and treatment of trauma patients. 2) Review the embolization methods in treating traumatic injury. 3) Review indications for IVC filters in trauma patients.

ABSTRACT

Interventional radiologists have a crucial role in the evaluation and management of trauma patients. Transcatheter arteriography for the diagnosis of traumatic injury has been supplanted by accurate and expedient advanced cross-sectional imaging. However, continued progress in endovascular and percutaneous therapies have propelled interventional radiology to the forefront of trauma care. This discussion will focus on the vital impact that interventional radiology has on the trauma patient and will review various therapeutic techniques and prophylactic interventions.

Active Handout: Brian Jason Schiro

http://abstract.rsna.org/uploads/2016/16000915/Trauma_in_IR_Handout.pdf

MSSR44

RSNA/ESR Hybrid Imaging Symposium: Hybrid Imaging of the Brain (An Interactive Session)

Wednesday, Nov. 30 3:30PM - 5:00PM Room: S402AB



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



Discussions may include off-label uses.

Participants

Alexander Drzezga, MD, Cologne, Germany (*Moderator*) 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
Katrine Riklund, MD, PhD, Umea, Sweden, (katrine.ahlstrom.riklund@umu.se) (*Moderator*) Nothing to Disclose

Sub-Events

MSSR44A Neurodegenerative Disorders

Participants

Henryk Barthel, Leipzig, Germany, (henryk.barthel@medizin.uni-leipzig.de) (*Presenter*) Consultant, Siemens AG; Consultant, The Piramal Group; Travel support, Siemens AG; Travel support, The Piramal Group; Speaker, Siemens AG; Speaker, The Piramal Group

LEARNING OBJECTIVES

1.) To learn about pathophysiology in neurodegenerative disorders. 2) To learn about different tracers and how to interpret the findings. 3) To understand the role of hybrid imaging in neurodegenerative disorders.

ABSTRACT

MSSR44B Brain Tumors

Participants

Jonathan E. McConathy, MD, PhD, Birmingham, AL (*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) To get an overview of brain tumours and tracers used. 2) To learn how to interpret the examinations. 3) To understand the role of hybrid imaging of brain tumours.

ABSTRACT

MSSR44C Interactive Case Discussion

Participants

Henryk Barthel, Leipzig, Germany, (henryk.barthel@medizin.uni-leipzig.de) (*Presenter*) Consultant, Siemens AG; Consultant, The Piramal Group; Travel support, Siemens AG; Travel support, The Piramal Group; Speaker, Siemens AG; Speaker, The Piramal Group
Jonathan E. McConathy, MD, PhD, Birmingham, AL (*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) To learn about evaluation of hybrid imaging in neurodegenerative disorders. 2) To learn about evaluation of hybrid imaging of brain tumours.

ABSTRACT

MSRT46

ASRT@RSNA 2016: MRI Guidance for Prostate Cancer: A Radiation Therapist Perspective

Wednesday, Nov. 30 3:40PM - 4:40PM Room: N230B



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

 Discussions may include off-label uses.

Participants

Jessy Abed, Toronto, ON, (jessy.abed@hotmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Explain the importance and relevance of an MRI-guided approach to prostate cancer treatment (EBRT, HDR brachytherapy). 2) Explain the rationale for GTV-tumour targeted approach versus whole gland prostate treatment. 3) Discuss the interventional program at Princess Margaret Cancer Centre, including demonstration of the innovative MRI-guided HDR brachytherapy suite.

ABSTRACT

With the evolution of advancements in image-guided technologies, radiation therapy treatment accuracies and efficiencies in delivery continue to improve as well as a reduction in associated toxicities. But despite these improvements, local recurrence of prostate cancer remains prevalent. Localized prostate cancer is not limited to the prostate gland. As such, regions of tumour-density within the prostate can serve as the gross tumour volume (GTV). Adopting a tumour-targeted radiation therapy (RT) approach to treat prostate cancer is one that may improve the therapeutic ratio by decreasing normal tissue toxicities while improving local control. This can be accomplished by adopting magnetic resonance imaging (MRI) as the image-guided modality for external beam radiation therapy (EBRT) and high dose rate (HDR) brachytherapy for prostate cancer. MRI provides excellent soft tissue contrast without exposing the patient to ionizing radiation. It also allows for more specialized delineation of anatomic structures and disease, thereby allowing more accurate visualization of the target volume. Interventional radiotherapy using MRI-guidance can increase target precision while allowing for dose escalation and normal tissue avoidance. Our institution employs MRI for interventional prostate HDR and EBRT treatment. Adopting a tumor-targeted method for prostate cancer is an innovative approach to prostate cancer RT treatment.

Introduction to Computational Fluid Dynamics from Medical Images: A Step by Step Demonstration (Hands on)

Wednesday, Nov. 30 4:30PM - 6:00PM Room: S401AB



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

Participants

Dimitris Mitsouras, PhD, Boston, MA, (dmitsouras@alum.mit.edu) (*Presenter*) Research Grant, Toshiba Corporation;

LEARNING OBJECTIVES

At the end of this course the attendee will be able to: 1) Describe each of the steps involved in performing a computational fluid dynamic (CFD) simulation of blood: a) Segment the blood lumen in a 3D volumetric angiography image dataset (e.g., CT or MRI) starting from DICOM images. b) Produce a finite volume mesh on which to perform the CFD computation starting from the segmented lumen. c) Determine appropriate CFD boundary conditions to set up the problem physics on this mesh. d) Perform the blood flow simulation e) Finally, interrogate the resulting solution for quantities of interest such as pressure, fractional flow reserve (FFR) or endothelial shear stress. 2) Identify the different software components required to perform each of the steps. 3) Use these software components to perform their own computational fluid dynamic analyses in their own field of interest.

ABSTRACT

In this exercise, we will be working with the contrast-enhanced coronary CT angiogram (CTA) of a 48-year-old male patient with hypertension and dyslipidemia who presented with atypical chest pain and that had no personal or family history of CAD. Coronary CTA demonstrated a 59% stenosis of the proximal RCA (AHA segment 1). The patient then underwent elective catheter angiography, which demonstrated a 61% stenosis of the corresponding segment and an FFR measurement of 0.85, indicating no hemodynamic significance of this obstructive ($\geq 50\%$) lesion. We will first use a semi-automated coronary segmentation tool in Mimics (Materialise NV) to segment the right coronary artery and its two terminal branches, the posterior descending artery (PDA) and posterior left ventricular branch (PLV) from the CTA and create a 3D model. We will then export the 3D model in the Standard Tessellation Language, or STereo Lithography (STL) file format. The STL file will then be imported into the CFD software (Fluent, ANSYS Inc) and we will generate a finite volume mesh to fill the lumen defined by this STL. We will finally solve the Navier-Stokes equations in this mesh simulating blood flow at hyperemic conditions in the steady state, and we will interrogate the solution for pressure and CT-FFR after setting the coronary pressure at the ostium to that measured in the patient using a sphygmomanometer at the time of CTA. The training guide for this course can be downloaded from here: [Click to Download PDF automatically](http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/documents/RSNASyllabus-final-online.pdf) or if link doesn't work, copy paste this URL to your web browser: http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/documents/RSNASyllabus-final-online.pdf

Handout: Dimitris Mitsouras

http://abstract.rsna.org/uploads/2016/16005103/RSNASyllabus_final.pdf

RCB45

Tackling Lung Cancer Screening Informatics (Hands-on)

Wednesday, Nov. 30 4:30PM - 6:00PM Room: S401CD



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

Participants

Robert J. French Jr, MD, Burlington, MA, (robert.french@lahey.org) (*Presenter*) Nothing to Disclose
Peter B. Sachs, MD, Aurora, CO, (Peter.Sachs@ucdenver.edu) (*Presenter*) Nothing to Disclose
Shawn M. Regis, PhD, Burlington, MA, (shawn.m.regis@lahey.org) (*Presenter*) Consultant, Medtronic plc

LEARNING OBJECTIVES

1) Understand the clinical and regulatory requirements for an accredited lung cancer screening program. 2) Understand several options for clinical program organization. 3) Understand multiple options for tools available or buildable in the EMR, PACS, work list and Voice Recognition components of radiology workflow to support lung cancer screening. 4) Understand how informatics tools can support data collection and reserach in this rapidly evolving realm.

ABSTRACT

Active Handout:Shawn M. Regis

http://abstract.rsna.org/uploads/2016/16005104/Active_RCB45_Lahey_presentation_v3.pdf

RCC45

Deep Learning & Machine Intelligence in Radiology

Wednesday, Nov. 30 4:30PM - 6:00PM Room: S501ABC

IN

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

Participants

Paul J. Chang, MD, Chicago, IL (*Moderator*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Advisory Board, Bayer AG

Sub-Events

RCC45A An Introduction to Deep Learning & Machine Intelligence: What the Radiologist Needs to Know

Participants

Vlado Menkovski, PhD, Eindhoven, Netherlands, (vlado.menkovski@philips.com) (*Presenter*) Research, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Explain the principles behind learning computer programs from data (Machine Learning). 2) Explaining the use of deep machine learning models (Deep Learning). 3) Describe the application of Deep Learning to medical image analysis and its challenges.

RCC45B Applying Deep Learning to Image Diagnosis

Participants

Igor J. Barani, MD, San Francisco, CA (*Presenter*) Stockholder, Enlitic, Inc; Employee, Enlitic, Inc

SPDL41

RSNA Diagnosis Live™: Neuro and MSK

Wednesday, Nov. 30 4:30PM - 6:00PM Room: E451B



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

Participants

Neety Panu, MD, FRCPC, Thunder Bay, ON (*Presenter*) Nothing to Disclose
Gregory L. Katzman, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Omer A. Awan, 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

SPFB41

Illicit Uses of Radioactive Materials

Wednesday, Nov. 30 4:30PM - 6:00PM Room: E353B



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

Participants

Robert D. Simmons, Chicago, IL (*Presenter*) Nothing to Disclose
E. Frank Moore, Lemont, IL (*Presenter*) Nothing to Disclose
Christine Van Horn, Lemont, IL (*Presenter*) Nothing to Disclose
Joe Adduci, Lemont, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the types of radioactive materials used in patient care that are of concern for theft and how those material may be used for illicit purposes. 2) To gain an understanding of suspicious activities to be aware of in order to protect radioactive material of concern. 3) To understand the reporting process when suspicious activity is observed and how that information is used to assist in the overall investigation process.

ABSTRACT

URL

SPSC41

Controversy Session: Intravenous Contrast Media: Should There Be Any Contraindications to Use?

Wednesday, Nov. 30 4:30PM - 6:00PM Room: S404AB

SQ

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

FDA

Discussions may include off-label uses.

Participants

Matthew S. Davenport, MD, Cincinnati, OH, (matdaven@med.umich.edu) (*Moderator*) Royalties, Wolters Kluwer nv; ;

LEARNING OBJECTIVES

1) To understand the risks of intravenous iodinated contrast media. 2) To understand the risks of intravenous gadolinium-based contrast media. 3) To understand the rationale for current policies on IV media administration.

ABSTRACT

Evolving data suggest that modern intravenous iodinated and gadolinium-based contrast media may confer less risk than originally thought, but the degree of risk remains uncertain and policy-makers are left wondering how to synthesize this new information. In this debate-themed discussion, proponents and opponents for each class of contrast media (i.e., iodinated and gadolinium-based) will attempt to argue whether contrast media risks remain relevant in 2016, or whether they continue to be overstated. Key topics will include: contrast-induced acute kidney injury, nephrogenic systemic fibrosis, allergic-like contrast reactions and premedication, gadolinium deposition in the brain, and fetal gadolinium exposure.

URL

Sub-Events

SPSC41A There Should Be No Contraindications to Giving Intravenous Iodinated Media

Participants

Jeffrey H. Newhouse, MD, New York, NY, (jhn2@columbia.edu) (*Presenter*) Consultant, General Electric Company

LEARNING OBJECTIVES

LEARNING OBJECTIVES 1) To understand the risks of intravenous iodinated contrast media. 2) To understand the risks of intravenous gadolinium-based contrast media. 3) To understand the rationale for current policies on IV media administration.

ABSTRACT

ABSTRACT Evolving data suggest that modern intravenous iodinated and gadolinium-based contrast media may confer less risk than originally thought, but the degree of risk remains uncertain and policy-makers are left wondering how to synthesize this new information. In this debate-themed discussion, proponents and opponents for each class of contrast media (i.e., iodinated and gadolinium-based) will attempt to argue whether contrast media risks remain relevant in 2016, or whether they continue to be overstated. Key topics will include: contrast-induced acute kidney injury, nephrogenic systemic fibrosis, allergic-like contrast reactions and premedication, gadolinium deposition in the brain, and fetal gadolinium exposure.

URL

SPSC41B There Should Be Contraindications to Giving Intravenous Media

Participants

Richard H. Cohan, MD, Ann Arbor, MI, (rcohan@med.umich.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review some of the instances in which there are relative contraindications to contrast material administration.

ABSTRACT

Iodinated and gadolinium based contrast material are well-tolerated by the vast majority of patients to whom they are administered; however, current literature still suggests that there are some instances in which contrast material should be used with great care, if at all. This includes patients who have had prior moderate or severe allergic-like reactions to contrast material and patients with severely compromised renal function and whose renal function is still counted upon to contribute to the patient's overall health.

URL

SPSC41C Panel Discussion

Participants

SPSC41D There Should Be No Contraindications to Giving Intravenous Gadolinium-based Media

Participants

Donald G. Mitchell, MD, Philadelphia, PA, (donald.mitchell@jefferson.edu) (*Presenter*) Consultant, CMC Contrast AB

LEARNING OBJECTIVES

1) To understand the theoretical safety concerns for use of intravenous gadolinium-based contrast media. 2) To properly utilize risk/benefit thought processes to determine the likely risk of clinical use of intravenous gadolinium-based contrast media. 3) To assess the existing data regarding the differences between currently available intravenous gadolinium-based contrast media, with regard to stability, safety, and incidence of nephrogenic systemic fibrosis. 4) To appreciate the importance of single and cumulative dose of intravenous gadolinium-based contrast media for assessing the relative risk to a given patient.

ABSTRACT

URL

SPSC41E There Should Be Contraindications to Giving Intravenous Gadolinium-based Media

Participants

Robert J. McDonald, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

SPSC41F Panel Discussion

Participants

SPSC42

Controversy Session: Emergency Imaging: Is Pain in the Chest a Pain in the Neck?

Wednesday, Nov. 30 4:30PM - 6:00PM Room: E450B



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

Participants

Charles S. White, MD, Baltimore, MD, (cwhite@umm.edu) (*Moderator*) Consultant, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Review the clinical challenges related to diagnosing the cause of acute chest pain in the ED. 2) Describe the role of current imaging techniques in evaluating patients who present with acute chest pain. 3) Discuss the feasibility, advantages, and challenges related to use of coronary CTA to evaluate ED chest pain. 4) Review the advantages and disadvantages of using a triple rule-out vs dedicated coronary CTA protocol to assess acute chest pain.

ABSTRACT

URL

Sub-Events

SPSC42A Traditional Strategies Are Still Valuable for Evaluating Acute Coronary Syndromes (ACS)

Participants

Vasken Dilsizian, MD, Baltimore, MD (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG

LEARNING OBJECTIVES

View learning objectives under the main course title.

SPSC42B Coronary CT Angiography (CCTA) Improves Over Traditional Strategies for ACS

Participants

Ricardo C. Cury, MD, Miami, FL, (rcury@baptisthealth.net) (*Presenter*) Research Grant, General Electric Company; Research Consultant, General Electric Company

LEARNING OBJECTIVES

1) Effectively utilize coronary computed tomography angiography (CTA) to properly diagnose, detect and evaluate emergency department patients with acute chest pain or other symptoms suggestive of coronary artery syndrome. 2) Explain the relationship between coronary CTA findings and the clinical outcome of patients with acute chest pain. 3) Utilize the appropriate noninvasive studies to assess risk of acute coronary syndrome.

ABSTRACT

Coronary computed tomography angiography (CCTA) is a rapid and accurate technique to exclude the presence of CAD. Furthermore, the immediate and future likelihood of cardiac events in patients with no or minimal CAD is extremely low for patients with acute chest pain. In light of these favorable test characteristics, several single-center and more recently, multicenter studies have demonstrated the feasibility, safety, and accuracy of CCTA in the ED to assess chest pain patients.

URL

SPSC42C Which is Better: Triple Rule-out or Standard CCTA?

Participants

Charles S. White, MD, Baltimore, MD, (cwhite@umm.edu) (*Presenter*) Consultant, Koninklijke Philips NV

LEARNING OBJECTIVES

View learning objectives under the main course title.

SPSC43

Controversy Session: Pelvic Imaging in the Emergency Department: Ultrasound, CT or MRI?

Wednesday, Nov. 30 4:30PM - 6:00PM Room: S404CD

GU **OB** **CT** **MR** **US** **ER**

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

Participants

Douglas S. Katz, MD, Mineola, NY, (dkatz@winthrop.org) (*Moderator*) Nothing to Disclose
Mariam Moshiri, MD, Seattle, WA, (moshiri@uw.edu) (*Moderator*) Consultant, Reed Elsevier; Author, Reed Elsevier;

LEARNING OBJECTIVES

1) To overview the current role of ultrasound, CT, and MR in the imaging of non-pregnant and pregnant women with known or suspected acute pelvic conditions, with an emphasis on evidence-based information and societal guidelines, to discuss the advantages and disadvantages of ultrasound, CT, and MR for imaging the acute female pelvis in several common/relatively common scenarios to overview specific protocols for performing effective and accurate ultrasound, CT, and MR imaging examinations of the acute female pelvis, to discuss current controversies regarding the roles of ultrasound, CT, and MR in the imaging of the acute female pelvis.

ABSTRACT

URL

Sub-Events

SPSC43A **US**

Participants

Sheila Sheth, MD, Cockeysville, MD, (ssheth@jhmi.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

ABSTRACT

URL

SPSC43B **CT**

Participants

Ana P. Lourenco, MD, Providence, RI, (alourenco@lifespan.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review radiation dose associated with current pelvic CT imaging. 2) To describe available strategies for minimizing radiation dose. 3) To identify CT imaging findings in a variety of diagnoses in both pregnant and non-pregnant patients presenting with acute pelvic pain.

ABSTRACT

In this session, we will review CT radiation dose, associated risks, and strategies to minimize patient dose. Cases will be shown to highlight the diagnostic accuracy of CT in the ED as well as to illustrate how protocols may be optimized depending upon the leading differential diagnosis.

URL

SPSC43C **MRI**

Participants

Christine O. Menias, MD, Chicago, IL, (menias.christine@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the Role of MRI in acute Pelvic conditions in the Pregnant and Nonpregnant Patient in Case-Based format. 2) Discuss the role of MRI in evaluating indeterminate lesions at US and CT in acute GYN conditions.

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/>

Christine O. Menias, MD - 2013 Honored Educator
Christine O. Menias, MD - 2014 Honored Educator

Christine O. Menias, MD - 2015 Honored Educator
Christine O. Menias, MD - 2016 Honored Educator

SPSC44

Controversy Session: Screening Mammography: Ending the Confusion

Wednesday, Nov. 30 4:30PM - 6:00PM Room: E451A

BR

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

Participants

Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (*Moderator*) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES

1) Understand the pros & cons between the different screening guidelines. 2) Discuss the importance of patient informed decision of the facts. 3) Be able to explain the different types of supplemental screening and when to use them appropriately.

ABSTRACT

URL

Sub-Events

SPSC44A Screening Mammography Guidelines

Participants

Debra L. Monticciolo, MD, Temple, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the basic data on breast cancer screening with mammography. 2) To review the basis for the current screening recommendations. 3) To understand the pros and cons of recommendations from different sources.

ABSTRACT

URL

SPSC44B Personalized Screening

Participants

Wendie A. Berg, MD, PhD, Pittsburgh, PA, (wendieberg@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify populations in which mammography screening has been less effective. 2) Describe indications for supplemental screening with MRI. 3) Discuss use of screening ultrasound and tomosynthesis in women with dense breasts.

URL

www.DenseBreast-info.org/Technology.aspx

SPSC44C Ask the Experts

Participants

Debra L. Monticciolo, MD, Temple, TX (*Presenter*) Nothing to Disclose

Wendie A. Berg, MD, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (*Presenter*) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES

View learning objectives under the main course title.

ABSTRACT

URL

Controversy Session: Head and Neck Controversies 'Tapas': Small Bites of Hot Topics in Head and Neck Imaging

Wednesday, Nov. 30 4:30PM - 6:00PM Room: E352



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

Participants

C. Douglas Phillips, MD, New York, NY (*Moderator*) Stockholder, MedSolutions, Inc Consultant, Guerbet SA
Deborah R. Shatzkes, MD, New York, NY, (shatzkes@hotmail.com) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the goals of imaging in the work-up of primary hyperparathyroidism, and the pros and cons of the available modalities. 2) To appreciate both the contributions and limitations of the radiologist in staging head and neck cancer. 3) To assess suitability of ultrasound as an imaging modality in various sites of the head and neck.

Sub-Events

SPSC45A What Should Be the Initial Imaging Modality in the Work-up of Primary Hyperparathyroidism?: 4D CT

Participants

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

LEARNING OBJECTIVES

1) Review the rationale for precisely localizing parathyroid lesions prior to surgery. 2) Describe the imaging findings of parathyroid adenoma on 4D-CT. 3) Describe the advantages of 4D-CT.

ABSTRACT

Preoperative parathyroid imaging in patients with primary hyperparathyroidism is routine, and for many years ultrasound and scintigraphy has been a common combination. However in recent years, there have been notable changes in surgery and imaging. In the early 2000s, the direction of surgery changed from four-gland cervical exploration to focused surgery. Focused surgery involves resecting a single parathyroid adenoma through a small unilateral incision on one side of the neck in one quadrant and requires precise imaging localization for operative planning. 4D-CT, which is a CT of the neck and upper chest with at least two contrast phases. 4D-CT was first reported in the surgical literature in 2006 and offers several advantages, including shorter scan time, detailed anatomical localization, and improved ability to detect multiglandular disease. Multiple studies show 4D-CT to be more sensitive than scintigraphy and ultrasound for preoperative localization. It is also possible to grade degree of confidence on 4D-CT.

SPSC45B What Should Be the Initial Imaging Modality in the Work-up of Primary Hyperparathyroidism?: Technetium-99m Sestamibi

Participants

Bennett S. Greenspan, MD, MS, Augusta, GA, (bengreenspan0708@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Attendees will be able to define the high degree of sensitivity and specificity and localizing ability that can be achieved with Tc-99m Sestamibi, particularly utilizing SPECT/CT. 2) Attendees will be able to explain why Tc-99m Sestamibi SPECT/CT is valuable in detecting and localizing ectopic parathyroid adenomas. 3) At the conclusion of the presentation, attendees will be able to explain why functional imaging with Tc-99m Sestamibi is the standard of practice for localizing parathyroid adenomas prior to surgery, especially in recurrent or residual disease.

ABSTRACT

Primary hyperparathyroidism is often discovered by routine screening that identifies the presence of hypercalcemia, and parathyroid immunoassay can identify elevated parathyroid hormone. The only curative treatment is surgery. Preoperative parathyroid scintigraphy, including with SPECT/CT, can assist in planning surgical strategy, to determine limited exploration vs. bilateral surgery, and identification of ectopic parathyroid glands. Ectopic glands, which occur approx. 5-15% of the time, can be seen in the mediastinum, occasionally below the level of the thymus. Technetium-99m Sestamibi is an excellent technique to detect and localize enlarged parathyroid glands. For parathyroid adenomas, sensitivity, accuracy and positive predictive value can be as high as 96%, 96% and 100%. For hyperplasia 86%, 86% and 100%. Localizing adenomas or hyperplasia to the correct side and upper or lower pole or ectopia, especially with SPECT/CT, can reduce surgical time. Imaging is particularly helpful in residual or recurrent disease, where previous surgery has produced altered anatomy. Tc-99m Sestamibi with SPECT/CT is the standard of practice, and provides high sensitivity, specificity, accuracy and localization.

SPSC45C When Interpreting Cancer Staging Imaging Studies, Should the Radiologist Put a Stage in Their Report?: Yes

Participants

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

LEARNING OBJECTIVES

1) To understand *my* opinion on the role of the radiologist in formal staging of head and neck cancer.

ABSTRACT

This presentation is entirely subjective, but everyone is entitled to *my* opinion. The radiologist has a critical role in head and neck cancer staging **when upstaging features are detected at imaging**. The clinician may not know about the nodal metastasis (clinically N0), an occult primary malignancy (clinically T0), or the perineural spread, bone destruction, or other relevant finding that indicates a higher stage tumor than is known clinically. In such circumstances, I feel strongly that it is the role of the diagnostic imaging oncologist (what I see in the mirror), to convey that formally within our report because accurate staging is critical to prognosis, staging, and assignment to treatment protocols. I routinely do this in my busy head and neck oncology practice, and have never once received negative feedback. On the other hand, I try to avoid understaging by tumor measurement, acknowledging that a mucosal lesion may be larger on clinical exam than I can see radiographically.

URL

SPSC45D **When Interpreting Cancer Staging Imaging Studies, Should the Radiologist Put a Stage in Their Report?: No**

Participants

Barton F. Branstetter IV, MD, Pittsburgh, PA, (bfb1@pitt.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the advantages and limitations of including a radiologic stage when interpreting staging examinations for head and neck squamous cell carcinoma.

ABSTRACT

Radiologists must have a comprehensive understanding of how head and neck squamous cell carcinoma is staged. That's the only way to ensure that our reports include all of the radiologic elements that contribute to staging. But there are also critical features of these cancers that might be unavailable to us when we are reading out, possibly because of incomplete documentation, or possibly because the information hasn't been gathered yet. A radiologic stage that is rendered without all the clinical data might be misleading, and could get propagated on later documents, leading to improper care. A multidisciplinary tumor board is the optimal place for consensus staging of head and neck tumors.

SPSC45E **Is Ultrasound Under-Utilized in Head and Neck Imaging?: Yes**

Participants

Kim Learned, MD, Philadelphia, PA, (kim.learned@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1. Utilization of Advanced Imaging Trend: Ultrasound, CT, MR, PET/CT. 2. Evaluation of neck mass: ACR appropriateness criteria & Clinical practice guideline in part account for under-utilization of Ultrasound compared to CT and MR in evaluation of Adults with neck masses. 3. Under-utilization of US in Neck Imaging: Barriers (training, lack of time and financial incentive, diagnostic performance) 4. Where Ultrasound should be utilized more? Best Practice: Ultrasound is valuable tool for evaluation of major salivary gland. Ultrasound-guidance biopsy increases cytology yield. Point-of-care Ultrasound & Ultrasound-guidance Procedure for palpable neck mass are in line with the Institute of Medicines six dimensions of high quality care: safe, timely, effective, efficient, equitable, and patient-centered.

ABSTRACT

The trend of utilization of Advanced Imaging continued to rise for all imaging modalities Ultrasound, CT, MR, PET/CT. Ultrasound is gold standard for evaluation of thyroid mass. However, CT and MR are initial imaging choice for evaluation of non-thyroidal neck mass in adults by ACR appropriateness criteria as well as common clinical practice. The barriers for utilization of Ultrasound in Neck Imaging include the perceived lack of training, time and financial incentive as well as shortcoming of ultrasound in evaluation of the deeper neck and easy accessibility of CT and MR in United States. Ultrasound is valuable tool for evaluation of major salivary gland. Ultrasound-guidance biopsy has greatest potential in providing high level of diagnostic efficacy as part of comprehensive clinical practice guidelines. Point-of-care Ultrasound & Ultrasound-guidance Procedure for palpable neck mass are in line with the Institute of Medicines six dimensions of high quality care: safe, timely, effective, efficient, equitable, and patient-centered. The ultimate goal for utilization of Ultrasound in Neck Imaging is to improve the patient's outcome and to optimize the imaging strategy, combining the highest diagnostic yield with the lowest cost.

Handout: Kim Learned

http://abstract.rsna.org/uploads/2016/16001605/RSNA_2016_Ultrasound_Neck_Imaging_Under-utilization.docx

SPSC45F **Is Ultrasound Under-Utilized in Head and Neck Imaging?: No**

Participants

Julie Bykowski, MD, La Jolla, CA, (jbykowski@ucsd.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review factors that influence first-line imaging of neck processes 2) Review neck anatomy not easily accessible by ultrasound 3) Discuss impact of access to imaging modalities and referral patterns on ultrasound utilization in the neck

ABSTRACT

Appropriate imaging of a neck mass or fullness is influenced by whether the patient is an adult or child, the location of any palpable finding, risk factors for cancer, or symptoms of infection. While ultrasound is a powerful tool to clarify if lesions are solid, cystic, or vascular, and guide sampling, it does not provide a comprehensive evaluation of multifocal, trans-spatial or non-palpable processes, or assist in identification of aerodigestive tract primary tumors. Factors such as access to cross-sectional imaging, radiation exposure, sonographer time and skill, and referral patterns for evaluation and sampling also influence utilization.

URL

MSRO49

BOOST: Head and Neck-eContouring

Wednesday, Nov. 30 4:45PM - 6:00PM Room: S104B



AMA PRA Category 1 Credits™: 1.25
ARRT Category A+ Credits: 1.50

Participants

Suresh K. Mukherji, MD, Northville, MI (*Presenter*) Nothing to Disclose

Sung Kim, MD, New Brunswick, NJ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

- 1) Review the pertinent anatomy of the upper aerodigestive tract.
- 2) Discuss the spread patterns of various head and neck tumors.
- 3) Illustrate the importance of multimodality imaging for tumor contouring.

ABSTRACT

This e-contouring session will be given by a head and neck radiologist and radiation oncologist. This session will review the pertinent anatomy of the upper aerodigestive tract, discuss the spread patterns of various head and neck tumor and illustrate the importance of multimodality imaging for tumor contouring.