Thursday

104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RSNA® 2018
TOMORROW'S RADIOLOGY TODAY

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
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SPDL50

Neuro Nightmares: Headscratchers from Overnight (Case-based Competition)

Thursday, Nov. 29 7:15AM - 8:15AM Room: E451B

CT MR NR

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

Participants
Vadim Spektor, MD, New York, NY (*Presenter*) Nothing to Disclose
Nazmus Sakib, MD, Newark, NJ (*Presenter*) Nothing to Disclose
William B. Zucconi, DO, Madison, CT (*Presenter*) Nothing to Disclose
Yair Levy, Newark, NJ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Analyze traumatic and non-traumatic emergent neuroradiology imaging. 2) Interpret neuroradiologic diagnoses using multimodality and case based approach. 3) Integrate critical pathophysiological and clinical issues of each clinical scenario. 4) Optimize technical parameters needed for image interpreation.

ABSTRACT

Imaging plays a critical role in assessing patients with acute neurologic symptoms. Every patient with neurologic symptoms will have some form of cross-sectional neurologic exam, CT or MRI. Large proportion if not majority of acute neurologic patients present after normal daytime hours. Radiology residents are often asked to provide the first line diagnosis in complicated and often confusing neurologic cases and initial treatment is often based on resident interpretation of these exams. We are presenting a collection of challenging Neuro cases that presented overnight in our emergency rooms.

SPSC50

Controversy Session: In Stenotic Vascular Disease, Diameter Stenosis is All that Matters

Thursday, Nov. 29 7:15AM - 8:15AM Room: E350

MR NR VA

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

FDA Discussions may include off-label uses.

Participants
David A. Saloner, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose

Sub-Events

SPSC50A Why do Neurologists use Diameter to Decide on Intervention?

Participants
Wade S. Smith, MD,PhD, San Francisco, CA (*Presenter*) Consultant, Stryker Corporation; Data Safety Monitoring Board, Stryker Corporation

SPSC50B Geometric Morphology in Stenotic Disease: Challenges Associated with Measuring Diameters

Participants
Giles Roditi, FRCR, Glasgow, United Kingdom (*Presenter*) Consultant, Canon Medical Systems Corporation

SPSC50C Imaging Beyond the Lumen: The True Risk Features of Atherosclerotic Disease

Participants
Chun Yuan, PhD, Seattle, WA (*Presenter*) Research Grant, Koninklijke Philips NV; ;

For information about this presentation, contact:

cyuan@u.washington.edu

LEARNING OBJECTIVES

1) To define the need for imaging atherosclerotic lesions. 2) To describe current approaches for vessel wall and atherosclerosis imaging. 3) Examine key imaging findings that help to detect high risk atherosclerotic lesions.

SPSH50

Hot Topic Session: Beyond FDG: Advancing PET Imaging of the Human Disease

Thursday, Nov. 29 7:15AM - 8:15AM Room: E353A

CA MI NR NM

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

FDA Discussions may include off-label uses.

Participants
Chadwick L. Wright, MD,PhD, Lewis Center, OH (*Moderator*) Nothing to Disclose
Katherine A. Zukotynski, MD, Ancaster, ON (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To highlight topics related to advances in Cardiovascular PET, Neuro PET and Oncologic PET with FDA approved radiotracers other than FDG. 2) To address myocardial perfusion and atherosclerosis imaging, amyloid imaging, and oncologic imaging.

Sub-Events

SPSH50A New PET Technologies and Acquisition Approaches

Participants
Michael V. Knopp, MD, PhD, Columbus, OH (*Presenter*) Nothing to Disclose

SPSH50B Molecular Imaging of Heart Diseases

Participants
Sharmila Dorbala, MD,MPH, Boston, MA (*Presenter*) Research Grant, Astellas Group

LEARNING OBJECTIVES

1) List clinically available novel PET radiotracers for imaging cardiovascular diseases. 2) Discuss emerging cardiac applications using radiotracers targeting amyloid fibrils, somatostatin receptors and microcalification.

URL

SPSH50C Non-FDG PET Tracers for Molecular Brain Imaging

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Presenter*) Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd;

SPSH50D Molecular Imaging of Cancer: Where Are We Going?

Participants
Peter L. Choyke, MD, Rockville, MD (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

pchoyke@nih.gov

LEARNING OBJECTIVES

1) Familiarize participants with several new promising PET agents for cancer imaging. 2) Discuss new technologies that will enable the development of similar agents in the near future. 3) Describe opportunities and barriers to broader use of Molecular Imaging in Cancer.

ABSTRACT

Several new PET agents have been developed that promise to revolutionize the way cancer is diagnosed. Agents targeting the somatostatin receptor for neuroendocrine tumors and PSMA for prostate cancers are changing the way these diseases are managed. However, these agents took a long time to develop and even now are not fully available. New small molecule discovery technologies promise to greatly speed up the development of future agents. Many of these are also compatible with targeted radionuclide therapy. The future of this field is exciting and there is much work to be done.

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MSRT51

ASRT@RSNA 2018: Working Together to Create 3D Printed Models in Medicine

Thursday, Nov. 29 8:00AM - 9:00AM Room: N230B

IN OT

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

Participants
Lincoln Wong, MD, Omaha, NE (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

3d@childrensomaha.org

LEARNING OBJECTIVES

1) Appreciate how 3D printing is being used in medicine. 2) Understand the teamwork needed to run a hospital-based print lab. 3) Develop a workflow from image acquisition to printing 3D models.

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RCA51

Prostate MRI (Hands-on)

Thursday, Nov. 29 8:00AM - 10:00AM Room: S401AB

GU MR

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

Participants
Jelle O. Barentsz, MD, PhD, Nijmegen, Netherlands (*Presenter*) Advisor, SPL Medical BV
Daniel J. Margolis, MD, Los Angeles, CA (*Presenter*) Consultant, Blue Earth Diagnostics Ltd
Roel D. Mus, MD, Groesbeek, Netherlands (*Presenter*) Nothing to Disclose
Joyce G. Bomers, Arnhem, Netherlands (*Presenter*) Nothing to Disclose
Jurgen J. Futterer, MD, PhD, Nijmegen, Netherlands (*Presenter*) Research Grant, Siemens AG
Rianne R. Engels, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Renske L. van Delft, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Michiel Sedelaar, MD, PhD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Antonio C. Westphalen, MD, Mill Valley, CA (*Presenter*) Scientific Advisory Board, 3DBiopsy, Inc;
Geert M. Villeirs, MD, PhD, Ghent, Belgium (*Presenter*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD, Rio De Janeiro, Brazil (*Presenter*) Nothing to Disclose
Vibeke B. Logager, MD, Herlev, Denmark (*Presenter*) Nothing to Disclose
Joseph J. Busch, MD, Chattanooga, TN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Renske.vandelft@radboudumc.nl

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 47 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. The coursebook can be found at: https://tinyurl.com/rsna2018 Please note: To guarantee the best learning experience we can only allow 100 people in the room. First come, first serve.

Active Handout:Renske Lian van Delft

http://abstract.rsna.org/uploads/2018/16002006/Workshop RSNA 2018 Coursebook small RCA.pdf

MSCN51

Case-based Review of Neuroradiology (Interactive Session)

Thursday, Nov. 29 8:30AM - 10:00AM Room: S406A

NR

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

Participants
Pina C. Sanelli, MD, Manhasset, NY (*Director*) Research funded, Siemens AG;

LEARNING OBJECTIVES

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

ABSTRACT

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

Sub-Events

MSCN51A Brain: Is that Mass a Tumor?

Participants
Pina C. Sanelli, MD, Manhasset, NY (*Presenter*) Research funded, Siemens AG;

LEARNING OBJECTIVES

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

MSCN51B Brain: White Matter Lesions - Making Sense of the Mess

Participants
Anne G. Osborn, MD, Salt Lake Cty, UT (*Presenter*) Author, Reed Elsevier;

For information about this presentation, contact:

anne.osborn@hsc.utah.edu

LEARNING OBJECTIVES

1) Make a reasonable (i.e., a clinically useful) differential diagnosis for T2/FLAIR brain parenchymal hyperintensities by listing which key questions to consider. 2) Understanding what's common and what's not. 3) Learning how to use anatomy and patterns to narrow the differential diagnosis of these nonspecific 'white spots' we so commonly see on brain MRs.

ABSTRACT

There are at least 50 different recognized causes of discrete T2/FLAIR hyperintensities in the brain parenchyma. In this presentation we will 'make sense of 'the mess" by learning what key questions to ask and understanding what's common (only 9 or 10 things really are). We will present a pattern-based anatomical approach that will allow us to narrow differential diagnoses to useful, clinically-actionable information.

MSCN51C Spine: There's So Much More than Degenerative Disease

Participants
Jeffrey G. Jarvik, MD, Seattle, WA (*Presenter*) Consultant, Wolters Kluwer nv; Co-editor, Springer Nature; Royalties, Springer Nature

For information about this presentation, contact:

jarvikj@uw.edu

LEARNING OBJECTIVES

1) Review the findings for conditions that frequently motivate primary care providers to order spine imaging. 2) Discuss differential diagnosis including the perspective of primary care provider.

ABSTRACT

When primary care providers order an imaging study of the lumbar spine, they are often more interesting in excluding low probability but high consequence conditions such as tumor or infection than identifying a degenerative pain generator. In this talk I will review cases that are typical of the types of entities which primary care providers are trying to rule-out.

Honored Educators

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MSCN51D Spine Imaging and Interventions: What You Should Know but May Not

Participants
Christie M. Lincoln, MD, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Christie.Lincoln@bcm.edu

LEARNING OBJECTIVES

1) To assess the spine and cord for imaging abnormalities that necessitate further angiographic or interventional pain procedure. 2) To review the latest literature of the case-based presentation to understand our role as diagnosticians in the healthcare team.

ABSTRACT

Spine imaging can provide a plethora of information that may or may not necessitate clinical management. As diagnosticians, we need to be aware of the diagnoses that warrant an angiographic or interventional pain procedure. Through this case-based presentation, we will review the latest literature in spine interventions to update the value we can provide as part of the healthcare team.

MSCS51

Case-based Review of Musculoskeletal Radiology (Interactive Session)

Thursday, Nov. 29 8:30AM - 10:00AM Room: S100AB

MK US

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

FDA Discussions may include off-label uses.

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

Sub-Events

MSCS51A Shoulder

Participants
Laura W. Bancroft, MD, Orlando, FL (*Presenter*) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc ; ;

For information about this presentation, contact:

laura.bancroft.md@flhosp.org

LEARNING OBJECTIVES

1) Review essential imaging characteristics of post-traumatic and sports-related shoulder injuries. 2) Review salient multimodality imaging features of various shoulder pathologies in a case based format.

MSCS51B Soft Tissue Lesions

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

MSCS51C MSK Ultrasound

Participants
Akira M. Murakami, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe anatomy, pathology and US appearances of MSK cases outlining use of dynamic imaging and doppler. 2) Identify potential pitfalls. 3) Describe how other imaging modalities are complimentary to MSK Ultrasound.

ABSTRACT

The presentation will be a case based approach to review ultrasound appearances of common musculoskeletal pathologies of the upper and lower extremity including the use of dynamic imaging and doppler. Potential pitfalls will be reviewed as well as the importance of other imaging modalities and how they are complimentary to ultrasound.

MSCS51D Spine Lesions

Participants
Glenn C. Gaviola, MD, Boston, MA (*Presenter*) Nothing to Disclose

MSES51

Essentials of Breast Imaging

Thursday, Nov. 29 8:30AM - 10:00AM Room: S406B

BR

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

Sub-Events

MSES51A Missed Lesions in Mammography: How to Improve Performance

Participants
Athina Vourtsi, MD, Athens, Greece (*Presenter*) Consultant, General Electric Company; Educator, ABUS

LEARNING OBJECTIVES

1) Identify the most common factors that may lead to missed breast cancers. 2) Apply the appropriate steps when interpreting mammography. 3) Enhance skills in order to avoid the possibility of missing a suspicious lesion.

MSES51B Update on Ductal Carcinoma in Situ

Participants
Cecilia L. Mercado, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the imaging characteristics of ductal carcinoma in situ as detected on various imaging modalities. 2) Identify the risk factors for the development of ductal carcinoma in situ. 3) Discuss the various treatment recommendations for ductal carcinoma in situ as supported by the recent multiple randomized controlled trials.

MSES51C Management of Non-simple Breast Cysts

Participants
A. Thomas Stavros, MD, San Antonio, TX (*Presenter*) Advisor, Devicor Medical Products, Inc Advisor, General Electric Company Advisor, SonoCine, Inc Owner, Ikonopedia, LLC Medical Director, Seno Medical Instruments, Inc

For information about this presentation, contact:

atstavros@gmail.com

LEARNING OBJECTIVES

1) To understand the histologic bases for the appearances of cysts that are not simple. 2) To know the differences between 'suspicious' complex cystic and solid masses and non-suspicious benign complicated cysts. 3) To be aware of ancillary ultrasound modality and dynamic maneuver contributions to distinguishing suspicious from non-suspicious non-simple cysts. 4) To know when to use interventional procedures and which to use. 5) To know how pre-test probability (screening vs. diagnosis) affects interpretation and when to apply the rule of multiplicity.

ABSTRACT

As a general rule, most non-simple breast cysts are part of the benign fibrocystic spectrum and have little risk of being malignant. Malignant breast cysts are uncommon and cystic malignancies usually look more like necrotic or hemorrhagic solid masses than benign appearing cysts. Nevertheless, needs a systematic approach to evaluation of non-simple breast cysts in order not to miss the uncommon cystic malignancy. We present an algorithmic approach to evaluating non-simple breast cysts that is derived from the mammographic and solid mass algorithms, where we look for suspicious features first. If there are no suspicious findings, we then look for definitively benign findings. If we cannot find benign findings, we look for probably benign features, and failing that, classify the lesion as suspicious and obtain histology. We show the histologic basis for echogenic cyst fluid and a variety of benign and malignant excrescences that cause a cyst to appear to be non-simple. We discuss the difference between complicated cysts and complex cystic and solid masses in appearances and risk. We show how Doppler can help us assess complex cystic and solid masses and complex clustered microcysts. We discuss the need for histologic rather than cytologic assessment of suspicious cystic breast masses. We show the appearances of acutely and chronically inflamed cysts before and after aspiration, how Doppler can help this assessment, and how these appearances differ from those of malignant cysts, and the need for gram stain and culture, but not cytology. We present a variety of definitively benign appearances for non-simple breast cysts such as scintillating echoes, fat fluid-levels, fluid-debris levels, milk of calcium, calcium oxalate crystals, and skin cysts, and present maneuvers to improve their assessment. We also discuss the complicated cyst that has fluid so echogenic that it simulates a solid nodule, such as a fibroadenoma, and a variety of methods of further evaluating such cysts, including shear wave and strain elastography and aspiration. Finally, we discuss the rule of multiplicity and how multiple similar appearing non-simple cysts can be downgraded to BI-RADS 2, especially during supplemental screening ultrasound for women with dense breasts on mammography.

Active Handout:A. Thomas Stavros

http://abstract.rsna.org/uploads/2018/18000959/06 BUS of cysts that MSES51C.pdf

MSES51D Breast Anatomy and Physiology

Participants
Ellen B. Mendelson, MD,MA, Chicago, IL (*Presenter*) Advisory Board, Delphinus Medical Technologies, Inc; Speaker, Siemens AG; Advisory Board, Seno Medical Instruments, Inc; ; ;

LEARNING OBJECTIVES

1) Describe the anatomic composition of the adult breast. 2) Correlate physiology with specific pathologic occurrences in young, pregnant, and lactating women. 3) Assess the value of whole breast US in management of bilateral benign-appearing masses.

RC601

Practical HRCT of the Lung (Interactive Session)

Thursday, Nov. 29 8:30AM - 10:00AM Room: N228

CH CT

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

Participants
Daria Manos, MD, FRCPC, Halifax, NS (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

daria.manos@nshealth.ca

LEARNING OBJECTIVES

1) Identify and distinguish common and important CT patterns of diffuse and interstitial lung disease. 2) Understand the clinical importance of HRCT pattern recognition, the overlap between patterns and the key imaging features to help avoid diagnostic error. 3) Use clinical context to tailor HRCT differential diagnosis. 4) Describe an approach to diffuse airspace disease detected on CT chest. 5) List 3 common causes of acute diffuse airspace disease. 6) List 3 common causes of chronic diffuse airspace disease. 7) Accurately identify the common and important features of cystic lung disease on HRCT. 8) Recognize distinguishing features from other mimics of cystic lung disease on HRCT. 9) Use clinical context and other ancillary findings to tailor HRCT differential diagnosis.

Sub-Events

RC601A Approach to Nodular Patterns

Participants
Daria Manos, MD, FRCPC, Halifax, NS (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

daria.manos@nshealth.ca

LEARNING OBJECTIVES

1) Identify and distinguish common and important CT patterns of diffuse and interstitial lung disease. 2) Understand the clinical importance of HRCT pattern recognition, the overlap between patterns and the key imaging features to help avoid diagnostic error. 3) Use clinical context to tailor HRCT differential diagnosis.

RC601B Diffuse Airspace Disease: Practical Tips

Participants
Elsie Nguyen, MD, Toronto, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

elsie.nguyen@uhn.ca

LEARNING OBJECTIVES

1) Describe an approach to diffuse airspace disease detected on CT chest. 2) List 3 common causes of acute diffuse airspace disease. 3) List 3 common causes of chronic diffuse airspace disease.

RC601C Cystic Lung Disease: What Are You Missing?

Participants
Judith L. Babar, MBChB, Thriplow, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

judith.babar@addenbrookes.nhs.uk

LEARNING OBJECTIVES

1) Accurately identify the common and important features of cystic lung disease on HRCT. 2) Recognize distinguishing features from other mimics of cystic lung disease on HRCT. 3) Use clinical context and other ancillary findings to tailor HRCT differential diagnosis.

RC601D Fibrotic Lung Disease: Not Always UIP

Participants
Susan J. Copley, MD, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sue.copley1@nhs.net

LEARNING OBJECTIVES

1) Accurately identify the common and important features of fibrotic lung disease on HRCT. 2) Describe the common and important HRCT features of UIP. 3) Recognize distinguishing features of other patterns of fibrotic lung disease on HRCT.

RC602

Image Perception and Radiology Education

Thursday, Nov. 29 8:30AM - 10:00AM Room: S403B

ED

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

Participants
Elizabeth A. Krupinski, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

ekrupin@emory.edu

LEARNING OBJECTIVES

1) Understand the importance of image perception in resident education. 2) Appreciate the potential role of perceptual training in radiographic image interpretation. 3) Improve understanding of the role of image perception and radiology litigation.

ABSTRACT

Medical image perception has a long history in radiology, including an emphasis on training and education. This aspect is especially important as it impacts current and future learners (residents and fellows) as well as those out of training but gaining experience through everyday clinical interpretation. This course will focus on three important aspects of training and image perception: the importance of image perception in resident education; the potential role of perceptual training in radiographic image interpretation; and the role of image perception and radiology litigation.

Sub-Events

RC602A Medical Image Perception and Its Importance in Resident Education

Participants
Elizabeth A. Krupinski, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ekrupin@emory.edu

LEARNING OBJECTIVES

1) Understand the importance of image perception in resident education. 2) Appreciate the potential role of perceptual training in radiographic image interpretation. 3) Improve understanding of the role of image perception and radiology litigation.

ABSTRACT

Medical image perception has a long history in radiology, including an emphasis on training and education. This aspect is especially important as it impacts current and future learners (residents and fellows) as well as those out of training but gaining experience through everyday clinical interpretation. This course will focus on three important aspects of training and image perception: the importance of image perception in resident education; the potential role of perceptual training in radiographic image interpretation; and the role of image perception and radiology litigation.

Honored Educators

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RC602B Perceptual Training in Radiographic Image Interpretations

Participants
William Auffermann, MD, PhD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

william.auffermann@hsc.utah.edu

LEARNING OBJECTIVES

1) Identify the types of perceptual errors that occur during medical image interpretation. 2) Examine how tailored training algorithms for image evaluation can help avoid these perceptual errors.

RC602C Image Perception and Radiology Litigation

Participants
Leonard Berlin, MD, Wilmette, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lberlin@live.com

RC603

Cardiac Imaging for Transcatheter Intervention Planning

Thursday, Nov. 29 8:30AM - 10:00AM Room: S103CD

CA CT IR MR

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

FDA Discussions may include off-label uses.

Participants
Joe Y. Hsu, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose

Sub-Events

RC603A Cardiac CT Acquisition: Protocol Optimization

Participants
Brian B. Ghoshhajra, MD, Waban, MA (*Presenter*) Research Grant, Siemens Healthcare USA;

RC603B Planning TAVR and Mitral Interventions

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

For information about this presentation, contact:

jleipsic@providencehealth.bc.ca

LEARNING OBJECTIVES

1) Review the data supporting the utility and clinical efficacy of transcatheter interventions. 2) Discuss the role of CT for procedural planning and device selection. 3) Review how CT can be used to help improve clinical outcomes.

Honored Educators

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RC603C Cardiac MRI and CT for Arrhythmia Treatment

Participants
Stefan L. Zimmerman, MD, Ellicott City, MD (*Presenter*) Project consultant, Siemens Healthcare; Research grant, American Heart Association;

For information about this presentation, contact:

stefan.zimmerman@jhmi.edu

LEARNING OBJECTIVES

1) Learn how non-invasive imaging with cardiac MRI and CT are used in the evaluation of patients with cardiac arrhythmias. 2) Understand how MRI and CT can be used for imaging of the arrhythmia substrate and pre-procedural planning. 3) Comprehend the role of non-invasive imaging for sudden cardiac death risk stratification and decisions related to ICD placement.

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RC604

Musculoskeletal Series: Musculoskeletal Interventions

Thursday, Nov. 29 8:30AM - 12:00PM Room: E353C

IR MK

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

Participants
Theodore T. Miller, MD, New York, NY (*Moderator*) Nothing to Disclose
William E. Palmer, MD, Boston, MA (*Moderator*) Nothing to Disclose
Kenneth S. Lee, MD, Madison, WI (*Moderator*) Grant, General Electric Company Research support, SuperSonic Imagine Research support, Johnson & Johnson Consultant, Echometrix, LLC Royalties, Reed Elsevier
Robert S. Campbell, MBBCh, Liverpool, United Kingdom (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

klee2@uwhealth.org

llenchik@wakehealth.edu

Active Handout:Robert SD Campbell

http://abstract.rsna.org/uploads/2018/18000807/Shoulder Intervention_Campbell RC604.pdf

Sub-Events

RC604-01 Spine

Thursday, Nov. 29 8:30AM - 8:55AM Room: E353C

Participants
William E. Palmer, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

wpalmer@mgh.harvard.edu

LEARNING OBJECTIVES

1) Correlate symptoms with MRI findings. 2) Explain pain generators on MRI. 3) Describe role of corticosteroid injection.

RC604-02 Hip/Knee

Thursday, Nov. 29 8:55AM - 9:20AM Room: E353C

Participants
Theodore T. Miller, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

millertt@hss.edu

LEARNING OBJECTIVES

1) Be able to describe the clinical uses of sonographically guided interventions of the hip and knee. 2) Be able to describe technique of sonographically guided interventions of the hip and knee.

RC604-03 3-Tesla MR-Guided MR Arthrography of the Shoulder: Technical Performance, Patient Experience, and Comparative Efficiency

Thursday, Nov. 29 9:20AM - 9:30AM Room: E353C

Awards
Student Travel Stipend Award

Participants
Ethan Dyer, McDonough, GA (*Presenter*) Nothing to Disclose
Moustafa Abou Areda, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Bao Chau Ly, BS,MS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Janice A. Wang, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

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PURPOSE

Direct shoulder MR arthrography typically requires image-guided joint injections before MRI. However, the coordination of rooms and teams can be time-consuming or may not be possible at outpatient sites, in which case MR-guided MR arthrography may be advantageous. Therefore, we evaluated the performance of MR-guided MR arthrography at 3-Tesla.

METHOD AND MATERIALS

Following IRB-approval and informed consent, 154 patients (average age, 36; range, 13-77) undergoing MR-guided shoulder MR arthrography with a 3T wide-bore MRI system were prospectively included. Patients underwent MRI, MR-guided glenohumeral injection, and MR arthrogram as a single session procedure. The injections were performed by fellow or attending physicians. Outcome variables included technical success, extracapsular contrast leakage, procedure times, major complications, and patient experience obtained through a postprocedural questionnaire. Efficiency was assessed by comparison with procedural times of 50 recent fluoroscopy-guided MR arthrography procedures, consisting of injection and subsequent mixed MRI and MR arthrography. We used unpaired t-test and a $p<0.05$ significance level.

RESULTS

MR-guided shoulder arthrography was technically successful in 152/154 (99%) patients, whereas in 2/154 patients the procedure was prematurely terminated due to patient discomfort and inability to achieve intra-articular puncture. 10/152 (7%) procedures had mild extra-articular contrast leakage. There were no major complications. The procedure was tolerated well with low rates of moderate nausea (3%), moderate pain (7%), severe pain (2%), and no higher-grade claustrophobia, flashes, or heat sensations. MR-guided MR arthrography required a total of 87 (53-140) min including MRI [39 (16-59) min], MR-guided injection [28 (9-77) min], and MRA [16 (4-27) min]. In comparison, fluoroscopy-guided MR-arthrography required a total time of 104 (51 -158) min ($p<0.001$).

CONCLUSION

3-Tesla MR-guided MR arthrography of the shoulder is clinically feasible and affords high technical accuracy, as well as favorable safety profile and efficiency, which may supersede traditional fluoroscopy-guided MR arthrography.

CLINICAL RELEVANCE/APPLICATION

3-Tesla MR-guided shoulder MR arthrography is safe, accurate, and can eliminate delays between and coordination of traditional MR arthrography caused by fluoroscopy-guided injection and MRI.

RC604-04 Percutaneous CT Guided Bone Biopsy For Suspected Osteomyelitis: Diagnostic Yield and Impact on Patient's Treatment Change and Recovery

Thursday, Nov. 29 9:30AM - 9:40AM Room: E353C

Participants
Diana Hoang, Dallas, TX (*Presenter*) Nothing to Disclose
Stephen Fisher, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, Dallas, TX (*Abstract Co-Author*) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

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PURPOSE

To evaluate the utility of percutaneous CT guided bone biopsy (PCBB) for suspected osteomyelitis (OM) and their eventual impact in the management of osteomyelitis in a consecutive series of patients in a tertiary care hospital system. Our hypothesis was that the yield of PCBB is not high and it changes the diagnostic plan only in a minority of cases.

METHOD AND MATERIALS

A chart review was performed of patients who received a PCBB for suspected OM from years 2012-2018. Patient demographics, location, ulcer grade, signs of toxemia, serology, wound and blood cultures, bone biopsy and cross-sectional imaging results were recorded. Diagnostic yield of the PCBB was determined from the histology as the primary event and secondarily, its role in influencing the final treatment plan and patient recovery were evaluated.

RESULTS

115 patients, mean age 50.86 ± 14.49 yrs, male to female ratio 2.4:1 were included. The locations were sacrum/ischium (49/115, 43%), spine (35/115, 30%), extremities (32/115, 28%), and chest wall (2/115, 1.7%). Clinical findings included 40/115 (35%) had toxemia and 67/115 (58%) had ulcers, of which 49/50 (98%) were high grade. 17/111 (15%), 64/74 (86%), and 86/98 (88%) had an elevated WBC, CRP, and sedimentation rate, respectively. 22/91 (24%) had a positive blood culture and all 23/23 had a positive wound culture. MRI, CT, and SPECT-CT were available in 103/114 (90%), 8/114 (7%), and 7/114 (6%), respectively. On imaging, definitive and possible OM were reported in 83% and 14%, respectively, with 1.7% as no OM. Only 24/115 (21%) had a positive bone biopsy culture of which 19/24 contained organisms not shown in blood or wound cultures. Notably, 5/55 (9%) bone cultures showed organisms already present in other cultures. Only 10/24 (42%) total positive bone cultures impacted the treatment plan. Conversely, 45/91 (49%) cases that had a negative bone culture resulted in an altered treatment plan solely on basis of other findings. During follow-up of both types of cases- 19/22 (79%) with positive bone cultures and 55/79 (70%) with negative bone cultures, improved.

CONCLUSION

Despite positive cross-sectional findings of OM, image directed CT guided bone biopsies produce a low yield in final culture and have low impact in changing the treatment plan or in patient recovery

CLINICAL RELEVANCE/APPLICATION

CT guided bone biopsies play a limited role in the final diagnosis of osteomyelitis or impacting patient management.

RC604-05 CT-guided Discitis-Osteomyelitis Biopsies: Needle Gauge and Microbiology Results

Thursday, Nov. 29 9:40AM - 9:50AM Room: E353C

Participants
Jad S. Husseini, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Brooks Applewhite, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Nathaniel D. Mercaldo, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Joao Rafael T. Vicentini, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sandra B. Nelson, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Frank J. Simeone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Connie Y. Chang, MD, Boston, MA (*Presenter*) Nothing to Disclose

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PURPOSE

To compare the microbiology results and needle gauge for CT-guided biopsies of suspected acute discitis-osteomyelitis.

METHOD AND MATERIALS

All CT-guided biopsies performed for suspected acute discitis-osteomyelitis between May 2014 and December 2017 were reviewed. Biopsy location, needle type and gauge, microbiology, pathology, and clinical and imaging follow-up were obtained through chart review. Descriptive statistics were computed for all demographic and biopsy characteristics. Logistic regression analyses were used to quantify the association between a correct test result and needle gauge. Odds ratios and 95% confidence intervals were computed using the full cohort to summarize accuracy and using those with confirmed acute discitis-osteomyelitis infection to summarize sensitivity.

RESULTS

A total of 79 (age: 55 ± 19 years; 26 (33%) F; 1 (1%) cervical, 18 (23%) thoracic, 60 (76%) lumbar) biopsies were performed. There were 37 (47%) bone/disc biopsies, 30 (38%) disc only biopsies, 9 (11%) bone only biopsies, and 3 (4%) paravertebral soft tissue biopsies. There were 14 (18%) 12 gauge (G) biopsies, 12 (15%) 13 G biopsies, 21 (27%) 14 G biopsies, and 32 (41%) 16+ G biopsies. True disease status (infection) was determined via either pathology findings (64, 82%) or clinical and imaging follow up (15, 18%). The overall accuracy and sensitivity of the CT-guided biopsies were 82% (95% CI: 73-91) and 74% (60-87), respectively. The estimates by gauge were [accuracy, sensitivity]: 12 G, [79 (49-95), 82 (48-98)]; 13 G, [58 (28-85), 56 (21-86)]; 14 G, [48 (26-70), 45 (23-68)]; 16+ G, [53(35-71), 42 (23-63)]. The odds ratios of 12 vs 13+, 12 and 13 vs 14+, and 12 to 14 vs 16+ G needle biopsies were 3.3 (0.9-15.8), 2.2 (0.8-6.1), and 1.3 (0.5-3.2), respectively. Similar estimates of obtaining positive microbiology results among disease positive patients were 5.4 (1.3-37.6), 3.0 (1.0-9.9), and 1.8 (0.7-5.1), respectively.

CONCLUSION

The odds of having an accurate microbiology result were 5.4 (1.3-37.6) times higher among disease positive patients. These results suggest that the use of a larger gauge biopsy needle may increase the likelihood of culturing the causative microorganism for CT-guided biopsies of acute discitis-osteomyelitis.

CLINICAL RELEVANCE/APPLICATION

Using a lower gauge biopsy needle needle to obtain a larger core sample may help to culture the causative organism in discitis-osteomyelitis.

RC604-06 Foot/Ankle

Thursday, Nov. 29 9:50AM - 10:10AM Room: E353C

Participants
Joel S. Newman, MD, Boston, MA (*Presenter*) Consultant, Pfizer Inc

LEARNING OBJECTIVES

1) Apply specific arthographic techniques to large and small joints of the foot and ankle, with emphasis on the subtalar joint and smaller articulations of the midfoot and forefoot. 2) Contrast fluoroscopic and ultrasound guided techniques for joint interventions at the foot. 3) Review a variety of ultrasound-guided interventions at the soft-tissues of the foot and ankle for the purposes of pain management, emphasizing tendon sheath and bursa injections . 4) Contrast varied anatomic approaches for ultrasound-guided injection of the interdigital webspaces at the toes for Morton Neuroma.

RC604-07 Elbow/Wrist

Thursday, Nov. 29 10:20AM - 10:40AM Room: E353C

Participants
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

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LEARNING OBJECTIVES

1) Understand the clinical indications of interventions involving the elbow and wrist. 2) Describe the interventional techniques involved in diagnosing and/or treating common elbow and wrist pathology.

RC604-08 Technical Feasibility of Electromagnetic Fusion Imaging-Guided Spinal Bone Biopsies

Thursday, Nov. 29 10:40AM - 10:50AM Room: E353C

Participants
Giovanni Mauri, MD, Milan, Italy (*Abstract Co-Author*) Consultant, Esaote SpA
Domenico Albano, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Carmelo Messina, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Angelo Corazza, MD, Genova, Italy (*Abstract Co-Author*) Nothing to Disclose
Santi Rapisarda, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Maria Sconfienza, MD, PhD, Milano, Italy (*Presenter*) Travel support, Bracco Group; Travel support, Esaote SpA; Travel support, ABIOGEN PHARMA SpA; Speakers Bureau, Fidia Pharma Group SpA

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PURPOSE

Electromagnetic fusion imaging is an established modality to perform interventional procedures around the body. However, this modality has never been tested in the spine. Our aim was to test the technical feasibility of electromagnetic fusion imaging-guided spinal bone biopsies.

METHOD AND MATERIALS

Between February and March 2018, nine patients (four males, mean age 4712 years) referred to our radiology unit of a tertiary orthopaedic center to undergo a bone biopsy of the spine. Lesions were located in the sacrum (n=3), vertebral body (n=3), intervertebral disc (n=3). Patients were placed prone on CT table (64 slice, Siemens, Germany), an external fiducial marker was placed in the relevant area and image volume was acquired. DICOM dataset was then loaded on a US system (Twice, Esaote, Italy) equipped with a GPS-based electromagnetic navigation unit and a needle-tracking system. Bone biopsy was then performed with standard procedure using CT and fusion guidance for the first six cases and fusion guidance only in the last three. For every procedure, we recorded the elapsed time between local anesthesia and specimen withdrawal, the number of CT passes, complications, specimen adequacy. We compared the elapsed times and number of CT passes with similar previous cases performed with standard CT-guided procedures.

RESULTS

Mean elapsed time for the first six cases was 455 minutes, while for cases performed using fusion imaging only was 307 minutes (P=0.061). In similar previous cases performed with standard CT-guided procedures, elapsed time was 446 minutes (P=0.809) and 454 minutes (P=0.05), respectively. Median number of CT passes for the first six cases was 7.5 (IQR 5.75-8.25) while it was 3 (3-3) for cases performed using fusion imaging only. In similar previous cases performed with standard CT-guided procedures, median number of CT passes was 6 (5-7.25) (P=0.219) and 8 (7-8) (P=0.042), respectively. No complications occurred and all specimens were adequate.

CONCLUSION

Although on a small series and after initial testing, electromagnetic fusion imaging-guided spine biopsy seems to be feasible and may reduce the procedural time and the number of CT passes, thus also reducing radiation administration.

CLINICAL RELEVANCE/APPLICATION

Electromagnetic fusion imaging-guided spine biopsy seems to be promising in reducing procedure time and amount of radiations administered to patients.

RC604-09 Clinical and Patient-Reported Outcomes After Image-Guided Intra-Articular Therapeutic Hip Injections in Patients with Osteoarthritis Related Hip Pain: A Retrospective Study

Thursday, Nov. 29 10:50AM - 11:00AM Room: E353C

Participants
William Walter, MD, New York, NY (*Presenter*) Nothing to Disclose
Craig Bearison, New York, NY (*Abstract Co-Author*) Nothing to Disclose
James Slover, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Heather T. Gold, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Soterios Gyftopoulos, MD, Scarsdale, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate change in patient reported outcomes (PROs) scores for patients undergoing image-guided intraarticular therapeutic hip steroid injections for pain management and assess potential correlation of outcomes with patient- and injection-specific factors.

METHOD AND MATERIALS

We performed a retrospective medical record review of consecutive patients undergoing treatment for hip pain who completed PRO surveys from 10/2011-09/2017 at an outpatient orthopedic surgery clinic. Patients underwent steroid hip injection and completed PRO assessments: EuroQol-5 domain (EQ5D), EQ5D visual analog scale, and the hip disability and osteoarthritis outcome (HOOS), before injection and within 1-6 months post-injection. Pre- and post-injection PRO scores were compared. Time to repeat injection and hip surgery was recorded. Available imaging was reviewed for degree of osteoarthritis. Statistical methods included exact Wilcoxon signed rank test to assess score differences and Spearman correlation, and Kruskal-Wallis, and exact Mann-Whitney tests to assess correlation of PRO scores with patient and injection-specific factors.

RESULTS

In the 144 patients who met our inclusion criteria, there was no significant change from pre-injection to post-injection in the EQ5D (p=0.210), EQ5D visual analog scale (p=0.293), average HOOS (p=0.562) or total HOOS (p=0.459) scores. Forty patients (27.8%)

underwent hip arthroplasty within 1 year of the injection. Weakly positive correlation was found between number of days from injection to surgery and change in EQ-5D (r=0.29, p=0.023) and average (r=0.36, p=0.008) and total HOOS (r=0.40, p=0.003) scores. No other significant correlations between PRO score change and patient- or injection-specific factors, including radiographic degree of osteoarthritis, were detected.

CONCLUSION

We demonstrated no significant change in EQ5D or HOOS scores measured before intra-articular therapeutic hip injections compared with 1-6 months after injection. While our results should temper expectations for symptom improvement, further study is required to systematize PRO collection and identify predictive factors or patient subsets most likely to benefit from these injections.

CLINICAL RELEVANCE/APPLICATION

Image-guided therapeutic injections may not significantly change quality of life among patients with osteoarthritis-related hip pain, as measured by PROs.

RC604-10 Ultrasound-Guided Aspiration of Hematomas: Safety, Efficacy and Relationship to Sonographic Appearance

Thursday, Nov. 29 11:00AM - 11:10AM Room: E353C

Awards
Student Travel Stipend Award

Participants
Edward S. Yoon, MD, New York, NY (*Presenter*) Nothing to Disclose
Theodore T. Miller, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Susan C. Lee, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the safety and efficacy of ultrasound-guided aspiration of musculoskeletal hematomas. To determine whether the age of hematomas correlates with their sonographic appearance, and if the appearance predicts the ease of aspiration.

METHOD AND MATERIALS

With IRB approval, we searched our radiology database between 1/01/2008 - 9/28/2017, for hematoma aspirations performed by a single senior musculoskeletal radiologist specializing in musculoskeletal ultrasound. We reviewed the echogenicity of the collection (hypoechoic, heterogeneous, complex, echogenic), age of the hematoma, aspiration amount and aspirate consistency/quality, whether lavage was performed, needle gauge, location, complications, and amount of decompression categorized as minimal (<25% decompression), moderate (25-75%), and complete (>75%). Electronic medical records were reviewed to determine the clinical outcome and any complications.

RESULTS

67 patients (32 females/35males, 16-80 years old) had US-guided hematoma aspirations. 47 patients returned for clinical follow-up with no infections and all reporting symptomatic relief. Hematoma locations included intramuscular, intrabursal, and intraarticular. Of the 67 hematomas, 34 were lavaged with saline or lidocaine which improved the aspiration. The amount of decompression ranged from: minimal (8/67), moderate (18/67), and complete (41/67). Of the completely decompressed hematomas, (6/41,13%) were hypoechoic, (23/41,47%) heterogeneous, (18/41,40%) complex, and (0/41) echogenic. Of the moderately decompressed hematomas, (0/18) were hypoechoic, (10/18,56%) heterogeneous, (8/18,44%) complex, and (0/18) echogenic. Of the minimally decompressed hematomas, (1/8,13%) were hypoechoic, (4/8,50%) heterogeneous, (2/8,25%) complex, and (1/8,13%) echogenic. Age of hematomas in 45/67 patients ranged from 1-90 days with an average of 11 days. Ordinal logistic regression showed no significant correlation between echotexture (p=0.075) or the age of the hematoma with ease of aspiration (p=0.085).

CONCLUSION

Ultrasound-guided hematoma aspiration is a safe and effective treatment. There is no correlation between the echogenicity of the hematoma, age of the hematoma, and ease of aspiration/amount of decompression.

CLINICAL RELEVANCE/APPLICATION

Hematoma aspiration is a safe procedure. The age and sonographic appearance of the hematoma do not predict the ease of aspiration.

RC604-11 Shoulder

Thursday, Nov. 29 11:10AM - 11:35AM Room: E353C

Participants
Robert S. Campbell, MBBCh, Liverpool, United Kingdom (*Presenter*) Nothing to Disclose

Active Handout:Robert SD Campbell

http://abstract.rsna.org/uploads/2018/18000812/Shoulder Intervention_Campbell_RSNA_2018RC604-11.pdf

LEARNING OBJECTIVES

1) The clinical Indications for undertaking shoulder intervention. 2) The techniques for performing shoulder interventions. 3) The evidence base that supports the use of shoulder interventions.

RC604-12 Ablative Techniques

Thursday, Nov. 29 11:35AM - 12:00PM Room: E353C

Participants
Travis J. Hillen, MD, Saint Louis, MO (*Presenter*) Consultant, Biomedical Systems; Consultant, Medtronic plc

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LEARNING OBJECTIVES

1) Discuss the mutliple different ablation modalities and common uses for each. 2) Indications and techniques for benign musculoskeletal tumor ablation. 3) Indications and techniques for malignant tumor ablation. 4) Indications and techniques for thermoprotection with ablation. 5) Contraindications and potential complications to tumor ablation.

RC605

Traumatic Brain Injury

Thursday, Nov. 29 8:30AM - 10:00AM Room: E352

ER NR

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

Participants
Apostolos J. Tsiouris, MD, New York, NY (*Moderator*) Consultant, BioClinica, Inc; Consultant, ICON plc; Consultant, PAREXEL International Corporation

Sub-Events

RC605A Imaging and Subconcussive Impacts in Youth Sports

Participants
Joseph A. Maldjian, MD, Dallas, TX (*Presenter*) Consultant, BioClinica, Inc; Consultant, Koninklijke Philips NV

For information about this presentation, contact:

Joseph.Maldjian@UTSouthwestern.edu

LEARNING OBJECTIVES

1) Discuss impact exposure in youth and high school football. 2) Recognize the imaging correlates of head impact. exposure. 3) Identify how risks can be reduced.

RC605B 'Don't Miss' Lesions in Traumatic Brain Injury

Participants
Yvonne W. Lui, MD, New York, NY (*Presenter*) Research collaboration, Siemens AG; Advisor, Bold Brain Ventures

LEARNING OBJECTIVES

1) Understand the anatomy of head trauma. 2) Know indications for Brain MRI in the setting of trauma. 3) Be aware of new techniques in imaging for concussion.

RC605C Neuroimaging of Military TBI

Participants
Gerard Riedy, MD, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify unique characteristics of military TBI compared to civilian TBI. 2) Understand advanced imaging MRI techniques application to military TBI. 3) Recognize the potential uses and limitations of these techniques for chronic mild TBI in the US military.

RC606

Imaging of the Head & Neck Glands: Thyroid, Parathyroid, and Salivary Glands (Interactive Session)

Thursday, Nov. 29 8:30AM - 10:00AM Room: E450B

HN NR

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

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shatzkes@hotmail.com

Sub-Events

RC606A Salivary Gland Disease

Participants
Claudia F. Kirsch, MD, New York, NY (*Presenter*) Stockholder, ABIOMED, Inc; Stockholder, LeMaitre Vascular, Inc; Stockholder, Becton, Dickinson and Company; Royalties, Informa plc;

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LEARNING OBJECTIVES

1) Define the radiographic features of salivary tissue and cross-sectional imaging techniques utilized to image salivary tissue with Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). 2) Classify and compare the radiographic features of salivary diseases arising from infectious, inflammatory or neoplastic etiologies. 3)Describe key radiographic features allowing for differentiation of salivary gland pathology.

ABSTRACT

The purpose of this course is to define the normal and pathologic radiographic features of salivary tissue utilzing cross-sectional imaging techniques such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). After attending this course the attendee should have a better awareness of how to classify and compare the radiographic features of salivary pathology occuring from infectious, inflammatory or neoplastic etiologies.

RC606B Imaging Work-up of Hyperparathyroidism

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

For information about this presentation, contact:

jennykh@gmail.com

LEARNING OBJECTIVES

1) Discuss rationale for imaging for hyperparathyroidism. 2) Review essential anatomy and embryology of the parathyroid glands. 3) Describe the role of the different imaging modalities and typical and atypical imaging findings.

Active Handout:Jenny K. Hoang

http://abstract.rsna.org/uploads/2018/18000456/Imaging for hyperparathyroidism RC606B.pdf

RC606C TI-RADS and the Incidental Thyroid Nodule

Participants
Ashley H. Aiken, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Discuss the incidence, significance and natural history of incidental thyroid nodules and differentiated thyroid cancer respectively. 2) Know the current literature and best practice recommendations for further imaging evaluation (US) and FNA of the incidental thyroid nodule.3) Understand the lexicon and risk categories of TI-RADS in order to provide evidence based recommendations for thyroid nodule management based on sonographic features.

ABSTRACT

Thyroid nodules are extremely common, with approximately 50% at autopsy. Most of these nodules are less than a centimeter. Thyroid cancer is also common, but not nearly as common as thyroid nodules, with approximately 2-5% at autopsy. Thyroid cancer incidence is on the rise without a significant change in mortality rate. There is evidence that a rising incidence of sub centimeter papillary thyroid cancer results from increased detection on CT. In the past several years, ACR has published a series of white

papers to guide the management of these extremely common incidental thyroid nodules. This presentation will review the current literature and suggest some practical guidelines to help radiologists decide how to report these nodules. Current evidence suggests that a stratification approach, incorporating aggressive imaging findings, age younger than 35-40 years, and a 15-mm cutoff for triaging work-up, may reduce this excess work-up of benign ITNs while capturing the same proportion of thyroid malignancies. Ultrasound is the study of choice for the evaluation of an intrathyroidal mass or nodule. CT has no signs that help to differentiate malignant from benign thyroid nodules, and is therefore not the study of choice. Templates should be easily understandable with numerical scores for levels of suspicion and have linked management recommendations which reflect a multidisciplinary consensus approach. The consensus for next management steps opens avenues for direct patient reporting and highlights the radiologist's added value in patient care. These templates also produce data minable reports which will pave the way to address optimal surveillance imaging algorithms and timing, imaging accuracy, reader performance, inter-observer variability, etc.The goal of ACR TI-RADS is to provide practitioners with evidence- based recommendations for the management of thyroid nodules on the basis of sonographic features that can be applied to every lesion. The ACR TI-RADS committee has produced three ACR white paper publications: Management guidelines for incidental thyroid nodules, thyroid ultrasound reporting lexicon and a standardized risk stratification system called TI-RADS (Thyroid Imaging, Reporting and Data system). The lexicon outlines the evaluation of thyroid nodules according to composition, echogenicity, shape, size, margins and echogenic foci, and the risk stratification system based on this lexicon directs management.

Active Handout:Ashley Hawk Aiken

http://abstract.rsna.org/uploads/2018/18000457/incidentalthyroid RC606C.pdf

RC606D Imaging Thyroid Cancer

Participants
Yoshimi Anzai, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To understand how imaging can be used for diagnostic work-up for patients with thyroid cancer. 2) To discuss various imaging options for evaluation of thyroid cancer. 3) To learn new AJCC TNM staging changes for thyroid cancer.

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/ Yoshimi Anzai, MD - 2014 Honored Educator

RC607

Chronic Pelvic Pain: Added Value of MRI in Endometriosis, Fibroids, and Pelvic Floor Relaxation

Thursday, Nov. 29 8:30AM - 10:00AM Room: S402AB

GU MR

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

Participants
Susan M. Ascher, MD, Washington, DC (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Improve knowledge of the economic and psychosocial impact of chronic pelvic pain. 2) Review the indications and MRI imaging protocols for endometriosis. 3) Recognize the MRI appearance of endometriosis. 4) Review the epidemiology and clinical presentations of leiomyomas. 5) Review current treatment options for symptomatic leiomyomas. 6) Recognize the MRI appearance of leiomyomas to include differentiating them from other myometrial masses. 7) Review common surgical interventions for stress urinary incontinence and pelvic organ prolapse. 8) Describe the MRI technique for imaging synthetic material in the pelvic floor. 9) Recognize normal and abnormal MRI appearances of synthetic materials used in pelvic floor dysfunction.

Sub-Events

RC607A Overview: Why is this Subject Important?

Participants
Susan M. Ascher, MD, Washington, DC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC607B Endometriosis: Pearls and Pitfalls

Participants
Elizabeth A. Sadowski, MD, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC607C Leiomyomas: Pre- and Post-procedural Imaging - More Than a Roadmap

Participants
Yuliya Lakhman, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC607D Slings and Meshes: Guide to MR Imaging of Pelvic Floor Following Surgical Repair

Participants
Gaurav Khatri, MD, Dallas, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Review common surgical interventions for stress urinary incontinence and pelvic organ prolapse. 2) Describe the MRI technique for imaging synthetic material in the pelvic floor. 3) Recognize normal and abnormal MRI appearances of synthetic materials used in pelvic floor dysfunction.

Active Handout:Gaurav Khatri

http://abstract.rsna.org/uploads/2018/18000692/Khatri_ RSNA 2018_MRI of Pelvis After Surgical Repair_HANDOUT RC607D.pdf

RC608

Emergency Radiology Series: Current Imaging of the Acute Abdomen

Thursday, Nov. 29 8:30AM - 12:00PM Room: E451B

ER GI GU OB

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

FDA Discussions may include off-label uses.

Participants
John J. Hines Jr, MD, Huntington, NY (*Moderator*) Nothing to Disclose
Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose
Mariano Scaglione, MD, Castel Volturno, Italy (*Moderator*) Nothing to Disclose
Ferco H. Berger, MD, Toronto, ON (*Moderator*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To understand the rational use of plain film, US, CT and MR in the acute abdomen. 2) To evaluate the imaging modalities in the appropriate clinical contest.

Sub-Events

RC608-01 Uncommon Acute Conditions of the Small Bowel

Thursday, Nov. 29 8:30AM - 9:05AM Room: E451B

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

LEARNING OBJECTIVES

1) Utilize plain film, CT and MRI to identify and characterize acute conditions of the small bowel. 2) Identify uncommon conditions of the small bowel that result in obstruction, ischemia, inflammation, and hemorrhage including Meckel's diverticula, angioedema, small bowel tumors, and foreign bodies. 3) Differentiate between surgical and nonsurgical causes of acute small bowel pathology. 4) Assist referring clinicians to guide management.

Honored Educators

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RC608-02 Identification of Pneumoperitoneum on Chest Radiographs Using Deep Learning

Thursday, Nov. 29 9:05AM - 9:15AM Room: E451B

Participants
Paul H. Yi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Tae Kyung Kim, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jinchi Wei, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ji Won Shin, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Tae Soo Kim, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Gregory D. Hager, PhD, MSc, Baltimore, MD (*Abstract Co-Author*) Co-founder, Clear Guide Medical LLC CEO, Clear Guide Medical LLC
Susan C. Harvey, MD, Lutherville, MD (*Abstract Co-Author*) Consultant, Hologic, Inc Consultant, IBM Corporation
Haris I. Sair, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand K. Hui, MD, Richmond, VA (*Abstract Co-Author*) Speakers Bureau, Terumo Corporation Speakers Bureau, Penumbra, Inc Stockholder, Blockade Medical Inc
Cheng Ting Lin, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Pneumoperitoneum is a critical finding which can be missed at the periphery of chest radiographs (CXRs). The purpose of this study

was to develop and test the performance of deep convolutional neural networks (DCNNs) for the automated detection of pneumoperitoneum on CXRs.

METHOD AND MATERIALS

We obtained 148 de-identified frontal view CXRs consisting of 74 abnormal CXRs with and 74 control CXRs without pneumoperitoneum (50% each). Ground-truth classification was performed by 2 board-certified radiologists. The CXRs were randomly split into training (70%), validation (10%), and test (20%) datasets. The training and validation datasets were augmented 30x using multiple rotations, flipping, random cropping, and non-rigid deformation. The ResNet-18 DCNN pretrained on ImageNet was then trained and validated using these augmented images. Receiver operating characteristic (ROC) curves with area under the curve (AUC) and standard diagnostic measures were used to evaluate the DCNN's performance on the test dataset.

RESULTS

The DCNN had an AUC of 0.98 and accuracy of 98% for distinguishing between the presence and absence of pneumoperitoneum on the test dataset. The DCNN was incorrect in 1 of the 25 test cases (false negative), which was correctly interpreted by a thoracic radiologist. Sensitivity and specificity were 100% and 96%, respectively.

CONCLUSION

Even with a small training set, our DCNN has very high accuracy for automated identification of pneumoperitoneum on CXRs, which may help expedite radiologist review of CXRs with potentially-life threatening findings.

CLINICAL RELEVANCE/APPLICATION

Deep convolutional neural networks can automatically detect pneumoperitoneum with near-perfect accuracy, thus potentially expediting diagnosis of potentially-life threatening condition.

RC608-03 Utility of Biphasic Multi-Detector Computed Tomography in Suspected Acute Mesenteric Ischemia in the Emergency Department

Thursday, Nov. 29 9:15AM - 9:25AM Room: E451B

Participants
Prasaanthan Gopee-Ramanan, MD, Hamilton, ON (*Presenter*) Nothing to Disclose
Michael N. Patlas, MD,FRCPC, Hamilton, ON (*Abstract Co-Author*) Nothing to Disclose
Bharadwaj Pindiprolu, BSC, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Douglas S. Katz, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To retrospectively evaluate the utility of biphasic multi-detector computed tomography (MDCT) with arterial and portal venous phases for the depiction of suspected acute mesenteric ischemia (AMI) in emergency department (ED) patients.

METHOD AND MATERIALS

An IRB-approved retrospective review of all adult patients who underwent an emergency biphasic IV contrast-enhanced 64-MDCT examination of the abdomen and pelvis due to clinical suspicion for AMI over a five-year period at a single institution was performed. Extracted data included demographics, initial clinical presentations, laboratory tests (serum lactate level), MDCT findings, and subsequent management (operative vs. non-operative).

RESULTS

225 patients underwent biphasic MDCT for suspected occlusive AMI between 10/1/2011 and 31/7/2016. 200/225 patients were negative for AMI, with the main alternative findings in descending order of prevalence including no significant abnormalities (98), non-specific colitis (24), small bowel obstruction (12), and acute cholecystitis (8). 25/225 patients [mean age 73.5 years; age range 48 to 94 years; 13 men and 12 women] had MDCT findings positive for bowel ischemia (yield of 11.1%). On MDCT, 18/25 (72%) had an occlusive arterial etiology for AMI (splanchnic vessel thrombus/severe stenosis, and associated ischemic changes of the bowel), 2/25 (8%) had an occlusive venous etiology (venous thrombus and associated bowel ischemia), and 5/25 (20%) had non-occlusive AMI (bowel ischemia with normal vessels). Of the patients with MDCT positive for AMI, 14/25 (56%) were surgically managed. 12/14 (85.7%) had surgically-proven occlusive arterial AMI, and 1/14 (7.1%) had surgically-proven occlusive venous AMI. 20/25 (80%) patients with positive MDCT findings of AMI also had an elevated serum lactate level, including 14/18 (77.8%) patients with arterial occlusive AMI on MDCT, 2/2 (100%) with venous occlusive AMI on MDCT, and 4/5 (80%) with non-occlusive AMI on MDCT. There were no false-positive scans, to our knowledge.

CONCLUSION

Biphasic MDCT demonstrated low but not trivial yield (11.1%) for the depiction of suspected acute mesenteric ischemia in the ED, but was particularly low for occlusive venous AMI (0.9%).

CLINICAL RELEVANCE/APPLICATION

Biphasic MDCT had a low yield for the depiction of venous acute mesenteric ischemia in our retrospective series. The portal venous phase can potentially be eliminated from CT examinations performed for suspected AMI.

Honored Educators

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RC608-04 Complicated Sigmoid Volvulus: Identification of the High Risk Patients Necessitating Emergent Surgery

Thursday, Nov. 29 9:25AM - 9:35AM Room: E451B

Participants
Subin Heo, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hye Jin Kim, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bohyun Kim, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Bracco Group
Jimi Huh, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jei Hee Lee, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jai Keun Kim, MD, PhD, Suwonsi, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

This study aims to determine which clinical, laboratory, or computed tomography (CT) findings can help to accurately identify complicated sigmoid volvulus requiring surgery instead of endoscopic detorsion in the emergency setting.

METHOD AND MATERIALS

We performed a retrospective study of data from cohort of 51 patients admitted for sigmoid volvulus in the emergency department from January 2003 to July 2017. These patients attempted initial endoscopic detorsion after CT. Contrast-enhanced CT findings were retrospectively reviewed by two radiologists in consensus. Clinical and laboratory findings were also analyzed to evaluate the complicated sigmoid volvulus defined as irreversible bowel ischemia to necrosis requiring surgery. The reference standard for complicated sigmoid volvulus was based on surgery and follow-up endoscopic findings. Patients were categorized with complicated and simple sigmoid volvulus group. The characteristics of the two groups were compared using chi-square or Fisher exact tests. Univariate and multivariate analyses were performed to identify the risk factors predicting the complicated sigmoid volvulus.

RESULTS

Of 51 study patients, 11 patients (21.6%) were found to have complicated sigmoid volvulus, whereas 40 patients (78.4%) had simple sigmoid volvulus. Univariate analysis revealed three CT findings of reduced bowel wall enhancement, increased bowel wall thickness (> 2.2 mm), and mesenteric vein thrombosis, as well as two laboratory findings of elevated C-reactive protein and lactate levels were significantly associated with complicated sigmoid volvulus. In multivariate analysis, two CT findings of reduced bowel wall enhancement (HR, 20.2; 95% CI: 1.8, 220.4) and increased bowel wall thickness (HR, 11.9: 95% CI: 2.5, 57.8) and one clinical finding of low systolic blood pressure (< 90 mmHg [HR, 66.8, CI: 4.5, 984.3]) were identified as independent predictive factors of complicated sigmoid volvulus.

CONCLUSION

CT findings of reduced bowel wall enhancement and increased bowel wall thickness together with low systolic blood pressure can predict the complicated sigmoid volvulus necessitating surgery instead of colonoscopic detorsion as a primary emergency treatment of choice.

CLINICAL RELEVANCE/APPLICATION

CT findings of reduced bowel wall enhancement and increased bowel wall thickness and low systolic blood pressure can predict the complicated sigmoid volvulus necessitating emergent surgery.

RC608-05 Imaging of the Acute Abdomen in Pregnancy

Thursday, Nov. 29 9:35AM - 10:10AM Room: E451B

Participants
Gabriele Masselli, MD, Rome, Italy (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To discuss the current evidence-based recommendations regarding radiation dose concerns, the use of iodinated and gadolinium-based contrast agents, and the comparative advantages and drawbacks of multimodality imaging (ultrasound, CT, and MRI) during pregnancy. 2) To understand how to diagnose the most common causes of acute abdominal pain in pregnancy. 3) To review the imaging features of various pathologies which may present as acute abdominal pain during pregnancy.

RC608-06 Characteristics of Appendicoliths That Lead to Perforated Appendicitis in Patients Undergoing Laparoscopic Appendectomy

Thursday, Nov. 29 10:10AM - 10:20AM Room: E451B

Participants
Mustafa B. Chaudhry, MBBS, Karachi, Pakistan (*Presenter*) Nothing to Disclose
Muhammad S. Khan, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose
Asad Shakil, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose
Wasim A. Memon I, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose
Muhammad T. Siddiqui, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Appendicoliths (AL) are associated with an increased incidence of acute appendicitis. Our purpose is to determine the number, shape, density and a more proximal location of AL in the appendix that lead to perforated appendicitis (PA).

METHOD AND MATERIALS

A retrospective review of charts, of patients who underwent preoperative CT scan, had appendicitis with AL, followed by laparoscopic appendectomy from 01/2008-12/2015, was completed. Patients were divided into two groups; PA and non-perforated appendicitis (NPA). AL was divided into 2 groups according to its density; high-density AL (HDA) with >200 Hounsfield unit (HU) density and low-density AL (LDA), <200 HU. CTGA was done using radiological parameters including appendix diameter, wall thickness, intraluminal and extraluminal air, periappendiceal fat stranding and fluid, caecal wall thickening, and abscess formation. A normal appendix is considered Grade 0, and most severe, perforated appendix with abscess and pneumoperitoneum on CT was graded as Grade V. The number, density and position of the AL were ascertained and studied in relation to PA on laparoscopy.

RESULTS

Overall 100 patients were included, mean age was 28.8±11.9 years with 74 patients being males. 23 patients were in PA group and 77 in NPA group. Significantly greater proportion of patients in the PA group had; appendicolith location at the base [PA vs NPA: 14(36%) vs 25(32%) p-value 0.04], rounded lamellated type of appendicolith [PA vs NPA: 13(56%) vs 19(24.6%) p-value 0.04], higher CTGA between III-V [PA vs NPA: 15(82%) vs 38(49%) p-value 0.015], increased width of appendiceal lumen [PA vs NPA: 15.5±3.5 mm vs 13.1±8.9 mm) p-value 0.009] and thickness of appendiceal wall [PA vs NPA: 4.8±1.7 mm vs 4.1±1.4 mm) p-value 0.05]. The multiplicity of appendicoliths, HDA and post-op infectious complications were not significantly associated between groups. On multivariate analysis, no significant association was noted, due to small sample size.

CONCLUSION

High CTGA, rounded lamellated shape appendicoliths, and proximal location of AL at appendix base are more likely to cause perforated appendicitis. However, studies with large sample size are needed to establish the true characteristics of appendicoliths resulting in PA.

CLINICAL RELEVANCE/APPLICATION

High clinical suspicion must be observed for patients who have equivocal clinical signs for PA but have appendicoliths with these characteristics on CT and higher CTGA.

RC608-07 Evaluation of an AI-based Detection of Acute Findings in Abdominal CTs: Towards an Automated Work List Prioritization of Routine CT Exams

Thursday, Nov. 29 10:20AM - 10:30AM Room: E451B

Participants
David J. Winkel, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose
Tobias Heye, MD, Basel , Switzerland (*Abstract Co-Author*) Nothing to Disclose
Thomas Weikert, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Daniel Boll, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To test the diagnostic performance of a deep learning-based triage system for the detection acute findings in abdominal computer tomography (CT) examinations.

METHOD AND MATERIALS

Using a RIS/PACS search engine, we obtained 100 consecutive abdominal CTs with at least one of the following findings: free-gas, free-fluid or fat-stranding and 100 control cases with absence of the listed findings. The CT data was analyzed using a convolutional neural network algorithm trained for detection of these findings on an independent sample. The validation of the results was performed on a web-based feedback system by one radiologist without prior knowledge of image findings through visual confirmation and in comparison with the original report. Measures of diagnostic accuracy were then calculated.

RESULTS

194 cases were included in the analysis, 6 excluded because of technical problems during the extraction of the DICOM datasets from the local PACS. Overall, the algorithm achieved a 93% sensitivity (91/98, 7 FN) and 97% specificity (93/96, 3 FP) in the detection of acute abdominal findings. Intraabdominal free gas was detected with a 92% sensitivity (54/59) and a 93% specificity (39/42), free fluid with a 85% sensitivity (68/80) and a 95% specificity (20/21) and fat stranding with a 81% sensitivity (42/50) and a 98% specificity (48/49). False-positive results were due to streak artifacts, partial volume effects and a misidentification of a diverticulum (each n = 1).

CONCLUSION

The algorithm's autonomous detection of acute pathological abdominal findings demonstrated a high diagnostic performance, enabling guidance of the radiology workflow towards prioritization of abdominal CT examinations with acute life threatening conditions

CLINICAL RELEVANCE/APPLICATION

Artificial Intelligence has the potential to become a key component in the radiology workflow optimization and empowers prioritization of urgent exams performed in a routine setting, thus enabling faster diagnosis, prompt communication and timely treatment.

RC608-08 Frequency Selective Nonlinear Blending in Computed Tomography for Diagnosis of Acute Gangrenous

Cholecystitis

Thursday, Nov. 29 10:30AM - 10:40AM Room: E451B

Awards
Trainee Research Prize - Resident

Participants
Ricarda Schwarz, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Malte N. Bongers, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Hendrik Ditt, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Clemens Hinterleitner, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Advisory Panel, Siemens AG; Speakers Bureau, Siemens AG; Speaker Bureau, Bayer AG
Hans Bosmuller, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Marius Horger, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To assess the potential benefit of frequency selective nonlinear blending (F-NLB) of contrast-enhanced CT-image (CECT) data for differentiation between gangrenous cholecystitis (GC) and acute non-gangrenous cholecystitis (AC) by comparison with conventional linear blending (LB) and histology.

METHOD AND MATERIALS

The local ethics committee approved this retrospective data analysis. We evaluated a total of 39 patients (26 men, mean age 67.8 ± 14.6 years) with clinical signs of acute cholecystitis that were referred to CECT for diagnosis and underwent subsequently surgery for cholecystitis. In average there were 4.7 days ± 4.1 days between CECT and surgery. Macroscopic evaluation of the resected gallbladders (GB) focused on the presence of focal or diffuse GB-wall necrosis, ulcera and perforation compatible with gangrenous cholecystitis. Cases with GB-perforation were assigned also to this group. CECT-image (portal-venous phase) data was evaluated by two radiologists in two different reading sessions using LB and F-NLB.

RESULTS

Histology yielded 31 GC and 8 AC. According to LB and F-NLB, cholecystitis was classified 7 GC and 32 AC and 29 GC and 10 AC, respectively. Recognition of GC reached significance only for F-NLB. 77% of GC were missed by LB. Sensitivity/specificity/PPV/NPV for LB for diagnosis of GC was 22.6%/100%/100%/25% and for F-NLB was 80.6%/50%/86.2%/40%.

CONCLUSION

F-NLB is superior to LB for early assessment of GC showing great agreement with histology.

CLINICAL RELEVANCE/APPLICATION

The main challenge for the radiologist in this emergency setting consists of making the difference between the GC and AC as accurate as possible in order to guide the surgeon in choosing the right treatment strategy (surgery vs. systemic antibiotics) and for the former to indicate the best operative approach (laparoscopic vs. open cholecystectomy). The former treatment strategy of systemic antibiotics or even external percutaneous drainage of GB may be indicated in elderly patients presenting with severe comorbidities, but only in case that they have no GC. At this point, enhancing diagnostic accuracy by increasing tissue contrast in the gallbladder wall between ischemic and non-ischemic areas might solve this dilemma.

RC608-09 Imaging of the Acute Non-pregnant Pelvis

Thursday, Nov. 29 10:55AM - 11:30AM Room: E451B

Participants
Christine O. Menias, MD, Chicago, IL (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Review the Imaging features in common emergent female pelvic conditions on Ultrasound, CT and MR. 2) Discuss the role of MRI in female Pelvic Emergencies and the practical issues involved. 3) Highlight common pitfalls and differential diagnoses in acute GYN conditions. 4) Emphasize the imaging features that should not be overlooked in acute GYN conditions.

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RC608-10 Usefulness of Diffusion-Weighted Magnetic Resonance Imaging on Comparison with Dynamic Contrast-enhanced Magnetic Resonance Images and Doppler Ultrasonography in Detection and Management of Testicular Torsion

Thursday, Nov. 29 11:30AM - 11:40AM Room: E451B

Participants
Balaji Jeevanandham, MBBS,MD, Chennai, India (*Presenter*) Nothing to Disclose

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PURPOSE

To compare the usefulness of diffusion-weighted magnetic resonance imaging with dynamic contrast enhanced magnetic resonance images and Doppler ultrasonography in detection and its usefulness in managementof testicular torsion

METHOD AND MATERIALS

This was a prospective study over a period of 2 years and 9 months with 78 patients were included in the study. Patients with acute scrotal pain and clinical suspicion of testicular torsions were included in the study. Patients who were known cases of epididymo-orchitis were excluded in the study. These patients were evaluated initially with ultrasound and Doppler examinations. Then the patients were imaged in Magnetic resonance imaging including T2, T2*, Diffusion weighted and Dynamic contrast enhanced images. Informed consents were obtained from the patients. Approval was obtained from institutional review board and local ethical committee.

RESULTS

Diagnostic quality images of diffusion weighted, ADC maps and Dynamic contrast subtracted images were obtained in 78 patients. In23 cases of testicular torsion as evidenced by flat curve in dynamic contrast enhanced images, the mean ADC values were significantly lower than that of the nonaffected testes (0.650 ± 0.216 vs. 1.017 ± 0.165 × 10-3 mm2/sec, $P < 0.05$). In other scrotal disorders ($n = 42$), there was no significant difference in the mean ADC value of the testes between the affected and nonaffected side ($P = 0.625$). In rest 13 cases no significant abnormality detected in both testes. The ADC value of affected-to-nonaffected testes ratio was significantly lower in cases testicular torsion than that in other scrotal disorders ($P < 0.05$).

CONCLUSION

In conclusion, this study has demonstrated that most cases of acute scrotum could be evaluated on the ADC map based on diffusion-weighted images using a 3.0 T MR system. Although diffusion-weighted imaging of the scrotum is still in the investigative stage, it can allow for the detection of testicular torsion without any use of contrast media.

CLINICAL RELEVANCE/APPLICATION

Diffusion-weighted imaging of scrotum with ADC measurements of testis can detect testicular torsion without any use of contrast media and is problem solving in equivocal cases which were difficult to dianose in Doppler ultrasonograph

RC608-11 Shortcuts Lead to Failure or Success? Analysis of the Diagnostic Accuracy of an Abbreviated MRCP Protocol in the Emergency Department

Thursday, Nov. 29 11:40AM - 11:50AM Room: E451B

Awards
Student Travel Stipend Award

Participants
David Tso, MD, Boston, MA (*Presenter*) Nothing to Disclose
Renata R. Almeida, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mohammad Mansouri, MD, MPH, Framingham, MA (*Abstract Co-Author*) Nothing to Disclose
Anand M. Prabhakar, MD, Somerville, MA (*Abstract Co-Author*) Nothing to Disclose
Ali S. Raja, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company; Institutional research support, General Electric Company; Stockholder, General Electric Company; Consultant, MedyMatch Technology, Ltd; Consultant, Takeda Pharmaceutical Company Limited; Consultant, D-Pharm Ltd
Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To determine the clinical utility and diagnostic accuracy of an abbreviated MRCP (A-MRCP) protocol in evaluating patients visiting the emergency department for suspected biliary obstruction.

METHOD AND MATERIALS

This is a retrospective study evaluating adult patients (Age 18 years and over) visiting a quaternary care, urban academic Level 1 trauma center between January 1, 2016 and December 31, 2017, who were imaged with MRCP while in the ED for suspected biliary obstruction. Patients were scanned with either the A-MRCP protocol consisting of 6 sequences, or the conventional MRCP (C-MRCP) protocol, consisting of 18 sequences. Findings of the A-MRCP studies were correlated with available subsequent ERCP. Other pertinent non-biliary findings were documented.

RESULTS

116 ED patients were scanned on the dedicated ED MRI scanner. Of those patients, 85 patients were scanned with the A-MRCP protocol (45.9% male, mean 57.4 years, median 57 years). The mean scan time for the A-MRCP protocol was 34 minutes,

significantly lower compared to the C-MRCP of 61 minutes ($p < 0.0001$). Only 1 study was prematurely aborted due to patient discomfort. The remainder of the studies were of diagnostic quality. 44.7% of patients received subsequent (diagnostic or therapeutic) ERCP (mean follow-up time [FU] 3 days), where the A-MRCP protocol identified 86.8% of the findings with a sensitivity of 85%, specificity of 88.9%, PPV 89.5%, NPV 84.2% using ERCP as the gold standard for the detection of biliary obstruction. A subsequent C-MRCP was acquired in 7.1% of cases for further characterization of lesions or equivocal findings (Mean FU time 66 days). Common non-biliary findings from the A-MRCP scans included pancreatic pathologies (21.1% of cases), most commonly pancreatitis (12.9%) or malignancy (8.2%). Hepatic findings were seen in 17.6% of cases and included cirrhosis (10.6%), solid liver lesions (4.7%), and abscesses (2.4%).

CONCLUSION

In the ED, abbreviated MRCP protocols for the evaluation of biliary obstruction significantly decreases the time to accurately diagnose biliary obstruction and can facilitate disposition of these patients.

CLINICAL RELEVANCE/APPLICATION

Abbreviated MR protocols have the potential to facilitate expedited management and disposition of patients in the ED while maintaining a high diagnostic accuracy.

RC608-12 Turning Around Cancer: Oncologic Imaging and Implications for Emergency Radiology Workflow

Thursday, Nov. 29 11:50AM - 12:00PM Room: E451B

Awards
Student Travel Stipend Award

Participants
Marc D. Succi, MD, Boston, MA (*Presenter*) Patent agreement, Frequency Therapeutics, LLC; Patent agreement, AugMI Labs, Inc; Stockholder, 2 Minute Medicine
Brian J. Yun, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ravi V. Gottumukkala, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
McKinley Glover IV, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jonathan Sonis, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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Benjamin A. White, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company; Institutional research support, General Electric Company; Stockholder, General Electric Company; Consultant, MedyMatch Technology, Ltd; Consultant, Takeda Pharmaceutical Company Limited; Consultant, D-Pharm Ltd
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Anand M. Prabhakar, MD, Somerville, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Oncology patients comprise a substantial portion of the patient population served by academic hospitals. As a result, academic ED radiology departments are performing an increasing number of oncologic imaging studies, including non-acute staging studies to assess disease status. We assessed how performing and reading non-acute oncologic examinations affects ED radiology workflow and turnaround time (TAT), as defined by the time from imaging start to final signed radiologist interpretation.

METHOD AND MATERIALS

We retrospectively identified all patients on whom computed tomography (CT) was performed and interpreted in a quaternary hospital ED during the period from February 2016 to September 2017. Any CT exam order history containing cancer descriptors were included. Subsequently, chart review was performed, with assessment of free text entered by ordering physicians to determine if CT indication was related to acute presentation. All CTs performed for routine acute ED indications, and not primarily oncologic staging, were excluded. A matched cohort of routine ED CT exams during the same period was identified. We then performed a multivariate log-transformed linear regression to compare TATs.

RESULTS

Following adjustment for age and CT imaging code, oncologic CTs were independently associated with an increased log TAT compared to the log time to interpretation for routine ED CTs (114.5 mins (IQR 112) versus 69 mins (IQR 67), respectively, $p<0.0001$). Average age, examination duration, time from initial order to scan completion, and time from scan completion to image availability in PACS did not significantly differ between the oncologic imaging group and the matched non-oncologic cohort.

CONCLUSION

Non-acute oncologic staging CTs in the ED are associated with a significantly longer TAT compared to routine ED CT examinations. This has important implications for how hospitals, especially quaternary care institutions, can improve workflow and reduce TATs by triaging non-acute oncologic imaging examinations to non-ED imaging divisions.

CLINICAL RELEVANCE/APPLICATION

Oncology patients who present to the emergency department (ED) are frequently imaged. We assessed the impact of non-acute oncologic imaging performed in the ED on emergency radiology workflow.

RC609

Imaging of the Esophagus, Stomach, and Small Bowel

Thursday, Nov. 29 8:30AM - 10:00AM Room: E351

GI

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

FDA Discussions may include off-label uses.

Participants
Judy Yee, MD, Bronx, NY (*Moderator*) Research Grant, EchoPixel, Inc; Research Grant, Koninklijke Philips NV;

Sub-Events

RC609A Imaging of Gastroesophageal Reflux and Complications

Participants
Cheri L. Canon, MD, Birmingham, AL (*Presenter*) Royalties, The McGraw-Hill Companies

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LEARNING OBJECTIVES

1) Describe radiographic findings in gastroesophageal reflux disease.

RC609B Imaging Following Bariatric Procedures

Participants
Laura R. Carucci, MD, Richmond, VA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the expected postoperative radiologic appearance following commonly performed bariatric surgical procedures for morbid obesity. 2) Describe and recognize common complications and potential pitfalls following these bariatric procedures.

RC609C Diagnosing and Reporting of Small Bowel Crohn's Disease

Participants
Joel G. Fletcher, MD, Rochester, MN (*Presenter*) Grant, Siemens AG; Consultant, Medtronic plc; ;

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LEARNING OBJECTIVES

1) Understand SAR/AGA recommendations for the utilization of CT and MR enterography in small bowel Crohn's disease. 2) Review the unifying morphologic construct describing Crohn's enteric inflammation. 3) Review imaging findings that differentiate non-specific small bowel inflammation from active inflammatory Crohn's disease. 4) Understand imaging findings that indicate moderate to severe active inflammatory Crohn's disease, including intramural edema, ulcerations, restricted diffusion, and mural thickening. 5) Understand the standardized SAR/AGA impressions to be used for CT and MR entrography in describing active inflammatory Crohn's disease and its stricturing and penetrating complications. 6) Review the difference between transmural response and transmural healing at CT and MR enterography and understand its prognostic significance.

RC609D Recognizing Internal Hernias

Participants
Lawrence C. Chow, MD, Stanford, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lchow@stanford.edu

LEARNING OBJECTIVES

1) Recognize the most common types of internal hernias associated with congenital fossae. 2) Recognize the most common types of post-surgical internal hernias. 3) Describe universal imaging features associated with internal hernias. 4) Discuss key anatomic relationships specific to the most common types of internal hernias.

Active Handout:Lawrence C. Chow

http://abstract.rsna.org/uploads/2018/18000684/Internal Hernias_LChow_RSNA2018 RC609.pdf

RC610

Liver and Biliary Tree, Including Doppler, Contrast, and Elastography

Thursday, Nov. 29 8:30AM - 10:00AM Room: S102CD

GI US

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

Sub-Events

RC610A Liver Doppler Ultrasound

Participants
Mark E. Lockhart, MD, Birmingham, AL (*Presenter*) Author, Oxford University Press; Author, JayPee Brothers Publishers; Editor, John Wiley & Sons, Inc; Deputy Editor, Journal of Ultrasound in Medicine

LEARNING OBJECTIVES

1) Describe the technique of hepatic Doppler ultrasound and methods to improve study quality. 2) Review qualitative and quantitative criteria for diagnosing vascular abnormalities in ultrasound Doppler examinations of the liver.

ABSTRACT

This presentation will initially describe the liver Doppler ultrasound examination with emphasis on techniques to improve study quality. Subsequently, normal Doppler waveforms and threshold values will be reviewed. A variety of abnormal liver Doppler findings will then be discussed in the context of several disease processes. A significant portion of the presentation will revolve around vascular abnormalities associated with liver diseases and evaluation of TIPS shunts will be addressed. Brief discussion of how diagnostic criteria apply to complications of liver transplantation will also be covered.

RC610B Liver Tumors: The Fundamentals of Interpretation with Contrast-enhanced Ultrasound

Participants
Stephanie R. Wilson, MD, Calgary, AB (*Presenter*) Equipment support, Koninklijke Philips NV; Equipment support, Siemens AG; Equipment support, Samsung Electronics Co, Ltd; Research support, Koninklijke Philips NV; Research support, Lantheus Medical Imaging, Inc; Speaker, Samsung Electronics Co, Ltd

For information about this presentation, contact:

stephanie.wilson@ahs.ca

LEARNING OBJECTIVES

1) Provide specific diagnoses of focal over masses based on the CEUS arterial phase imaging patterns. 2) Predict malignancy based on the changes in enhancement occurring in the portal venous phase. 3) Appreciate the advantages afforded by dynamic real time imaging for CEUS showing enhancement regardless of its timing or duration.

RC610C Liver Elastography

Participants
Paul S. Sidhu, MRCP, FRCR, London, United Kingdom (*Presenter*) Speaker, Koninklijke Philips NV; Speaker, Bracco Group; Speaker, Hitachi, Ltd; Speaker, Siemens AG; Speaker, Samsung Electronics Co, Ltd; Advisory Board, Samsung Electronics Co, Ltd; Advisory Board, Itreas Ltd

For information about this presentation, contact:

paulsidhu@nhs.net

LEARNING OBJECTIVES

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

An overview of liver ultrasound elastography, with emphasis on the techniques, clinical application and limitations of the technique.

RC610D Gallbladder and Biliary Disease

Participants
Robin P. Goldenson, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the utility of Ultrasound to assess the gallbladder and biliary tree including technical considerations. 2) To be able to identify a broad range of pathological conditions involving the gallbladder and biliary tree. 3) To be able to help referring clinicians

with management and follow up of findings seen incidentally such as gallbladder polyps.

ABSTRACT

Ultrasound is arguably the best way to assess clinical concerns about the gallbladder and biliary tree, common problems in the United States and around the world. Often, the Ultrasound Department is the first to assess a patient who presents with right upper quadrant pain, jaundice, or abnormalities in liver function tests, among others. In addition, abnormalities of the gallbladder and biliary tree can be identified incidentally on imaging studies performed for other indications. This presentation will review common pathology of the gallbladder and biliary tree as well as complications and challenges related to diagnosis. In addition, less common pathology will be discussed as well as suggestions for the management and follow-up of commonly seen incidental findings such as gallbladder polyps.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RC611

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

Thursday, Nov. 29 8:30AM - 10:00AM Room: S504CD

CA CT NM

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

FDA Discussions may include off-label uses.

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 minizing 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

RC611A Advances in Cardiac SPECT

Participants
E. Gordon Depuey, MD, New York, NY (*Presenter*) Nothing to Disclose

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 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.

RC611B Advances in Cardiac PET

Participants
Sharmila Dorbala, MD,MPH, Boston, MA (*Presenter*) Research Grant, Astellas Group

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 coronary artery disease. 3) Discuss novel clinical applications of cardiovascular PET imaging in systemic diseases 4) Review Case Examples of Cardiac PETs

ABSTRACT

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. Robust clinical evidence coupled with 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. A growing body of recent literature supports the role of targeted molecular PET to image inflammatory, infectious and infiltrative heart diseases. 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 current advanced clinical tool. 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.

RC611C Cases, Clinical Examples-Panel: How to Build Practice (Both PET and SPECT)

Participants
E. Gordon Depuey, MD, New York, NY (*Presenter*) Nothing to Disclose
Sharmila Dorbala, MD,MPH, Boston, MA (*Presenter*) Research Grant, Astellas Group

LEARNING OBJECTIVES

1) Interpret cardiac SPECT and PET scans with optimal sensitivity and specificity. 2) Recognize technical and patient-related artifacts. 3) Characterize myocardial perfusion defects whereby patients can be risk stratified with regard to risk of future cardiac events. 4) Formulate reports in a clinically relevant manner.

RC612

Diseases of the Thoraco-abdominal Aorta

Thursday, Nov. 29 8:30AM - 10:00AM Room: S503AB

CH VA

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

FDA Discussions may include off-label uses.

Participants
Phillip M. Young, MD, Rochester, MN (*Moderator*) Consultant, Arterys Inc
Kate Hanneman, MD, FRCPC, Toronto, ON (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

kate.hanneman@uhn.ca

LEARNING OBJECTIVES

1) Discuss the epidemiology of aortic dissections. 2) Review multi-modality imaging findings in patients with acute and chronic dissections. 3) Describe protocols for imaging and techniques for accurately measuring aortic aneurysms. 4) Indicate key measurements and observations relevant to the clinician when interpreting aortic aneurysms. 5) Discuss important secondary findings that may indicate increased risk of aneurysm rupture or influence management decisions. 6. Understand the typical imaging features of large vessel vasculitis and its complications. 7. Discuss challenging cases with insights from pathologic correlation. 8. Understand the role of imaging in diagnosis and management of these disorders. 9) Identify the significance of early versus delayed endograft complications. 10) Describe types of endoleaks including fenestrated aortic grafts. 11) Present treatment of endoleaks and follow-up imaging.

Sub-Events

RC612A Imaging of Aortic Dissection

Participants
Kate Hanneman, MD, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

kate.hanneman@uhn.ca

LEARNING OBJECTIVES

1) Discuss the epidemiology of aortic dissections. 2) Review multi-modality imaging findings in patients with acute and chronic dissections.

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/ Kate Hanneman, MD, FRCPC - 2017 Honored EducatorKate Hanneman, MD, FRCPC - 2018 Honored Educator

RC612B Imaging of Aortic Aneurysm

Participants
Iain D. Kirkpatrick, MD, Winnipeg, MB (*Presenter*) Speaker, Siemens AG

For information about this presentation, contact:

kirkpatrick_iain@hotmail.com

LEARNING OBJECTIVES

1) Describe protocols for imaging and techniques for accurately measuring aortic aneurysms. 2) Indicate key measurements and observations relevant to the clinician when interpreting aortic aneurysms. 3) Discuss important secondary findings that may indicate increased risk of aneurysm rupture or influence management decisions.

ABSTRACT

Aortic aneurysms are a frequent finding on thoracoabdominal CT, and in an era of minimally invasive treatment it is increasingly important to be able to accurately image, measure and characterize them. This session will discuss how to optimize your scanning protocols for assessing aortic aneurysms as well as how to most accurately measure them. Key measurements and observations useful for clinicians will be reviewed. Signs of impending rupture or which suggest an infectious/inflammatory aneurysm will be discussed, as well as risk assessment for rupture.

RC612C Imaging of Vasculitis

Participants
Phillip M. Young, MD, Rochester, MN (*Presenter*) Consultant, Arterys Inc

For information about this presentation, contact:

young.phillip@mayo.edu

LEARNING OBJECTIVES

1. Understand the typical imaging features of large vessel vasculitis and its complications 2. Discuss challenging cases with insights from pathologic correlation 3. Understand the role of imaging in diagnosis and management of these disorders.

RC612D Aortic Repair Complications: CT Imaging Findings You Need to Know

Participants
Terri J. Vrtiska, MD, Rochester, MN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

vrtiska.terri@mayo.edu

LEARNING OBJECTIVES

1) Identify the significance of early versus delayed endograft complications. 2) Describe types of endoleaks including fenestrated aortic grafts. 3) Present treatment of endoleaks and follow-up 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/ Terri J. Vrtiska, MD - 2016 Honored Educator

RC613

Pediatric Series: Pediatric Safety and Quality

Thursday, Nov. 29 8:30AM - 12:00PM Room: S502AB

PD SQ

AMA PRA Category 1 Credits ™: 3.00
ARRT Category A+ Credits: 3.75

FDA Discussions may include off-label uses.

Participants
Neville Irani, MD, Kansas City, KS (*Moderator*) Nothing to Disclose
Alex Towbin, MD, Cincinnati, OH (*Moderator*) Author, Reed Elsevier; Grant, Guerbet SA; Grant, Siemens AG; Grant, Cystic Fibrosis Foundation; Consultant, Anderson Publishing, Ltd; Advisory Board, IBM Corporation; Advisory Board, KLAS Enterprises LLC;
Nadja Kadom, MD, Atlanta, GA (*Moderator*) Nothing to Disclose
Nghia Vo, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events

RC613-01 Optimizing Run Times for MRI Protocols: Successes and Lessons Learned

Thursday, Nov. 29 8:30AM - 8:50AM Room: S502AB

Participants
Neville Irani, MD, Kansas City, KS (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how to determine a viable focus area for improvement. 2) Know the common errors made during quality improvement projects. 3) Become familiar with a method to quantify return on investment upon conclusion of your project.

RC613-02 Beyond the DRL: Applying Automated Quality Metrics to Assess Pediatric CT Program Liver Lesion Detection Performance

Thursday, Nov. 29 8:50AM - 9:00AM Room: S502AB

Participants
Tyler Lacy, Durham, NC (*Presenter*) Nothing to Disclose
Aiping Ding, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Ehsan Abadi, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Yakun Zhang, MS, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Francesco Ria, DMP, 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; Advisory Board, medInt Holdings, LLC; License agreement, 12 Sigma Technologies; License agreement, Gammex, Inc
Donald P. Frush, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

donald.frush@duke.edu

PURPOSE

To apply an automated program for evaluating pediatric body CT study quality which utilizes metrics of dose and image quality for optimization of liver lesion detection.

METHOD AND MATERIALS

With IRB approval, 880 clinical contrast-enhanced abdominopelvic (AP) CT scans of patients 0-18 years were evaluated. Studies were from Siemens Flash (n=621), GE 750 HD (n=151), and GE VCT (n=108). A quantitative metric of the detection of a potential 5 mm liver lesion was used as a marker for image quality (IQ). To generate this, metrics of spatial resolution, background noise, and lesion contrast were composited. Resolution was assessed by a validated method based on anatomical edges. For noise, phantom noise power spectra were matched to patient-specific scan parameters. For contrast, a 50 Hounsfield unit difference between the IV enhanced liver and a potential 5 mm lesion was the clinical task. The three quality metrics were used to calculate a single established detectability index (d') which represents the relative likelihood of detecting the lesion and was previously correlated with observer performance. Dose reports were extracted for each dataset using an institutional dose monitoring program. Relationships between d' and radiation dose were explored.

RESULTS

There was little CTDIvol variability across ages. For example, AP studies at 100 kVp on one scanner model had a median CTDIvol of 3.0 mGy (2.8-3.4 mGy interquartile range). However, when applying d', the age groups separated such that the younger patients had higher IQ than the older patients (Figure). For the youngest age group, d' and CTDIvol (medians) were 80 and 2.7 mGy; middle groups, 59 and 2.9 mGy; and oldest group, 42 and 3.4 mGy.

CONCLUSION

An automated method to assess clinical IQ using a task-based and patient-specific metric was ascertained. The d' allows establishment of quality reference levels (QRLs) which account for IQ and dose. This provides for robust quality quantification that can serve for single or collective patient CT performance assessment and optimization. Automation also facilitates potential integration with CT registries and investigations using machine learning approaches not feasible with observer ratings alone.

CLINICAL RELEVANCE/APPLICATION

Optimization in CT utilizes DRLs based on dose estimates without metrics of image quality. The addition of quality measures taken from clinical examinations affords improved CT performance assessment.

RC613-03 Contrast-Induced Nephropathy in Pediatric Patients: A Propensity Score-Adjusted Study

Thursday, Nov. 29 9:00AM - 9:10AM Room: S502AB

Participants
Jennifer S. Mcdonald, PhD, Rochester, MN (*Presenter*) Research Grant, General Electric Company; Scientific Advisor, General Electric Company
Robert J. McDonald, MD,PhD, Rochester, MN (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company; Consultant, Bracco Group
Cheryl L. Tran, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Amy B. Kolbe, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Eric E. Williamson, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
David F. Kallmes, MD, Rochester, MN (*Abstract Co-Author*) Research support, Terumo Corporation; Research support, Medtronic plc; Research support, Sequent Medical, Inc; Research support, Benvenue Medical, Inc; Research support, General Electric Company; Consultant, General Electric Company; Consultant, Medtronic plc; Consultant, Johnson & Johnson

For information about this presentation, contact:

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PURPOSE

The risks of iodinated contrast material administration in pediatric patients are not well defined. The purpose of this study was to examine the rates of acute kidney injury (AKI), dialysis, and death following intravenous contrast material administration in a cohort of pediatric patients.

METHOD AND MATERIALS

Pediatric (<18 yo) patients were identified who underwent either a contrast-enhanced (contrast group) or unenhanced (noncontrast group) CT scan at our institution from 12/2001-1/2016. Patients with insufficient pre- and post-CT creatinine results, who received other iodinated contrast material at the time of CT scan, or who were on dialysis at the time of CT scan were excluded. Contrast and noncontrast group patients underwent propensity score analysis using numerous acute and chronic clinical covariates based on contrast exposure before comparing rates of AKI, dialysis, and death.

RESULTS

A total of 2201 pediatric patients (1773 contrast, 428 noncontrast) were identified. The rate of AKI and dialysis in the contrast group was 3.3% (59/1773) and 0.1% (2/1773), respectively. Following propensity score adjustment, similar rates of AKI (stage 1 AKI OR (95% CI) 0.75 (0.32-1.78), p=.51; stage 2 AKI OR 2.00 (0.18-21.9), p=.57; stage 3 AKI OR 0.50 (0.05-5.48), p=.57), dialysis (OR 1.00 (0.06-15.9, p=.99), and death (OR 1.50 (0.53-4.22), p=.44) were observed between the contrast and noncontrast groups. All patients diagnosed with post-CT stage 3 AKI were found to have other, contrast-independent potential causes of AKI.

CONCLUSION

Rates of AKI, dialysis, and death following contrast-enhanced CT scan were very low in this pediatric cohort. Administration of intravenous contrast material was not associated with an increased risk of these outcomes following propensity-score adjustment.

CLINICAL RELEVANCE/APPLICATION

These findings demonstrate that AKI and other sequelae are rare following intravenous iodinated contrast material administration in pediatric patients.

RC613-04 Safety of Repeated Pediatric Hyperpolarized 3He MR Imaging in Asthma

Thursday, Nov. 29 9:10AM - 9:20AM Room: S502AB

Participants
Nanae Tsuchiya, Madison, WI (*Presenter*) Nothing to Disclose
Mark L. Schiebler, MD, Madison, WI (*Abstract Co-Author*) Stockholder, Stemina Biomarker Discovery, Inc; Stockholder, HealthMyne, Inc;
Michael Evans, MS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Robert V. Cadman, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Ronald L. Sorkness, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Sean B. Fain, PhD, Madison, WI (*Abstract Co-Author*) Research Grant, General Electric Company Research Consultant, Marvel Medtech, LLC

PURPOSE

The purpose of this study was to evaluate the safety of pediatric hyperpolarized helium 3 magnetic resonance imaging (HP3He MRI) in children with asthma or potential risk of asthma.

METHOD AND MATERIALS

This was an IRB approved prospective study with parental informed consent, and assent from each child. HP3He MRI was performed in 66 children (age range 8 -18 years 38 boys, 28 girls). Fifty-five subjects received a repeated follow-up examination and 5

subjects received two repeated follow-up examinations. A total of 127 HP3He MRI exams were assessed. Heart rate (HR), respiratory rate (RR) and oxygen saturation (SpO2) were recorded before, during (2min and 5 min after gas inhalation) and 1 hour after MRI. Blood pressure (BP) was obtained before and 1 hour after MRI. Any subjective symptoms were also noted. Changes in vital signs were tested for significance across time and subject age group (8-12 years, 13-15 years, 16-18 years) by using linear mixed effect models. A p value less than 0.05 determined statistical significance.

RESULTS

There were no serious adverse events. Only two minor adverse events (1.57%, headache and dizziness) were recorded. HR (p=0.007) and SpO2 (p=0.0004) were higher at 1 hour after MRI than at baseline. There were no significant changes of RR and BP in whole population. The 8-12 year-old age group had an increase in HR at 1 hour after MRI (p=0.005), a decrease in RR at 2 minutes (p=0.009) and 5 minutes (p=0.002), and an increase in SpO2 at 1 hour after gas inhalation (P<0.0001). In the 16-18 year-old group a decrease in SpO2 at 2 minutes after gas inhalation (p=0.002) was observed. No subject required treatment after HP3He MRI.

CONCLUSION

HP3He MRI was safely performed in children with asthma or potential risk of asthma, including repeated examinations in a subset of the study population. Although vital signs were slightly changed during and after MRI, there were no physiological vital signs requiring advanced monitoring or treatment. The younger age group tended to have vital signs that were more variable than their older peers.

CLINICAL RELEVANCE/APPLICATION

The use of HP3He MRI is safe in pediatric subjects with asthma. The pulse oximetry oxygen saturation levels (SpO2) were not adversely affected by this test.

RC613-06 A Novel Methodology for Automated Image Quality Assessment of Pediatric CT

Thursday, Nov. 29 9:30AM - 9:40AM Room: S502AB

Awards
Student Travel Stipend Award

Participants
Tyler Lacy, Durham, NC (*Presenter*) Nothing to Disclose
Aiping Ding, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Ehsan Abadi, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Yakun Zhang, MS, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Francesco Ria, DMP, 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; Advisory Board, medInt Holdings, LLC; License agreement, 12 Sigma Technologies; License agreement, Gammex, Inc
Donald P. Frush, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

donald.frush@duke.edu

PURPOSE

To develop an effective and automated methodology for patient-specific image quality assessment of clinical pediatric body CT examinations.

METHOD AND MATERIALS

This IRB approved study evaluated 816 clinically performed (6/14-11/17), contrast-enhanced abdominopelvic (AP) CT scans of pts ages 0-18. Studies were from 3 scanners: Siemens Flash (n=637), GE 750 HD (n=72), and GE VCT (n=107). Quality metrics included noise magnitude, spatial resolution, and image contrast enhancement. Previously validated methods to measure these in adults were modified and validated for use in pediatric clinical CT images. For noise, the algorithm uses uniform areas of the images to characterize the standard deviation (SD) of Hounsfield units (HU). For contrast, the algorithm identifies ROIs in the liver, lung, aorta, and spine and measures HU values and SD. For resolution, the algorithm samples the skin-air interface which allows for quantification of spatial resolution. The frequency at 50% of the MTF curve is used in our resolution reporting which was found concordant with observer performance.

RESULTS

This system allows for determination of quality variability between any divisions of patient- or scanner-specific metrics (e.g., age, size, gender, model, protocol). In one scanner, between the youngest and oldest age groups, noise increased by 89%, absolute contrast in the liver increased by 14%, the standard deviation of liver contrast increased by 129%, and the f50 value for resolution decreased by 6% (Figure).

CONCLUSION

A novel automated system to obtain advanced quantitative image quality metrics in clinically performed AP examinations in children was established. We are able to quantitatively assess differences between metrics of study quality from patient studies rather than using simplistic phantom studies, observer studies, or manual determination of quality. One benefit of this model is that these patient-specific metrics can be integrated to generate a task-specific quantification to predict observer performance on lesion detection. This quantitative tool serves as a foundation for true CT performance optimizations beyond what can be achieved with the current quality assessment methods and dose monitoring alone.

CLINICAL RELEVANCE/APPLICATION

Current CT practice quality optimization utilizes phantom studies or cumbersome methods that require observers or manual analysis. Automated quality metrics would improve assessment of CT performance.

RC613-07 Variation in Pediatric CT Dose Indices Across the USA: Does the Type of Hospital Matter?

Thursday, Nov. 29 9:40AM - 9:50AM Room: S502AB

Participants
Keith J. Strauss, MS, Cincinnati, OH (*Presenter*) Consultant, Medical Physics Consultants, Inc Consultant, Koninklijke Philips NV Speakers Bureau, Koninklijke Philips NV
Elanchezhian Somasundaram, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Debapriya Sengupta, MBBS,MPH, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Jennifer R. Marin, MD,MSc, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Samuel L. Brady, PHD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

keith.strauss@cchmc.org

PURPOSE

To compare three CT dose indices during pediatric imaging in academic pediatric (APED) hospitals to academic adult (AADLT), non-academic adult (NAADLT) and non-academic pediatric (NAPED) hospitals for three CT examinations.

METHOD AND MATERIALS

A list published by Children's Hospital Association identified 250 pediatric hospitals in the USA. All other institutions were classified as adult facilities. An institution with a medical school affiliation was labeled an academic center. All other institutions were labeled non-academic. The National Radiology Data Registry (NRDR) for calendar years 2016 and 2017 (N=240301) provided dose data for 3 CT examinations: Brain no IV contrast, Chest no IV contrast, and Abdomen-Pelvis with IV contrast. Pediatric patients were grouped into six and five size ranges respectively for trunk and head examinations. CT dose Index volume (CTDIvol), size specific dose estimate (SSDE), and the Dose Length Product (DLP) were compared for trunk exams; SSDE could not be compared for head examinations as it is not defined. The unequal variance T-test and F-test were used to test the hypotheses that the dose index levels and variances respectively in the APED hospitals are lower than the three other hospital groups. Statistical tests were performed for each size category and the Bonferroni-Holm correction factor was employed to establish the level of statistical significance for the statistical tests to perform multiple comparisons.

RESULTS

Analysis indicates for the majority of size groups (>=83%) the APED hospitals had statistically lower CTDIvol, DLP, and SSDE dose levels and less variability compared to AADLT, NAADLT, and NAPED hospitals. The mean percentage difference in CTDIvol for APED hospitals compared to non-academic pediatric, academic adult, and non-academic adult hospitals were lower by 45±3%, 67±3% and 71±3% across all the size groups and exam types.

CONCLUSION

The results support the hypothesis that pediatric hospitals with academic affiliations use lower, more consistent (lower variance) dose levels during pediatric CT imaging than non-academic pediatric or adult hospitals.

CLINICAL RELEVANCE/APPLICATION

These results identify the need, with the help of medical physicists, to improve imaging techniques for pediatric patients undergoing CT examinations in non-academic pediatric and adult hospitals

RC613-08 Pediatric Quality Initiatives in a Large, Multi-centric Practice

Thursday, Nov. 29 9:50AM - 10:10AM Room: S502AB

Participants
Richard E. Heller III, MD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

richard.heller@radpartners.com

LEARNING OBJECTIVES

1) Understand the value of quality improvement projects in a large group practice. 2) Describe the challenges and opportunities associated with QI projects in a multi-centric practice. 3) Outline the role of technology in operationalizing projects.

RC613-09 Leading Change: Examples from the Frontline

Thursday, Nov. 29 10:30AM - 10:50AM Room: S502AB

Participants
Alex Towbin, MD, Cincinnati, OH (*Presenter*) Author, Reed Elsevier; Grant, Guerbet SA; Grant, Siemens AG; Grant, Cystic Fibrosis Foundation; Consultant, Anderson Publishing, Ltd; Advisory Board, IBM Corporation; Advisory Board, KLAS Enterprises LLC;

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LEARNING OBJECTIVES

1) Describe at least 3 methods of leading change. 2) Describe at least three common causes of resistance to change.

ABSTRACT

Change is hard. Radiology departments strive to constantly improve. While the motiviation to improve can come from within the department or external to the department, the changes related to improcvement are often met with resistance. The purpose of this lecture is to describe multiple improvement projects and discuss the methods that the project leaders used to address resistance and incentivize change.

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/ Alex Towbin, MD - 2014 Honored Educator

RC613-10 Improving Efficiency and Patient Access for Pediatric Sedation MRI

Thursday, Nov. 29 10:50AM - 11:00AM Room: S502AB

Participants
Shlomit Goldberg-Stein, MD, Bronx, NY (*Presenter*) Nothing to Disclose
Mark C. Liszewski, MD, Bronx, NY (*Abstract Co-Author*) Grant, Carestream Health, Inc; Advisory Board, Carestream Health, Inc
Kenay Johnson, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Aralis Ferreira, MS, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Glenn Mann, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Chhavi Katyal, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Kimberly DeFatta, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Marcel Stevenson, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Todd S. Miller, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Seymour Sprayregen, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Vera Donnelly, RN, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Steven Choi, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Wait time for pediatric sedation MRI appointment was >7 weeks at the start of this project. The service was inefficient with median first-case start time of 9:23am for 8am exams, with a high (23%, n=89) rate of same-day cancellations, 20% of which were due to ineffectual pre-screening for sedation suitability. Our SMART aim was to decrease MRI median start time by 50% by 11/30/17, with secondary aims to lower the same-day cancellation rate and improve access to appointments.

METHOD AND MATERIALS

We adopted a structured performance improvement project using a Donabedian model, process maps, waste walks, Ishikawa and key driver diagrams, and Pareto charts. Outcome measure was First-Case MRI start time. Four process measures were: Patient Arrival, RN Assessment Time, Sedation NP Arrival, Sedation MD Arrival. Late patient arrival was targeted over 3 PDSA cycles: PDSA 1- Management of Variation: Standardized pre-call messaging; PDSA 2- Use of Cognitive Aids: Implemented checklist and standard-language for appointment confirmations and required 3 call-attempts at 48 hrs (vs. 24 hrs) prior to appointment; PDSA 3- Enhancing relationships: Obtained free valet parking for pediatric sedation MRI. PDSA 4- Standardizing Work: Created work process for sedation pre-screening.

RESULTS

Baseline data (12/2016- 2/2017) were: 1) Patient Arrival: Median 8:06am (7:46-10:40am); 2) RN Assessment: Median 29min (10-45min); 3) Sedation NP Arrival: Median 8:30am (7:35-10am); 4) Sedation MD Arrival: Median 8:30am (7:35-10am). Baseline MRI First Case Start-Time was median 83min after 8am (range 27-195min). Run charts demonstrate improvements in late patient arrival for PDSA1 (8:06 to 7:25am), PDSA2 (7:25 to 7:20am), and PDSA3 (7:20 to 7:11am). Run chart of First-Case MRI Start demonstrates special cause variation with median decrease from 9:23 to 8:55am. PDSA 4 dropped screening failure cancellations 27% to 10%. Access improved from 51 to 12-day appointment wait.

CONCLUSION

We demonstrate significant improvement (by 35%) in first case start-time for Pediatric Sedation MRI exams. Patient arrival time was significantly improved (71 to 11min delay). Same-day cancellations from screening failure decreased 27% to 10%. Patient access to pediatric sedation MRI appointments improved from 51 to 12 days.

CLINICAL RELEVANCE/APPLICATION

A Quality Improvement Team reduced first-case delays and eliminated a backlog of patients waiting for pediatric sedation MRI appointments.

RC613-11 Image to Image Translation of Pediatric Computed Tomography through the Generative Adversarial Network (GAN)-Based Deep Learning Approach

Thursday, Nov. 29 11:00AM - 11:10AM Room: S502AB

Participants
Sun Kyoung You, MD, Daejeon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jeong Eun Lee, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyoung Suk Park, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kiwan Jeon, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the clinical feasibility of the virtual 120 kilovoltage (kVp) image made by a generative adversarial network (GAN)-based deep learning approach using the original 80 kVp image of pediatric abdominal and pelvic computed tomography (APCT).

METHOD AND MATERIALS

Total 82 low dose APCT (LDCT; fixed 80 kVp and 100 mAs reference tube current) and 65 conventional APCT (CCT; fixed 120 kVp and 200 mAs reference tube current) thorough 64-channel multidetector CT scanner in the emergency room were included in our study. We prepared a data set by selecting 20 dcm files that contain the portal vein and liver for each patients. The dataset of 42 patients from LDCT and 42 patients from CCT were used for training of GAN. We train a GAN based model that enables the 80 kVp image-to-120 kVp image transformation with unpaired 80 kVp and 120 kVp images. To preserve the morphological structure of 80 kVp image, the proposed model includes an additional penalty that enforces similarities between 80 kVp and corresponding virtual

120 image. Other datasets of 41 patients from LDCT were used to create the virtual 120 kVp images (VI) as the original 80 kVp images (OI). Quantitative and qualitative image analyses were performed by two radiologists to compare the OI and VI.

RESULTS

The mean CT number of the portal vein, liver, psoas muscles and the mean image noise in OI were higher than in VI ($p<0.001$, respectively). The mean CNR of the main portal vein, the mean SNR of the portal vein and the liver of VI were higher than in OI ($p<0.001$, $p<0.001$, $P=0.001$, respectively). Qualitative analysis showed no significant difference between the two groups with substantial agreement between two reviewers.

CONCLUSION

GAN-created virtual image can be applied to conventional CT scanner, which can not be applied recent developed dose reducing programs, and our results are expected to be extended to other areas of low dose CT. Our study suggest new direction of low dose CT research using deep learing algorithm.

CLINICAL RELEVANCE/APPLICATION

Image to image translation based on generative adversarial network (GAN)-based deep learning can be applied to conventional CT scanner. If the result of our studies extended to overweight children or adolescents, this could be applicable to adult patients with low body mass.

RC613-12 Effect of Pediatric Emergency Care Applied Research Network (PECARN) Algorithm Embedded in EMR on Head CT Utilization in Minor Pediatric Head Trauma

Thursday, Nov. 29 11:10AM - 11:20AM Room: S502AB

Participants
Joel Y. Sun, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Ryan K. Lee, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Bryan J. Kang, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Neena David, MD, Hershey, PA (*Abstract Co-Author*) Nothing to Disclose
Terence A. Matalon, MD, Philadelphia, PA (*Abstract Co-Author*) Speaker, Koninklijke Philips NV

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PURPOSE

To determine the effect embedding PECARN algorithm has on the utilization of head CT in pediatric patients with minor head trauma. We previously presented (SIIM 2018) that implementation of PECARN into the EMR increased the compliance of adherence to PECARN algorithm from 30% (before) to 80%(after).

METHOD AND MATERIALS

A clinical decision algorithm for minor pediatric head trauma was developed based on the PECARN validated algorithms for the identification of children under age 18 in the setting of minor head trauma. The CDS was implemented into the EHR at a level 1 trauma center and two suburban hospitals. Head CT use and the total number of ED visits made by patients under 18 presenting with a traumatic indication was obtained prior to implementation of PECARN in the EMR (September 2016- August 2017) and after the implementation of PECARN in the EMR (September 2017- March 2018). Head CT outcomes for both time periods were also reviewed, with a positive result defined as the presence of intracranial hemorrhage or calvarial fracture.

RESULTS

Out of 670 pediatric trauma ED visits before implementation of CDS, 58 head CTs were obtained (8.7%). After implementation of CDS, 61 head CTs were obtained out of 649 ED visits (9.4%), which was not significantly different ($p=0.67$). One head CT (1.7%) was positive during the pre-intervention period and 6 exams (9.8%) were positive during the post-intervention period, which was not significantly increased ($p=0.07$).

CONCLUSION

Despite the improved compliance for PECARN as a result of implementation of PERCARN into the EMR, it does not affect utilization of head CT for pediatric head trauma in the ED. Furthermore, implementation of this algorithm into the EMR does not have an effect on the identification of intracranial hemorrhages. Despite this, implementation of PECARN in EMR improves standardization of care through the improved compliance of the algorithm.

CLINICAL RELEVANCE/APPLICATION

The implementation of a PECARN derived CDS can improve adherence to evidence based guidelines without affecting utilization.

RC613-13 Image Gently and Rapidly - Elimination of Sedation and Repeat Scans: How Fast is Fast Enough?

Thursday, Nov. 29 11:20AM - 11:30AM Room: S502AB

Participants
Marta Hernanz-Schulman, MD, Nashville, TN (*Presenter*) Nothing to Disclose
Diana E. Carver, PhD, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
Kenneth Lewis, PHD, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
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David R. Pickens III, PhD, Nashville, TN (*Abstract Co-Author*) Stockholder, Johnson & Johnson; Stockholder, Thermo Fisher Scientific Inc; Stockholder, Pfizer Inc; Stockholder, Merck & Co, Inc; Stockholder, Bristol-Myers Squibb Company; Stockholder, Celgene Corporation; Stockholder, Henry Schein Inc; Stockholder, Cepheid; Stockholder, Maximus Medical; Stockholder, Teleflex Incorporated; ; ;

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PURPOSE

Motion can affect many pediatric scans, and scans of older patients who are tachypneic or in distress. Obtaining diagnostic CT scans on young or uncooperative children may require sedation, result in repeated scans, or delay the performance of urgent examinations, particularly those intolerant of any patient motion, such as angiography. Newer CT units have lower tube rotation times (TRT), higher table speeds and pitches (P) than earlier versions of multislice spiral equipment. Our purpose was to investigate the acquisition speed at which motion could be consistently frozen in a simulated moving patient

METHOD AND MATERIALS

An oval fluid-filled object measuring 6.3 cm long, 6.7 cm wide, 5.0 cm across, was scanned stationary and then rotating at 20 RPM at 120 kVp and 20 mA. TRT and P were varied resulting in scan times (ST) between 0.1 and 2.5 seconds. Image motion was quantified by: 1) dividing standard deviation (SD) around object edges by background SD (O/B), 2) counting number of side lobes (NSL) generated 3) subjective grading image quality by a pediatric radiologist and a pediatric neuroradiologist as near motionless (G1) diagnostic (G2) limited(G3) or unusable (G4)

RESULTS

The stationary O/B was 1.6; SL = 0. Moving object O/B ranged from 1.2 (TRT=0.28s, P=3.0, ST=0.10s [G1]) to 114 (TRT=1s, P=0.6, ST=2.46s [G4]). NSL ranged from 0 (TRT=0.25s, P=3.0, ST=0.09[G1]) to too numerous to count (TRT=1s, P=0.6, ST=2.46s[G4]). Images with TRT=0.25s and 0.28s, when coupled with a P >1.5 and ST <0.18sec had O/B=1.2 to 2.8 and were graded G1 or G2. Images obtained with TRT=0.4s, P=0.8 to1.3 and ST=0.49s to 0.79s were limited (G3). Images with a TRT >= 0.75s , P=0.64 to 1.0 and ST = 1.2s-2.5s had O/B 64-114 and were unusable (G4), while more than doubling the dose to 50mAs

CONCLUSION

Fractions of a second matter. Scans with TR 0.4 had poor motion suppression, and were nondiagnostic at pitches of <1 with ST >0.5 seconds while more than doubling radiation dose. Scans with TR 0.28 or lower had diagnostic images at pitches greater than 1.5, with the fastest settings, highest pitches and ST <0.2 seconds nearly freezing object motion

CLINICAL RELEVANCE/APPLICATION

Knowledge of speed where patient motion freezes will help determine investment in equipment, which patients will not need sedation, optimize protocol parameters, and decrease or eliminate repeat scans

RC613-14 Brain Iron Deposition after Ferumoxytol-enhanced MRI: A Study of Pediatric and Porcine Brains

Thursday, Nov. 29 11:30AM - 11:40AM Room: S502AB

Participants
Ashok Joseph Theruvath, MD, Mainz, CA (*Presenter*) Nothing to Disclose
Michael Iv, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Laura J. Pisani, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Olga Lenkov, BSC, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Kristen W. Yeom, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Heike E. Daldrup-Link, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Iron oxide nanoparticles are re-emerging as promising contrast agents for MRI. While gadolinium deposition in the brain has raised safety concerns, it is unknown if iron oxide nanoparticles are deposited in brain as well. The purpose of this study was to evaluate, if intravenously administered ferumoxytol nanoparticles are deposited in brain tissue.

METHOD AND MATERIALS

In an IRB-approved retrospective case-control study, 12 pediatric patients (age 4-24, mean 12.3) received at least two ferumoxytol injections intravenously (3mg/kg) for brain MRIs at 3T with quantitative susceptibility mapping and R2* maps. 12 additional patients served as unexposed controls. In addition, brains of 10 pigs, who received 1-2 intravenous ferumoxytol injections (5mg/kg; n=4) or remained untreated (n=6) underwent *ex vivo* MRI at 7T with R2* maps. MRI scans were evaluated by measuring R2* values of the caudate, globus pallidus, putamen, dentate nucleus, thalamus, and substantia nigra. Pig brains were sectioned and stained with Prussian blue. Data of ferumoxytol-exposed and unexposed groups were compared with unpaired and paired t-tests and Pearson correlation.

RESULTS

In pediatric patients, visual susceptibility effects and quantitative R2* data of all brain regions did not significantly differ from baseline ($p>0.05$). On follow up studies at 14.67 ± 7.70 months after the last ferumoxytol infusion slightly increased R2* in the dentate and globus pallidus ($p=0.013$ and $p=0.019$, respectively) were detected. No significant correlation was found between ferumoxytol dose and R2* and susceptibility values. In pigs, there were no significant differences in R2* of brain regions in the ferumoxytol group vs control ($p>0.05$) and no significant correlation between ferumoxytol dose and R2* values. Histologically, no difference in iron deposition was found.

CONCLUSION

No significant differences were found in R2* values in pediatric and pig brains after ferumoxytol-enhanced MRIs. However, slightly increased R2* in the dentate nucleus and globus pallidus in pediatric brains at follow-up were detected, which suggests that ferumoxytol might be transiently retained in specific brain regions.

CLINICAL RELEVANCE/APPLICATION

Iron oxide nanoparticles are a promising alternative for gadolinium-enhanced MRI. Further studies have to evaluate potential minimal

and transient retention of iron oxides in the brain.

RC613-15 Pediatric Headache Imaging: Cost Effectiveness Analysis Benefits and Pitfalls

Thursday, Nov. 29 11:40AM - 12:00PM Room: S502AB

Participants
Nadja Kadom, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the value of cost-effectiveness research. 2) Discuss imaging issues in pediatric headache. 3) Identify shortcomings in cost-effectiveness studies.

RC614

Interventional Series: Non-Vascular Interventions

Thursday, Nov. 29 8:30AM - 12:00PM Room: N227B

IR

AMA PRA Category 1 Credits ™: 3.00
ARRT Category A+ Credits: 3.50

FDA Discussions may include off-label uses.

Participants
Ramona Gupta, MD, Chicago, IL (*Moderator*) Nothing to Disclose
Bill S. Majdalany, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

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Sub-Events

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

Thursday, Nov. 29 8:30AM - 8:45AM Room: N227B

Participants
David C. Madoff, MD, New York, NY (*Presenter*) Advisory Board, RenovoRx; Consultant, General Electric Company; Consultant, Terumo Corporation; Consultant, Argon Medical Devices, Inc; Consultant, Abbott Laboratories; Consultant, Embolx, Inc

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LEARNING OBJECTIVES

1) To briefly review the pathophysiology related to the development of ascites. 2) To describe the minimally invasive treatment options currently available in the management of ascites. 3) To assess data to optimize which treatment strategy is most appropriate for a specific indication.

RC614-02 Transthoracic Biopsy Considerations

Thursday, Nov. 29 8:45AM - 9:00AM Room: N227B

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

LEARNING OBJECTIVES

1) Review current indications and techniques for lung biopsies. 2) Review data on acceptable complication rates and techniques for mitigating complications. 3) Review techniques for complex biopsies.

RC614-03 Percutaneous Gastrostomy Tube Placement is Safe in Patients on High Dose Aspirin

Thursday, Nov. 29 9:00AM - 9:10AM Room: N227B

Participants
Ryan S. Dolan, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Daryl T. Goldman, MD , New Orleans, LA (*Abstract Co-Author*) Nothing to Disclose
Zachary Bercu, MD, Atlanta, GA (*Abstract Co-Author*) Speaker, Terumo Medical Corporation; Grant, Coulter Translational Program, Steerable Robotic Guidewire
Janice M. Newsome, MD, Alexandria, VA (*Abstract Co-Author*) Nothing to Disclose
Jonathan Martin, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Percutaneous gastrostomy tube placement is a common procedure performed by interventional radiologists and has a moderate risk of bleeding per the Society of Interventional Radiology. Anticoagulants are typically held until reaching acceptable lab coagulation parameters, and clopidogrel is held for 5 days prior to procedure. High dose (325mg) aspirin (ASA) is commonly held for 5 days, but in certain populations (e.g. patients with new free flaps), holding ASA may put the patient at increased risk of complications (small vessel thrombosis and flap necrosis). The purpose of this study is to evaluate the safety of performing percutaneous gastrostomy tube placement in patients on aspirin 325mg.

METHOD AND MATERIALS

A retrospective review of patients who underwent gastrostomy tube placement by IR at a tertiary care center between 1/2017 - 3/2018 was performed. The primary outcome was bleeding noted at the gastrostomy site within 48 hours by the IR or clinical team. A chi-squared test was used to test for differences in bleeding rates between patients on ASA 325mg and patients not taking antiplatelet/anticoagulation therapy.

RESULTS

Of the 213 patients (age 64.8±11.7, 42% female) who underwent gastrostomy tube placement, 163 were being treated for head and neck cancer (95 patients had prior resection surgery, 92 with a flap, 54 within 1 month of surgery; 52 undergoing radiation therapy at time of procedure). Fifty-three patients were on ASA 325mg (48 with head and neck cancer, 39 within 1 month post-surgery), which was not held in any patients. Four patients were on clopidogrel (held for 5 days) and 21 were on anticoagulation (held until labs within acceptable range). None of the 53 patients on ASA 325mg experienced bleeding, but three other patients had significant bleeding at their gastrostomy site, one of whom was on warfarin (held with pre-procedure INR 1.64). There was no significant difference in bleeding rate between patients on ASA 325mg and patients not taking antiplatelet/anticoagulation therapy (P=0.37).

CONCLUSION

Gastrostomy tube placement may be safe in patients in whom holding ASA 325mg is risky clinically (e.g. patients with new flaps). Further study with a larger sample size is warranted.

CLINICAL RELEVANCE/APPLICATION

Holding high dose aspirin in patients undergoing percutaneous gastrostomy tube placement may not be necessary, especially in patients with new free flaps.

RC614-04 Sealing the Needle Track with Saline Solution After-lung Biopsy Decreases the Risk of Pneumothorax

Thursday, Nov. 29 9:10AM - 9:20AM Room: N227B

Participants
Irene Vicente Zapata, MD, Murcia, Spain (*Presenter*) Nothing to Disclose
Ana Sanchez, Murcia, Spain (*Abstract Co-Author*) Nothing to Disclose
Juana M. Plasencia-Martinez, MD,PhD, Murcia, Spain (*Abstract Co-Author*) Nothing to Disclose
Begona Marquez-Argente-del-Castillo, MS, Murcia, Spain (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To assess whether saline solution instillation through the coaxial needle track after computed tomography-guided lung biopsy (SSLB) reduces the risk of pneumothorax.

METHOD AND MATERIALS

In this retrospective matched case-control study, we compared the size and early evolution of pneumothorax in patients undergoing SSLB (cases) vs. patients studied with a conventional technique (CoLB). Other variables possibly related with pneumothorax were also evaluated. Sample size was calculated and univariate and multivariate statistical analysis were performed. Differences were significant when $P < 0.05$.

RESULTS

Fifty-six cases and 56 controls were recruited. Pneumothorax was diagnosed in 35/112 (31.3%) patients after lung biopsy, but it was less frequent ($P = 0.025$) with SSLB (12/56; 21.4%) than CoLB (23/56; 41.1%). Size (SSLB 6.58 ± 5.99 mm vs. CoLB 9.17 ± 4.60; P=0.16) and progressive pneumothorax increase (SSLB 5.67 ± 4.72 mm; 0% equal or greater than 2 cm vs. CoLB 15.90 ± 11.83 mm; 40% equal or greater than 2 cm; $P = 0.18$) did not reach a significant difference. According to the multivariate analysis, SSLB was the unique variable independently related with pneumothorax (OR 2.48, 95% confidence interval = 1.03-5.96; $P = 0.042$). Biopsy needle gauge, added fine-needle aspiration, patient position, lesion depth and lobe, and lesion semiology were not related with pneumothorax risk after lung-biopsy.

CONCLUSION

Saline solution instillation while removing the coaxial needle in CT-guide lung biopsy is an easy and cost-effective strategy to decrease the incidence and severity of pneumothorax.

CLINICAL RELEVANCE/APPLICATION

We can reduce the number and severity of pneumothorax as a complication of CT-guided lung biopsy with an easy strategy: sealing the coaxial needle track with normal saline solution.

RC614-05 Refractory Abscess Management

Thursday, Nov. 29 9:20AM - 9:35AM Room: N227B

Participants
Claire Kaufman, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Identify the various etiologies and risk factors associated with refractory abscesses. 2) Review treatment options. 3) Understand the role of the interventionalist in the management of refractory abscesses. 4) Review complications that can occur with refractory

abscesses.

RC614-06 Outcomes and Factors Influencing Complications and Pain Scores in Image-Guided Percutaneous Nephrostomy Tube Insertion: A Prospective Study

Thursday, Nov. 29 9:35AM - 9:45AM Room: N227B

Awards
Student Travel Stipend Award

Participants
Prateek Malik, DMRD,MBBS, Vellore, India (*Presenter*) Nothing to Disclose
Vinu Moses, MD, Vellore, India (*Abstract Co-Author*) Nothing to Disclose
Shyamkumar N. Keshava, FRCR,FRANZCR, Vellore, India (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

There exists a paucity of data, especially prospective studies, regarding complication rates and factors influencing them in patients undergoing image-guided percutaneous nephrostomy (PCN) tube insertion. Pain and quality of life post percutaneous nephrostomy is an important factor which again has not been extensively studied. Our study aims to assess patient and procedure related outcomes, post procedural pain and possible factors influencing the same in patients undergoing an image-guided PCN tube insertion

METHOD AND MATERIALS

All consecutive patients undergoing a PCN insertion over a period of 1 year (2016-2017) were included in the study. Procedure information including interviews with the patient and radiologists were collected at the time of the procedure. Post-procedure 8, 24 and 48hour pain & anxiety scores were collected via interviews conducted in post-procedure rounds using a Visual Analog Scale (VAS) scoring system. A follow-up of the patient from discharge upto tube removal was maintained during OPD visits. Outcomes group consisting of Complications (present Vs absent) and high pain and anxiety scores (>5 vs <5) were then analysed for multiple factors using univariate and multivariate regression on SPSSv25

RESULTS

A successful PCN insertion was done for 98% of the procedures (112/114). 111 procedures were included and 1 was lost to follow up. Minor complication rate of the study was 20.5% (23/111) and there were no major complications. Tube duration was found to be significantly associated with higher complication rates (p-value -0.032). Difficulty of the procedure (p-value -0.016), radiologists experience (p-value -0.035), duration between preprocedural analgesic and procedure (p-value -0.001), preprocedure pain scores (p-value -0.04) and anxiety scores (p-value -0.016) were found to be significantly associated with significant post procedure pain.

CONCLUSION

PCN is a safe procedure with low complication rates. Tubes with a longer insitu duration have a higher risk of complication. Difficult procedures, higher preprocedural patient pain and anxiety, delay between the procedure and preprocedural analgesic and inexperience of the radiologist performing the procedure are associated with a more painful post procedural period.

CLINICAL RELEVANCE/APPLICATION

To our knowledge, factors determining complications &pain scores post PCN tube insertion haven't been studied previously.

RC614-07 Percutaneous Enterocutaneous Fistula Repair

Thursday, Nov. 29 9:45AM - 10:00AM Room: N227B

Participants
Jeffry S. Kriegshauser, MD, Phoenix, AZ (*Presenter*) Research support, General Electric Company

LEARNING OBJECTIVES

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

RC614-08 Celiac Plexus Blocks

Thursday, Nov. 29 10:30AM - 10:45AM Room: N227B

Participants
Andrew J. Lipnik, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

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

RC614-09 Contemporaneous Placement of Port Catheter and Percutaneous Feeding Gastrostomy Tubes In Head and Neck Cancer Patient: Is a Single Session Combined Procedure Safe?

Thursday, Nov. 29 10:45AM - 10:55AM Room: N227B

Participants
Tyler Braaten, MD, Houston, TX (*Presenter*) Nothing to Disclose
Jason M. Low, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rodrick C. Zvavanjanja, MD, FRCR, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Placement of ports for chemotherapy and percutaneous feeding gastrostomy (PFG) in the same setting is controversial. Traditionally, these procedures have been performed on separate days due to the theoretical risk for port site infection from transient bacteremia induced by PFG placement and possible skin contamination from gastrointestinal flora. The primary purpose of this study was to evaluate the safety of same setting combined port catheter and PFG placement. The secondary purpose was to evaluate any potential cost reduction to the patient.

METHOD AND MATERIALS

A retrospective review of 21 adult head and neck cancer patients who underwent combination port catheter and PFG placement between February 2013 and February 2017 at a single academic institution was performed. All procedures were performed in a standard interventional radiology suite. Antibiotic prophylaxis was administered. A proprietary method of separate sterile preparation was performed and will be further delineated. In all but one case, the port was performed first and in all cases the operator changed their sterile attire for each procedure. Clinical and procedural details were evaluated in the electronic medical record. To assess for post procedure complications, clinic follow up notes were reviewed. Procedure related port infection was deemed as any site infection within the first two weeks of placement. The costs of combined procedures vs. separate procedures was determined based on CPT codes and average national payments adjusted based on the Centers for Medicare and Medicaid Services (CMS) Multiple Procedure Payment Reduction (MPPR) calculations.

RESULTS

Of the 21 patients with same day port and PFG placement, there were no cases of early port site infection. 2/21 (9.5%) patients had gastrostomy tube site infections, all of which resolved with oral antibiotic therapy. The cost of the combined procedure is cheaper for the patient based on CMS MPPR by reducing the cost by $724.25.

CONCLUSION

Placement of a port and PFG in a single session did not result in increased port complications. The combined procedure is more cost-effective and could be more convenient to the patient. Further large-scale multi-center experiences are required to validate our results.

CLINICAL RELEVANCE/APPLICATION

The study suggests it is safe to perform combined chest port catheter and PFG placement in the same setting and there is a significant associated cost savings to the patient.

RC614-10 Primary Biliary Stenting

Thursday, Nov. 29 10:55AM - 11:10AM Room: N227B

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

RC614-11 Percutaneous Occlusion of Biliary Leaks with the Artventive EOS Device: A Feasibility Study in a Porcine and Bovine Model

Thursday, Nov. 29 11:10AM - 11:20AM Room: N227B

Participants
Daniel Kuetting, MD, Bonn, Germany (*Presenter*) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Claus C. Pieper, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

daniel.kuetting@ukbonn.de

PURPOSE

Percutaneous treatment of postoperative biliary leaks is an increasingly required, yet technically challenging intervention, typically limited to minor leaks. The aim of this study was to investigate the occlusive properties of the ArtVentive Endoluminal Occlusion System (EOS) for the occlusion of bile duct and cystic duct leaks.

METHOD AND MATERIALS

The employed occlusion device - EOS - consists of a detachable ePTFE-coated nitinol spiral. In 5 explanted porcine and 3 explanted bovine livers artificially created biliary leaks were occluded using the EOS device. After establishing percutaneous biliary access in conventional PTCD technique, artificially created biliary leaks were occluded via a 6F guide catheter using 5 and 8 mm EOS devices. Using the 5 mm device peripheral (n = 3), central (n = 1) and cystic duct leaks (n = 1) were occluded, whereas with the 8 mm device peripheral (n = 1), central (n = 1), main duct (n = 1) and cystic duct leaks (n = 2) were occluded.

RESULTS

All central biliary leaks (3/3) and all cystic duct leaks (3/3) could be selectively and immediately occluded with the EOS device. Peripheral biliary leaks could not be selectively catheterized in 3 out of 4 cases, devices had to be placed several millimeters proximal of the leaks.

CONCLUSION

In this feasibility study, the EOS device enabled selective and immediate occlusion of cystic duct-, central - and larger peripheral bile duct leaks.

CLINICAL RELEVANCE/APPLICATION

The ArtVentive EOS occlusive device offers an "off the shelf" solution for percutaneous occlusion of larger biliary leaks, while smaller

peripheral biliary leaks cannot be treated selectively.

RC614-12 Thoracic Duct Embolization

Thursday, Nov. 29 11:20AM - 11:35AM Room: N227B

Participants
Bill S. Majdalany, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

bmajdala@med.umich.edu

LEARNING OBJECTIVES

1) Recognize standard lymphatic anatomy and describe the physiology of the lymphatic system. 2) Discuss the clinical presentation and etiologies of chylothorax. 3) Understand the basic principles of Thoracic Duct Embolization and appraise current results. 4) Identify future trends in thoracic lymphatic interventions.

RC614-13 Lymphatic Interventions for Chylothorax: A Systematic Review and Meta-Analysis

Thursday, Nov. 29 11:35AM - 11:45AM Room: N227B

Participants
Pyeong Hwa Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jiaywei Tsauo, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ji Hoon Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

peace4701@hotmail.com

PURPOSE

To perform a systematic review and meta-analysis of published studies to evaluate the efficacy of lymphatic interventions for chylothorax.

METHOD AND MATERIALS

The MEDLINE, EMBASE, and Cochrane databases were searched for English-language studies until March 2017, and that included patients with chylothorax treated with lymphangiography (LAG), thoracic duct embolization (TDE) or thoracic duct disruption (TDD). The exclusion criteria were a sample size of < 10, no extractable data or data included in subsequent articles or duplicate reports.

RESULTS

The cases of 407 patients from nine studies were evaluated. The pooled technical success rates of LAG and TDE were 94.2% (95% confidence interval [CI], 88.4%-97.2%; I2 = 46.7%) and 63.1% (95% CI, 55.4%-70.2%; I2 = 37.3%), respectively. The pooled clinical success rates of LAG, TDE, and TDD, on a per-protocol basis, were 56.6% (95% CI, 45.4%-67.2%; I2 = 5.4%), 79.4% (95% CI, 64.8%-89.0%; I2 = 68.1%), and 60.8% (95% CI, 49.4%-71.2%; I2 = 0%), respectively. The pooled major complication rate of LAG and TDE was 1.9% (95% CI, 0.8%-4.3%; I2 = 0%) and 2.4% (95% CI, 0.9%-6.6%; I2 = 26.4%), respectively. The pooled overall clinical success rate of lymphatic interventions, on an intention-to-treat basis, was 60.1% (95% CI, 52.1%-67.7%; I2 = 54.3%). Etiology of chylothorax was identified as a significant source of heterogeneity for the pooled clinical success rate of TDE and overall clinical success rate.

CONCLUSION

Lymphatic interventions have a respectable efficacy for the treatment of chylothorax.

CLINICAL RELEVANCE/APPLICATION

LAG is associated with high technical success and low clinical success, whereas TDE is associated with high clinical success and low technical success. The efficacy of TDD is questionable. Traumatic chylothorax is associated with a higher clinical success of TDE and overall clinical success of lymphatic interventions than non-traumatic chylothorax.

RC614-14 Advanced Feeding Tube Placement

Thursday, Nov. 29 11:45AM - 12:00PM Room: N227B

Participants
Adam N. Plotnik, MBBS,FRANZCR, Los Angeles, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

aplotnik@mednet.ucla.edu

LEARNING OBJECTIVES

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

RC615

Advanced Breast Imaging Technologies

Thursday, Nov. 29 8:30AM - 10:00AM Room: E451A

BR MR NM

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

FDA Discussions may include off-label uses.

Participants
Maxine S. Jochelson, MD, New York, NY (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

jochelsm@mskcc.org

LEARNING OBJECTIVES

I will put my learning objectives in under my course itself and presume the other 2 presenters will do the same. Don't think there needs to be a separate learning objective for the moderator?

Sub-Events

RC615A PET and PET/MRI

Participants
Amy M. Fowler, MD, PhD, Madison, WI (*Presenter*) Research support, General Electric Company

For information about this presentation, contact:

afowler@uwhealth.org

LEARNING OBJECTIVES

1) Describe current approaches for performing breast PET imaging. 2) Assess diagnostic performance of breast PET imaging for extent of disease and therapy response evaluation. 3) Examine potential uses of PET/MRI for breast imaging.

RC615B Molecular Breast Imaging

Participants
Carrie B. Hruska, PhD, Rochester, MN (*Presenter*) Institutional license agreement, CMR Naviscan Corporation

For information about this presentation, contact:

hruska.carrie@mayo.edu

LEARNING OBJECTIVES

1) Describe MBI instrumentation and clinical protocol for low-dose imaging. 2) Assess performance of MBI in screening of women with dense breasts. 3) Examine the potential role of MBI as an imaging biomarker of breast cancer risk.

RC615C Contrast Enhanced Mammography & Tomosynthesis

Participants
Maxine S. Jochelson, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The utility of tomosynthesis in the screening setting. 2) The technique and risks of Contrast Enhanced Mammography. 3) Potential uses for Contrast Enhanced Mammography in the screening and diagnostic setting.

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RC616

The Impact of Artificial Intelligence on Radiology Training and Practice Around the World (Sponsored by RSNA Committee of International Radiology Education)

Thursday, Nov. 29 8:30AM - 10:00AM Room: E350

AI ED IN

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

LEARNING OBJECTIVES

1) Discuss how Artificial Intelligence (AI) will impact Radiology's role in global health. 2) Explain how AI is changing radiology training and practice in different parts of the world. 3) Identify radiology AI products that are ready and appropriate for implementation in low-resource environments. 4) Discuss how the CIRE might play a part in AI education.

ABSTRACT

Artificial intelligence (AI) will affect global health (global radiology) in myriad ways. In addition to AI for initial imaging evaluation in resource-limited environments, many AI products may be applicable to near-term implementation in these environments and may leap-frog traditional systems. AI will change not only the way in which radiology is practiced in global health but also how radiologists are trained and their roles within the healthcare system after residency.

Sub-Events

RC616A Introduction: The Potential for AI in Global Radiology and Training

Participants
Eliot L. Siegel, MD, Baltimore, MD (*Presenter*) Medical Advisory Board, Brightfield Technologies Medical Advisory Board, McCoy Board of Directors, Carestream Health, Inc Founder, MedPerception, LLC Board of Directors Clear Health Quality Institute 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 Medical Systems 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

For information about this presentation, contact:

esiegel@umaryland.edu

LEARNING OBJECTIVES

View learning objectives under main course title.

RC616B How Resident Training May Be Affected by AI

Participants
David C. Gimarc, MD, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC616C Panel Discussion

Participants
Nitin P. Ghonge, MD, New Delhi, India (*Presenter*) Nothing to Disclose
Omolola M. Atalabi, MBBS, Ibadan, Nigeria (*Presenter*) Nothing to Disclose
Claudio Silva, MD , Santiago, Chile (*Presenter*) Nothing to Disclose
Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Grant, Bayer AG Grant, General Electric Company Grant, Koninklijke Philips NV Grant, STARmed Co, Ltd Grant, RF Medical Co, Ltd Grant, Samsung Electronics Co, Ltd Grant, Guerbet SA

For information about this presentation, contact:

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mojisola3t@hotmail.com

LEARNING OBJECTIVES

View learning objectives under main course title.

RC616D Near-term adoption of AI in Global Radiology: Barriers and Opportunities

Participants
Jeffrey B. Mendel, MD, West Newton, MA (*Presenter*) Advisor, McKesson Corporation

For information about this presentation, contact:

jmendel@pih.org

LEARNING OBJECTIVES

View learning objectives under main course title.

RC616E How CIRE Can Serve as a Locus for the Extension of AI Into Global Radiology Training

Participants
Kristen K. DeStigter, MD, Burlington, VT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC616F Q&A

LEARNING OBJECTIVES

View learning objectives under main course title.

RC617

Emerging Technologies: Prostate Cancer Imaging & Management - Update 2018

Thursday, Nov. 29 8:30AM - 10:00AM Room: S505AB

GU MI MR NM

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

FDA Discussions may include off-label uses.

Participants
Peter L. Choyke, MD, Rockville, MD (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

pchoyke@nih.gov

LEARNING OBJECTIVES

1) Understand current issues in prostate cancer relevant to imaging. 2) Understand the role of emerging technologies in the imaging and management of prostate cancer.

ABSTRACT

Prostate cancer is a major health issue. Imaging has made great strides in the last decade including the use of multiparametric MRI, MR-ultrasound fusion biopsies and most recently PET scanning. This refresher course explores emerging technolgies in prostate cancer imaging and management.

Sub-Events

RC617A Introduction to Imaging in Prostate Cancer

Participants
Peter L. Choyke, MD, Rockville, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the impact of new screening guidelines on imaging of prostate cancer. 2) Understand the issues facing clinicians treating prostate cancer.

ABSTRACT

This talk will review the current status of screening for prostate cancer and how stage migration is beginning to be seen. The problems of early detection, early recurrence and early metastases will be discussed. This talk will serve as a starting off point for the subsequent talks on new technologies.

RC617B Next Generation Prostate MRI

Participants
Baris Turkbey, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand current status and uses of multi-parametric MRI. 2) Understand role of MRI in assessment of prostate cancer aggressiveness and tumor heterogeneity. 3) Understand role of computer aided diagnosis systems in evaluation of prostate cancer aggressiveness and tumor heterogeneity.

RC617C Molecular Prostate Imaging: Chemistry to Clinic

Participants
Martin G. Pomper, MD, PhD, Baltimore, MD (*Presenter*) Researcher, Progenics Pharmaceuticals, Inc; License agreement, Progenics Pharmaceuticals, Inc; Researcher, Advanced Accelerator Applications SA; License agreement, Advanced Accelerator Applications SA; Co-founder, Cancer Targeting Systems, Inc; Board Member, Cancer Targeting Systems, Inc; Researcher, Celgene Corporation, Inc; License agreement, Celgene Corporation, Inc; Co-founder, Neurly; Board Member, Neurly; Co-founder, Theraly Pharmaceuticals, Inc; Board Member, Theraly Pharmaceuticals, Inc

LEARNING OBJECTIVES

View learning objectives under the main course title.

RC617D Hyperpolarized C-13 MR Molecular Imaging of Prostate Cancer

Participants
Daniel B. Vigneron, PhD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company;

LEARNING OBJECTIVES

1) To describe the basic principles and techniques used in hyperpolarized carbon-13 MRI. 2) Understand the cellular metabolic reprogramming that occurs in prostate cancer. 3) Demonstrate the changes in pyruvate to lactate conversion that are observed in prostate cancer and differences with cancer aggressiveness and response to therapy.

RC617E Radionuclide Therapy for Prostate Cancer

Participants
Peter L. Choyke, MD, Rockville, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC618

Interactive Game: When Do Imaging Findings Make a Difference? (Interactive Session)

Thursday, Nov. 29 8:30AM - 10:00AM Room: E353B

GU MK NR OI

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

Participants
David M. Panicek, MD, New York, NY (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

panicekd@mskcc.org

LEARNING OBJECTIVES

1) To recognize and review a range of potential interpretive pitfalls in oncologic imaging of the nervous, gynecologic, and musculoskeletal systems, using an interactive audience response system.

GENERAL INFORMATION

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

Sub-Events

RC618A Neuro

Participants
Birgit B. Ertl-Wagner, MD, Toronto, ON (*Presenter*) Spouse, Stockholder, Siemens AG; ;

For information about this presentation, contact:

BirgitBetina.Ertl-Wagner@sickkids.ca

LEARNING OBJECTIVES

1) To comprehend the importance of signs in neuroimaging for diagnostic decision making. 2) To understand in which instances imaging findings have a direct consequence for therapeutic decision making. 3) To appreciate the therapeutic consequences of select neuroimaging findings.

RC618B Musculoskeletal

Participants
David M. Panicek, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

panicekd@mskcc.org

LEARNING OBJECTIVES

1) Assess imaging features that facilitate specific diagnoses of musculoskeletal lesions. 2) Describe scenarios in which various imaging features of musculoskeletal lesions lead to more accurate tumor staging and treatment response assessment. 3) Detect musculoskeletal complications of tumors and their treatment.

RC618C Pelvis

Participants
Rosemarie Forstner, MD, Salzburg, Austria (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of imaging in the management of gynaecological malignancies.2) Assess imaging features that allow accurate staging of gynaecological malignancies.3) Be familiar with pitfalls that can result in staging errors using imaging.4) Understand the changes in imaging appearance post treatment.

Honored Educators

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RC621

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

Thursday, Nov. 29 8:30AM - 10:00AM Room: S403A

CT PH

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

FDA Discussions may include off-label uses.

Participants

Ehsan Samei, PhD, Durham, NC (*Coordinator*) Research Grant, General Electric Company; Research Grant, Siemens AG; Advisory Board, medInt Holdings, LLC; License agreement, 12 Sigma Technologies; License agreement, Gammex, Inc
Lifeng Yu, PhD, Chicago, IL (*Coordinator*) Nothing to Disclose

For information about this presentation, contact:

yu.lifeng@mayo.edu

ABSTRACT

CT has become a leading medical imaging modality, thanks to its superb spatial and temporal resolution to depict anatomical details. New advances have enabled extending the technology to depict physiological information. This has enabled a wide and expanding range of clinical applications. These advances are highlighted in this multi-session course. The course offers a comprehensive and topical depiction of these advances with material covering CT system innovations, CT operation, CT performance characterization, functional and quantitative applications, and CT systems devised for specific anatomical applications. The sessions include advances in CT system hardware and software, CT performance optimization, CT practice management and monitoring, spectral CT techniques, quantitative CT techniques, functional CT methods, and special CT use in breast, musculoskeletal, and interventional applications.

Sub-Events

RC621A MDCT Systems and Acquisitions

Participants
Lifeng Yu, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

yu.lifeng@mayo.edu

LEARNING OBJECTIVES

1) Introduce recent development of multi-detector CT (MDCT) system. 2) Describe some of the latest CT acquisition techniques, including high pitch, gating, dynamic, and automatic kV selection. 3) Explain clinical applications of these novel acquisition techniques.

RC621B Cone-Beam CT Systems and Applications

Participants
Jeffrey H. Siewerdsen, PhD, Baltimore, MD (*Presenter*) 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, Precision X-Ray, Inc; License agreement, Elekta AB; ; ;

LEARNING OBJECTIVES

1) Understand the principles of cone-beam CT imaging. 2) Understand the challenges to cone-beam CT image quality and emerging techniques for image quality improvement. 3) Understand the scope of clinical applications in diagnostic and image-guided procedures utilizing cone-beam CT.

ABSTRACT

1) Understand the principles of cone-beam CT imaging. 2) Understand the challenges to cone-beam CT image quality and emerging techniques for image quality improvement. 3) Understand the scope of clinical applications in diagnostic and image-guided procedures utilizing cone-beam CT.

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RC622

Advances in Cone Beam CT Acquisition and Reconstruction in Radiotherapy

Thursday, Nov. 29 8:30AM - 10:00AM Room: S504AB

CT PH RO

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

FDA Discussions may include off-label uses.

Participants
Douglas Moseley, PhD, Toronto, ON (*Moderator*) License agreement, Modus Medical Devices Inc; Consultant, Elekta AB

Sub-Events

RC622A State of the Art in Advanced CBCT Acquisition and Reconstruction

Participants
Wojciech Zbijewski, PhD, Baltimore, MD (*Presenter*) Research Grant, Carestream Health, Inc; Research Grant, Siemens AG

For information about this presentation, contact:

wzbijewski@jhu.edu

LEARNING OBJECTIVES

1) Identify key challenges to image quality in CBCT. 2) Discuss latest developments in CBCT instrumentation. 3) Describe recent advances in reconstruction algorithms and artifact correction methods for CBCT. 4) Compare CBCT image quality achievable on their systems to state-of-the-art.

RC622B Clinical Need for Advanced CBCT Imaging in Radiotherapy

Participants
Tianyu Zhao, PhD, St. Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Gain greater understanding on the clinical need of CBCT in radiotherapy in the following applications: Image-Guided Radiotherapy (IGRT) with more precise tumor localization and better patient setup, 4D CBCT in managing respiratory motion, and adaptive radiotherapy (ART).

Active Handout:Tianyu Zhao

http://abstract.rsna.org/uploads/2018/18001992/RSNA 2018 handout RC622B.pdf

RC622C Technical Challenges in the Integration of CBCT Imaging into Radiotherapy

Participants
Douglas Moseley, PhD, Toronto, ON (*Presenter*) License agreement, Modus Medical Devices Inc; Consultant, Elekta AB

For information about this presentation, contact:

douglas.moseley@rmp.uhn.ca

LEARNING OBJECTIVES

1) Identify the technical challenges when using CBCT imaging for image-guided radiation therapy. 2) Discuss strategies for commissioning and QA of the IGRT workflow in the clinic. 3) Describe the future direction of in-room image guidance.

ABSTRACT

The Scan-Plan-Treat paradigm is becoming too simplistic to do describe the workflow in the modern radiation therapy clinic. Multiple CBCT scans are performed during the treatment delivery that may trigger, re-Scans and re-Plans. This presents several challenges.

RC623

Advanced Ultrasound Technology and Applications

Thursday, Nov. 29 8:30AM - 10:00AM Room: S404CD

PH US

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

FDA Discussions may include off-label uses.

Participants
William F. Sensakovic, PhD, Scottsdale, AZ (*Coordinator*) Speaker, Bayer AG; Research Grant, Mazor Robotics Ltd; Founder, Telerad Physics Teaching, LLC
Thaddeus A. Wilson, PhD, Madison, WI (*Coordinator*) Nothing to Disclose

For information about this presentation, contact:

wfsensak@gmail.com

LEARNING OBJECTIVES

1) Understand the role of contrast agents in ultrasound. 2) Explain the science and technology behind strain imaging. 3) Implement strain imaging and ultrasound contrast in clinical practice.

Sub-Events

RC623A Contrast Agents

Participants
Peter N. Burns, PhD, Toronto, ON (*Presenter*) Research collaboration, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Understand the physical composition of microbubble contrast agents and how they interact with an ultrasound field. 2) Describe the principles of contrast specific imaging modes found on modern ultrasound scanners. 3) Review the characteristics of contrast images and flow measurements as the basis for their interpretation in a clinic setting.

RC623B Elasticity Imaging

Participants
Stephen McAleavey, PhD, Rochester, NY (*Presenter*) Research collaboration, Siemens AG; Research Grant, Carestream Health, Inc;

For information about this presentation, contact:

stephen.mcaleavey@rochester.edu

LEARNING OBJECTIVES

1) Explain the physical principles of several elasticity imaging methods in clinical use. 2) Understand capabilities and limitations of elasticity methods. 3) Describe current and emerging clinical applications of elasticity imaging.

RC623C Practical Clinical Advice on the Use of Contrast and Strain Imaging

Participants
Richard G. Barr, MD, PhD, Campbell, OH (*Presenter*) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Canon Medical Systems Corporation; Research Grant, Esaote SpA; Research Grant, BK Ultrasound; Research Grant, Hitachi, Ltd

LEARNING OBJECTIVES

1) To review appropriate use of ultrasound contrast in the clinical setting. 2) Discuss which patients would benefit from a contrast enhanced ultrasound. 3) Review the requirements for performing a contrast enhanced ultrasound. 4) Review which applications are appropriate for elastography. 5) Discuss how elastography can help in diagnosis.

Honored Educators

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RC624

Fakes, Forgeries, and Hidden Repairs in Art and Archaeology: The Role of Forensic Imaging

Thursday, Nov. 29 8:30AM - 10:00AM Room: N229

OT

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

FDA Discussions may include off-label uses.

Participants
Barry D. Daly, MD, Baltimore, MD (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

bdaly@umm.edu

LEARNING OBJECTIVES

1) To describe the adaptation of modern imaging techniques to confirm or refute the authenticity of ancient treasures and artworks. 2) To learn about 'fingerprinting' of valuable artifacts with 3D imaging as a technique for identifying stolen art treasures. 3) To differentiate bona fide from fake restorations in ancient artifacts.

ABSTRACT

A major challenge in the world of art is the prevalence of faux or stolen treasures or works with concealed repairs. One of the major applications of modern imaging technology in this setting is the ability to non-invasively investigate the 3D structure and hidden internal contents of ancient and fragile treasures. Using a case-based approach, this course addresses the use of advanced imaging techniques to confirm or refute the authenticity of ancient artworks, with case examples from 3,000 year old Mezo-American statues to late Renaissance musical instruments and paintings. The implications of forgery, erroneous provenance, and concealed alterations or repairs to artworks are discussed.

Sub-Events

RC624A A Historical Perspective on the Use of Imaging Techniques to Confirm or Refute the Authenticity of Ancient Treasures and Artworks

Participants
Barry D. Daly, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC624B Hidden Restorations: Bona Fide or Fake?

Participants
Jonathan P. Brown, MS, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jpbrown@fieldmuseum.org

LEARNING OBJECTIVES

1) Discuss x-radiographic investigations for separating restoration from the original object so that the original may be examined without the overlying restorations.

RC624C 'Fingerprinting' of Valuable Artifacts: Imaging Techniques for Identifying Stolen Art Treasures

Participants
Vahid Yaghmai, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Honored Educators

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RC625

Mini-course: Radiation Safety for Patients and Staff - Emerging Advances in Patient Radiation Protection

Thursday, Nov. 29 8:30AM - 10:00AM Room: S105AB

AI PH SQ

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

FDA Discussions may include off-label uses.

Participants
Madan M. Rehani, PhD, Boston, MA (*Coordinator*) Nothing to Disclose

For information about this presentation, contact:

madan.rehani@gmail.com

Active Handout:Madan M. Rehani

http://abstract.rsna.org/uploads/2018/18001512/Rehani_RSNA_Quality _dose RC625.pdf

Sub-Events

RC625A Emerging Concepts of Integration of Image Quality, Radiation Dose, and Artificial Intelligence

Participants
Ehsan Samei, PhD, Durham, NC (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Advisory Board, medInt Holdings, LLC; License agreement, 12 Sigma Technologies; License agreement, Gammex, Inc

LEARNING OBJECTIVES

1) To understand how dose monitoring is but a component of the broad objective of quality and excellence in imaging. 2) To understand how dose and image quality need to be recognized together to enable optimized care. 3) To appreciate how artificial intelligence methods can be used to inform quality and safety monitoring and optimization.

RC625B Practical Aspects of Integration of Clinical Image Quality and Patient Dose Optimization

Participants
Madan M. Rehani, PhD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

madan.rehani@gmail.com

LEARNING OBJECTIVES

1) Define strength and limitations of diagnostic reference levels (DRLs). 2) Describe criteria for image quality assessment. 3) Apply the concept of integration of image quality scoring with dose indices in CT imaging for the purpose of optimization.

Active Handout:Madan M. Rehani

http://abstract.rsna.org/uploads/2018/18001514/Rehani_RSNA_Quality _dose RC625B.pdf

RC627

Basic Principles of Cost-Effectiveness Analysis in Imaging

Thursday, Nov. 29 8:30AM - 10:00AM Room: E353A

HP RS

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

Participants
Pari Pandharipande, MD, MPH, Boston, MA (*Moderator*) Research Grant, Medical Imaging & Technology Alliance
Stella Kang, MD,MSc, New York, NY (*Moderator*) Royalties, Wolters Kluwer nv

LEARNING OBJECTIVES

1) Describe the value of cost-effectiveness analyses in affecting reimbursement policies and practice guidelines. 2) Identify potential databases that can be used for input parameters for both effectiveness data and cost data. 3) Describe the incremental cost effectiveness ratio in laymen's terms to patients, physicians, and policymakers.

ABSTRACT

Cost-effectiveness analysis (CEA) is commonly used by policymakers to gain insight into the value of healthcare interventions. Standard CEA methods, grounded in principles of economics and resource allocation, are unfamiliar to most radiologists. In the current era of value-based care, radiologists' understanding of how health services researchers and economists project CEA outcomes will be increasingly important for identifying efficient and affordable imaging strategies. In this course, basic research concepts and applications relevant to CEA in imaging will be reviewed, including decision-analysis and simulation modeling, life expectancy and lifetime cost metrics, health-related quality-of-life measurement, and incremental cost-effectiveness ratios (ICERs). Our goal will be to expose early investigators and the general radiology community to CEA in imaging.

Sub-Events

RC627A An Introduction to Cost-Effectiveness Analysis in Diagnostic Testing

Participants
Pari Pandharipande, MD, MPH, Boston, MA (*Presenter*) Research Grant, Medical Imaging & Technology Alliance

LEARNING OBJECTIVES

1) Describe the basic structure of a decision-analytic model that is designed to evaluate the long-term health and economic consequences of a diagnostic test. 2) Describe how an incremental cost-effectiveness ratio (ICER) is calculated and used for policy-level decision-making. 3) Explain the strengths and limitations of cost-effectiveness analysis as method to determine the value of an imaging test.

RC627B An Example of Cost-Effectiveness Analysis in Imaging: MRI for Choledocholithiasis

Participants
Stella Kang, MD,MSc, New York, NY (*Presenter*) Royalties, Wolters Kluwer nv

For information about this presentation, contact:

stella.kang@nyumc.org

LEARNING OBJECTIVES

1) Understand how to approach the question of whether risk-stratified or non-risk-stratified use of imaging is more cost-effective. 2) Apply methods of evidence synthesis and probabilistic modeling to a cost-effectiveness analysis of MRI versus risk-stratified diagnostic evaluation for suspected acute biliary obstruction. 3) Evaluate the clinical and research implications of results from a cost-effectiveness analysis of diagnostic strategies for suspected acute biliary obstruction.

RC627C Cost-effectiveness of Imaging in Stroke

Participants
Ajay Gupta, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Explain the need for high quality cost-effectiveness studies to optimize imaging utilization in the prevention, diagnosis, and treatment of cerebrovascular diseases. 2) Describe the existing literature supporting the role of specific cost-effective imaging strategies in patients with stroke. 3) Identify gaps in our understanding of cost-effective imaging strategies in cerebrovascular diseases.

RC629

Quantitative MR Imaging and Clinical Applications (Interactive Session)

Thursday, Nov. 29 8:30AM - 10:00AM Room: S103AB

BQ MR OI

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

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

Sub-Events

RC629A MR Fingerprinting: Principles and Applications

Participants
Vikas Gulani, MD, PhD, Cleveland, OH (*Presenter*) Research support, Siemens AG; Licensed Technology, Siemens Healthineers - both myself and my spouse. MR Fingerprinting, on which we are both inventors, has been licensed by Siemens.

LEARNING OBJECTIVES

1) Understand the motivation behind the development of Magnetic Resonance Fingerprinting (MRF). 2) Understand basic principles and rationale in the design of an MRF acquisition, and comprehend the meaning of the output maps. 3) Identify applications to which MRF has been applied clinically thus far, and the unique insights that this work has thus far provided. 4) Understand the implications of MRF for tissue characterization, prediction of response to treatment, quantitative image analysis, radiomics, and computerized decision support. 5) Use the knowledge gained about MRF to analyze how this technology could be used in other clinical settings.

ABSTRACT

Magnetic Resonance Fingerprinting (MRF) is a new technology that enables efficient simultaneous mapping of multiple interesting MR properties, making it clinically feasible to measure T1 and T2, and thus provide a quantitative underlay to MRI. This enables a move towards a fully quantitative MR exam. We will start by laying out the rationale behind the need for quantitative MR. The approach adopted in MRF will be discussed, and the basics of such an acquisition will be explained. The initial clinical applications that have thus far been published will be shared, followed by a discussion of the implications of the technology in the future.

RC629B Radiomics for the Detection of Prostate Cancer

Participants
Masoom A. Haider, MD, Toronto, ON (*Presenter*) Advisory Board, Siemens AG; ;

LEARNING OBJECTIVES

1) Recognize the unmet needs in prostate cancer detection and surveillance. 2) Recognize the potential applications of quantitative imaging and radiomics to prostate cancer detection and surveillance. 3) Recognize what is required to have a valid imaging biomarker that can be applied to risk stratification in prostate cancer.

RC629C Free Breathing 3D Quantitative Perfusion MR Imaging of the Abdomen

Participants
Nicole Seiberlich, PhD, Cleveland, OH (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Describe various challenges to the collecting high-resolution, time-resolved MR images needed to quantify perfusion in the abdomen. 2) Understand different data collection and reconstruction strategies that have been recently proposed to enable this application. 3) Compare and contrast the merits of various novel acceleration methods for abdominal perfusion imaging. 4) Implement rapid perfusion quantification methods at their institution, or have the ability to contact those that can offer support in this area.

RC629D Elastography Beyond the Liver

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

LEARNING OBJECTIVES

1) Explain the basic physical principles of MR Elastography (MRE). 2) Understand the emerging applications of MRE for intracranial imaging. 3) Describe other potential applications of MRE that are being investigated, including assessing cardiac, lung, breast, renal, and pancreatic 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/ Richard L. Ehman, MD - 2016 Honored Educator

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RC631

Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on)

Thursday, Nov. 29 8:30AM - 10:00AM Room: E263

MK NR IR

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

Participants
A. Orlando Ortiz, MD, MBA, Mineola, NY (*Presenter*) Nothing to Disclose
Bassem A. Georgy, MD, MSc, San Diego, CA (*Presenter*) Consultant, Johnson & Johnson; Consultant, Merit Medical Systems, Inc; Consultant, Medtronic plc; Stockholder, Spine Solutions, Inc; ;
Todd S. Miller, MD, Bronx, NY (*Presenter*) Nothing to Disclose
Stanley Golovac, MD, Coral Gables , FL (*Presenter*) Nothing to Disclose
Allan L. Brook, MD, Bronx, NY (*Presenter*) Nothing to Disclose
Michele H. Johnson, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Afshin Gangi, MD, PhD, Strasbourg, France (*Presenter*) Proctor, BTG International Ltd; Proctor, Galil Medical Ltd

For information about this presentation, contact:

Sgolovac@mac.com

gangi@unistra.fr

tmiller@montefiore.org

LEARNING OBJECTIVES

1) To introduce common spinal injection procedures that are used for the diagnosis and treatment of neck and back pain disorders. 2) To learn the indications and contraindications for these procedures. 3) To understand how imaging guidance is used to perform these procedures. 4) To introduce some of the equipment and techniques that are helpful in performing spine injection procedures in a hands on format with an opportunity for attendees to address their specific questions and concerns with the course faculty.

ABSTRACT

Image guided spine interventions can be used for the diagnosis and/or treatment of painful conditions of the spinal access. Diagnostic procedures often include specific nerve blocks that can be performed with anesthetic agents. Facet joint and sacroiliac joint pain syndromes can likewise be managed with spine interventional techniques. Epidural steroid injections can be performed using interlaminar, caudal or transforaminal techniques in the management of focal back or neck pain with an associated radicular pain component. More advanced longer lasting treatments inclued radiofrequency neuolysis which can also be used to manage facet or sacroiliac joint related pain that temporarily responds to diagnostic median branch blocks or specific joint injections. Spinal cord stimulator placement is another advanced technique that can be used to manage chronic pain syndromes. The workshop emphasizes patient selection, imaging evaluation, procedure indication and contraindications in order to optimize treatment outcome.

RC632

Essentials of Radiology Operation

Thursday, Nov. 29 8:30AM - 10:00AM Room: S404AB

LM

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

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Moderator*) Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd;

Sub-Events

RC632A MACRA, MIPS, and the QPP: What is Ahead for Radiologists?

Participants
Lauren P. Golding, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lgolding@triadradiology.com

LEARNING OBJECTIVES

1) Discuss the major changes in MIPS for 2018, with emphasis on strategies to optimize eadiologists' performance. 2) Review the APM pathway within the QPP, highlighting opportunities for radiologists to participate in alternative payment models. 3) Discuss the future of value based healthcare, recent policy updates, and what may be on the horizon radiologists.

RC632B Measuring Radiologists' Productivity

Participants
Sanjay Saini, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Understand why productivity is a critical economic metric. 2) Describe the pros and cons of various methods for measuring productivity. 3) Outline approach for impremenring productivity measures in professional practices.

ABSTRACT

References: 1. Ding A, Saini S, Bernt ER. Radiologist Productivity: what, when and how. JACR 2009; 12:824-827.

RC632C Integration of Radiology Practice to Health System: Why and How?

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Presenter*) Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd;

For information about this presentation, contact:

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RC650

Fallopian Tube Catheterization (Hands-on)

Thursday, Nov. 29 8:30AM - 10:00AM Room: E260

GU OB IR

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

FDA Discussions may include off-label uses.

Participants
Amy S. Thurmond, MD, Portland, OR (*Presenter*) Nothing to Disclose
Ronald J. Zagoria, MD, San Francisco, CA (*Presenter*) Consultant, ReCor Medical, Inc
A. Van Moore JR, MD, Charlotte, NC (*Presenter*) Chairman and CEO, Strategic Radiology
Anne C. Roberts, MD, La Jolla, CA (*Presenter*) Nothing to Disclose
David M. Hovsepian, MD, Stanford, CA (*Presenter*) Nothing to Disclose
James E. Silberzweig, MD, New York, NY (*Presenter*) Nothing to Disclose
Lindsay S. Machan, MD, Vancouver, BC (*Presenter*) Stockholder, Analytics for Life, Inc; Stockholder, Calgary Scientific, Inc; Stockholder, Harmonic Medical; Stockholder, IKOMED Technologies Inc; Stockholder, Innovere Medical Inc; Stockholder, Confluent Medical Inc
Maureen P. Kohi, MD, San Francisco, CA (*Presenter*) Research Grant, Boston Scientific Corporation; Consultant, LaForce; Advisory Board, Boston Scientific Corporation; Advisory Board, AbbVie Inc

For information about this presentation, contact:

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acroberts@ucsd.edu

jsilberzweig@cvsnyc.com

LEARNING OBJECTIVES

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

ABSTRACT

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

Active Handout:Amy Suzanne Thurmond

http://abstract.rsna.org/uploads/2018/3990740/Hands-on 2018 handout RC650.pdf

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RC652

Live Ultrasound Interventional Procedures: Joint Injections, Cyst Aspiration, Abscess Drainage, Vascular Access, Core Biopsy, and Foreign Body Removal (Hands-on)

Thursday, Nov. 29 8:30AM - 10:00AM Room: E264

MK IR US

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

Participants

Veronica J. Rooks, MD, Honolulu, HI (*Moderator*) Nothing to Disclose
Veronica J. Rooks, MD, Honolulu, HI (*Presenter*) Nothing to Disclose
Stephen C. O'Connor, MD, Boston, MA (*Presenter*) Nothing to Disclose
James W. Murakami, MD, Columbus, OH (*Presenter*) Nothing to Disclose
Kal Dulaimy, MD, Springfield, MA (*Presenter*) Nothing to Disclose
Hisham A. Tchelepi, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Christian L. Carlson, MD, MS, Jbsa Ft Sam Houston, TX (*Presenter*) Nothing to Disclose
Paolo Minafra, MD, Pavia, Italy (*Presenter*) Nothing to Disclose
Leah E. Braswell, MD, Columbus, OH (*Presenter*) Nothing to Disclose
Horacio M. Padua JR, MD, Boston, MA (*Presenter*) Nothing to Disclose
Adam S. Young, MD, MBA, Los Angeles, CA (*Presenter*) Nothing to Disclose
Brian H. Ching, DO, Tripler Army Medical Center, HI (*Presenter*) Nothing to Disclose
Paula B. Gordon, MD, Vancouver, BC (*Presenter*) Stockholder, OncoGenex Pharmaceuticals, Inc ; Stockholder, Volpara Health Technologies Limited; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, DenseBreast-info, Inc;
Ebonee Carter, MD, Savanna, GA (*Presenter*) Nothing to Disclose
Eric Royston, DO, MPH, Tripler Army Med Ctr, HI (*Presenter*) Nothing to Disclose
Peter L. Cooperberg, MD, Vancouver, BC (*Presenter*) Nothing to Disclose
Shankar Rajeswaran, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Eva M. Smietana, MD, Kailua, HI (*Presenter*) Nothing to Disclose

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James.Murakami@nationwidechildrens.org

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, vascular access, and intraarticular steriod injection. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and prepartaion for more advanced interventional sonographic learning opportunities.

RC653

Machine Learning and Artificial Intelligence: The Non-Interpretive Considerations

Thursday, Nov. 29 8:30AM - 10:00AM Room: E450A

AI IN

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

FDA Discussions may include off-label uses.

Participants
Saurabh Jha, MD, Philadelphia, PA (*Moderator*) Speakers Bureau, Canon Medical Systems Corporation

For information about this presentation, contact:

saurabh.jha@uphs.upenn.edu

LEARNING OBJECTIVES

1) To appreciate the history of automation. 2) To understand the opposing economic factors in the adoption of artificial intelligence. 3) To understand what motivates entrepreneurs and venture capitalists to fund AI ventures. 4) To get an overview of how we can assess the quality of AI. 5) To appreciate the ethical and legal issues about AI.

ABSTRACT

This session will discuss the more non technical issues in artificial intelligence such as the economics, history, legal and ethical considerations, entrepreneurship and how we assess the product. The session intends to complement the more technical elements of artificial intelligence to give a rounded perspective about this emerging area.

Sub-Events

RC653A The Economics of Artificial Intelligence

Participants
Saurabh Jha, MD, Philadelphia, PA (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation

For information about this presentation, contact:

saurabh.jha@uphs.upenn.edu

LEARNING OBJECTIVES

1) Understand the history of automation. 2) Is automation inevitable in radiology? 3) Review economic theory relevant to automation. 4) Critique the economic theory and empirical evidence which informs us about artificial intelligence.

ABSTRACT

Though artificial intelligence is a recent phenomenon, at least in terms of scale, automation and the replacement of labor by machines, is not new. There are broad economic and cultural principles. What are these principles? Can they be applied to radiology in general and healthcare in particular?

RC653B Entrepreneurship and Artificial Intelligence

Participants
Ajay Kohli, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ajay@ajaykohlimd.com

LEARNING OBJECTIVES

1) Start-ups, funding, exit strategies and more: to learn about what it means to be an entrepreneur in healthcare. 2) To understand what motivates venture capitalists and healthcare CEOs to invest in Artificial Intelligence start-up companies. 3) To understand some of the barriers faced by entrepreneurs, speficially those working on bringing in Artificial Intelligence in medical imaging. 4) To learn how to evaluate Artifical Intelligence applications from start-up companies.

RC653C How to Tell if My AI is Telling the Truth

Participants
Hugh Harvey, MBBS, London, United Kingdom (*Presenter*) Employee, Kheiron Medical

For information about this presentation, contact:

hugh@kheironmed.com

LEARNING OBJECTIVES

1) Learn an overview on how to assess an AI application. 2) Understand how training data selection, biases, disease prevalence, and statistics can alter medical device claims. 3) Learn about 'intended use' as per medical device regulations.

RC653D Ethical and Legal Aspects of Machine Learning

Participants
Falgun H. Chokshi, MD, Marietta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss ethical ramifications of AI mediated imaging diagnosis versus detection. 2) Understand legal perspectives of AI's impact on Radiology as a speciality as they pertain to medical liability and risk. 3) Empathize with the patient's role and perspective in their care as AI augments radiologists' practices and workflow.

RC654

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

Thursday, Nov. 29 8:30AM - 10:00AM Room: S104A

IN LM SQ

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

Participants
Katherine P. Andriole, PhD, Dedham, MA (*Moderator*) Research Grant, NVIDIA Corporation; Research Grant, General Electric Company; Research Grant, Nuance Communications, Inc; Advisory Board, McKinsey & Company, Inc

For information about this presentation, contact:

kandriole@bwh.harvard.edu

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 pracitce 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

RC654A Introduction to Business Analytics Demonstrating Application to Radiology

Participants
Katherine P. Andriole, PhD, Dedham, MA (*Presenter*) Research Grant, NVIDIA Corporation; Research Grant, General Electric Company; Research Grant, Nuance Communications, Inc; Advisory Board, McKinsey & Company, Inc

For information about this presentation, contact:

kandriole@bwh.harvard.edu

LEARNING OBJECTIVES

1) Gain an overview of business analytics tools and understand how they might be used in radiology. 2) Be able to describe the general steps involved in business analytics, including data extraction, transformation, analysis, and presentation or visualization of key performance indicators (KPI). 3) Review several example radiology use cases.

ABSTRACT

This session will provide a general overview of business analytics concepts and how they can be used in radiology. A walk through of the basic steps involved in implementation including identifying, collecting, transforming, and analyzing data, followed by dynamically presenting key performance indicators (KPI) will be demonstrated. Example use cases involving multiple database sources taken from a radiology practice will be shown.

RC654B Operational and Predictive Analytics in Radiology

Participants
Luciano M. Prevedello, MD, MPH, 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.

RC654C Capabilities of Current and Future Business Analytics Technologies

Participants
Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Royalties, Osler Institute

For information about this presentation, contact:

tessa.cook@uphs.upenn.edu

LEARNING OBJECTIVES

1) To gain familiarity with currently available business technologies and their relevance to radiology practice. 2) To consider how existing business technologies can support quality assurance in radiology. 3) To learn about business analytics features that may be available/desirable in the future to augment and support both the practice of radiology.

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RCB51

Intro to Statistics with R (Hands-on)

Thursday, Nov. 29 8:30AM - 10:00AM Room: S401CD

IN RS

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

Participants
James E. Schmitt, MD, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose
James E. Schmitt, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Nathan M. Cross, MD, MS, Seattle, WA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

nmcross@uw.edu

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 xlsx. 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.

RCC51

Virtual Reality and 3D Printing

Thursday, Nov. 29 8:30AM - 10:00AM Room: S501ABC

IN

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

Participants
Beth A. Ripley, MD, PhD, Seattle, WA (*Moderator*) Nothing to Disclose
Nicole Wake, PhD, New York, NY (*Moderator*) In-kind support, Stratasys, Ltd

LEARNING OBJECTIVES

1) Describe the modes of visualizing medical images and models in VR/AR using a comprehensive conceptual framework. 2) Explain the considerations for the implementation of medical image visualization modes in VR/AR. 3) Describe key considerations for placing VR/AR visualization tools into a radiology-based workflow.

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/ Tatiana Kelil, MD - 2017 Honored Educator

Sub-Events

RCC51A Visualizing Medical Images and Models in VR

Participants
Justin Sutherland, PhD, Ottawa, ON (*Presenter*) Nothing to Disclose

RCC51B 3D Printed and Augmented Reality Urological Models

Participants
Nicole Wake, PhD, New York, NY (*Presenter*) In-kind support, Stratasys, Ltd

RCC51C AR/VR Multidimensional Medicine

Participants
Dmitry Levin, Seattle, WA (*Presenter*) Nothing to Disclose

RCC51D Augmented and Virtual Reality in Diagnostic Imaging: A Primer and Current State of the Art

Participants
Eliot L. Siegel, MD, Baltimore, MD (*Presenter*) Medical Advisory Board, Brightfield Technologies Medical Advisory Board, McCoy Board of Directors, Carestream Health, Inc Founder, MedPerception, LLC Board of Directors Clear Health Quality Institute 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 Medical Systems 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

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MSRT52

ASRT@RSNA 2018: The Missed Breast Cancer - Causes and Cures

Thursday, Nov. 29 9:15AM - 10:15AM Room: N230B

BR OI

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

Participants
Michael N. Linver, MD, Albuquerque, NM (*Presenter*) Medical Advisory Board, Solis; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc

For information about this presentation, contact:

mammomike@aol.com

LEARNING OBJECTIVES

1) Identify the major biological features of breast cancers which cause some cancers to be missed on mammography. 2) Identify the technical issues which cause some breast cancers to be missed on mammography. 3) Apply various strategies to prevent breast cancers from being missed on mammography.

ABSTRACT

This session will cover the major reasons that breast cancers are sometimes missed on mammography. Emphasis will be placed on the biological factors of breast cancers that the radiologist cannot control, and the technical factors related to the process of obtaining the images that the radiologist can and should control. For all of these issues, strategies will be offered to prevent missing cancers on mammography.

MSCN52

Case-based Review of Neuroradiology (Interactive Session)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S406A

HN NR PD

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

Participants
Pina C. Sanelli, MD, Manhasset, NY (*Director*) Research funded, Siemens AG;

Sub-Events

MSCN52A Head & Neck: What Space is That Lesion In?

Participants
Hillary R. Kelly, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

hillary.kelly@mgh.harvard.edu

LEARNING OBJECTIVES

1) Define the fascia-lined spaces of the head and neck as relevant to imaging interpretation. 2) Specify the anatomic landmarks that aid in recognition of the spaces of the neck on cross-sectional imaging. 3) Develop a region specific differential diagnosis for the major spaces in the head and neck.

MSCN52B Head & Neck: Vascular Lesions Important to Know!

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

For information about this presentation, contact:

shatzkes@hotmail.com

LEARNING OBJECTIVES

1) Understand modern classification and nomenclature of vascular lesions. 2) Recognize characteristic imaging findings of the most common vascular lesions encountered in the head and neck.

Active Handout:Deborah Rachelle Shatzkes

http://abstract.rsna.org/uploads/2018/18001605/ISSVA-Classification MSCN52B.pdf

MSCN52C Brain Interventions: Can We Really Treat That?

Participants
Philip M. Meyers, MD, New York, NY (*Presenter*) Consultant, Stryker Corporation; Clinical site, Medtronic plc; Consultant, Penumbra, Inc; Consultant, Siemens AG

LEARNING OBJECTIVES

The participant will understand the application and ongoing relevance of catheter cerebral arteriography and specific imaging considerations to the safe and effective endovascular treatment of specific pediatric neurovascular diseases.

ABSTRACT

Advancements in computer-aided imaging and catheter-based technologies now permit safe and effective treatment of an increasing range of neurovascular diseases. At the conclusion of this lecture, the participant will understand the application of these technologies and specific imaging considerations to the safe and effective treatment of important categories of pediatric neurovascular disease.

MSCN52D Pediatric: The Stuff We Don't See in Adults

Participants
Ahmet M. Agildere, MD, Bahcelievler, Turkey (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

muhtesem@baskent.edu.tr

LEARNING OBJECTIVES

1) Learn the essential differential diagnostic features of pediatric patients in neuroradiology. 2) Learn on the basis of interesting cases that the tumor, vascular, metabolic, infectious etc. diseases' unique properties belong to children that are important on the

differential diagnosis of pediatric patients.

ABSTRACT

The neurologic symptoms and signs are usually unable to make the certain diagnosis of pediatric patients even on the basis of laboratory and/or imaging findings. So evaluation of neuroradiologic findings and clues are more important in pediatric patients , particulary on MR. Some patients may have unique findings own to pediatric patients or require additional or advanced techniques for certain diagnosis. In this presentation main pediatric titles will be discussed on the basis of imaging findings.

MSCS52

Case-based Review of Musculoskeletal Radiology (Interactive Session)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S100AB

MK

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

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

Sub-Events

MSCS52A Foot and Ankle

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

For information about this presentation, contact:

hilary.umans@radnet.com

LEARNING OBJECTIVES

1) Learn to identify common pathology encountered in imaging the ankle / hind-foot, mid- and forefoot; cases will be selected to encompass common osteochondral, ligamentous, myotendinous capsular and soft tissue pathology.

MSCS52B Metabolic MSK Disorders

Participants
Giuseppe Guglielmi, MD, Foggia, Italy (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

giuseppe.guglielmi@unifg.it

LEARNING OBJECTIVES

1) To learn about osteoporosis, osteopoenia and osteomalacia in course of gastrointestinal, ematological, tumoral and metabolic diseases. 2) To understand the physiopathogenesis of these conditions and its differences from primary osteoporosis. 3) To present the role conventional and advanced techniques to evaluate bone mineral density and bone quality.

ABSTRACT

Metabolic bone diseases are widespread conditions which can be either primary or secondary to several disorders, such as gastrointestinal, ematological and tumoral ones. Conventional and advanced Imaging techniques may help the Radiologist to detect changes in bone mineral density (bone quantity) as well as in bone mineral architecture (bone quality) in order to make the proper diagnosis. In particular, in this session the role of Radiographs, bone densitometry, CT, MRI and their histology speciments will be discussed.

MSCS52C Hip

Participants
Donna G. Blankenbaker, MD, Fitchburg, WI (*Presenter*) Consultant, Reed Elsevier; Royalties, Reed Elsevier

LEARNING OBJECTIVES

1) Recognize the imaging appearance for different hip conditions. 2) Improve diagnostic skill and apply principles for developing a differential diagnosis.

MSCS52D Knee

Participants
Christine B. Chung, MD, La Jolla, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify current challenges in clinical diagnosis of commonly encountered knee pathology. 2) Apply strategies to address diagnostic challenges using a case-based format.

MSES52

Essentials of Trauma Imaging

Thursday, Nov. 29 10:30AM - 12:00PM Room: S406B

CT ER GI

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

Participants
Matthew T. Heller, MD, Gibsonia, PA (*Moderator*) Author, Reed Elsevier; Consultant, Reed Elsevier;

Sub-Events

MSES52A Blunt Abdominal Trauma

Participants
Matthew T. Heller, MD, Gibsonia, PA (*Presenter*) Author, Reed Elsevier; Consultant, Reed Elsevier;

For information about this presentation, contact:

hellermt@gmail.com

LEARNING OBJECTIVES

1) Describe common CT findings of blunt abdominal trauma. 2) Review key components for classification of traumatic injuries of abdominal organs. 3) Discuss the role of imaging findings in patient triage and management.

ABSTRACT

Blunt abdominal trauma is a significant cause of morbidity and mortality worldwide. Contrast-enhanced computed tomography (CT) is the most efficient and commonly used imaging modality to evaluate patients presenting after sustaining blunt abdominal trauma. Familiarity with common imaging findings and mechnism of injury are critical to the proper diagnosis and triage of patients. In this session, the key imaging findings and classifications of blunt abdominal trauma will be reviewed.

MSES52B Penetrating Abdominal Trauma

Participants
Felipe Munera, MD, Key Biscayne, FL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

fmunera@med.miami.edu

LEARNING OBJECTIVES

1) To discuss the role of MDCT in patients with Penetrating abdominal Trauma. 2) Describe MDCT protocols for PAT. 3) Review the MDCT findings of selected penetrating abdominal injuries.

ABSTRACT

Patients with PAT who are in a hemodinamically stable condition may forgo laparotomy if the do not have surgically pertinent MDCT findings. This lecture focuses on key MDCT findings in patients with penetrating abdominal trauma.

MSES52C Blunt + Penetrating Thoracic Trauma

Participants
Sanjeev Bhalla, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) An approach to CTA of the thorax in trauma. 2) Highlight the differences between blunt and penetrating trauma. 3) Emphasize the importance of direct and indirect signs.

ABSTRACT

CTA is frequently used in the assessment of thoracic trauma. Potential pitfalls can result in unnecessary work up if they are not appreciated and subtle injuries can easily be overlooked. This lecture will use cases to highlight an approach to CTA of the thorax in trauma and teh importance of direct vs. indirect signs.

Honored Educators

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MSES52D Motorcycle Injuries: Head to Toe

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

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104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRT53

ASRT@RSNA 2018: Techniques That Can Make or Break Musculoskeletal Imaging - A Case-Based Approach

Thursday, Nov. 29 10:30AM - 11:30AM Room: N230B

MK

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

Participants
Laura W. Bancroft, MD, Orlando, FL (*Presenter*) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc ; ;

For information about this presentation, contact:

laura.bancroft.md@flhosp.org

LEARNING OBJECTIVES

1) Discuss importance of proper radiographic positioning for upper and lower extremity musculoskeletal imaging. 2) Review radiographic pitfalls and potentially missed musculoskeletal cases in a case-based format.

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RCA52

Case Review: Introduction to LI-RADS - Bring Your Own Device (Hands-on)

Thursday, Nov. 29 10:30AM - 12:00PM Room: E450B

GI

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

FDA Discussions may include off-label uses.

Participants
Ania Z. Kielar, MD, Shanty Bay, ON (*Moderator*) Research Grant, General Electric Company
Kathryn J. Fowler, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Robert M. Marks, MD, San Diego, CA (*Presenter*) Nothing to Disclose
James T. Lee, MD, Lexington, KY (*Presenter*) Nothing to Disclose
Venkateswar R. Surabhi, MD, Houston, TX (*Presenter*) Nothing to Disclose
Cynthia S. Santillan, MD, San Diego, CA (*Presenter*) Consultant, Robarts Clinical Trials, Inc
Aya Kamaya, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Yuko Kono, MD, PhD, San Diego, CA (*Presenter*) Equipment support, Canon Medical Systems Corporation; Equipment support, General Electric Company; Contrast agent support, Lantheus Medical Imaging, Inc; Contrast agent support, Bracco Group
Alice W. Fung, MD, Portland, OR (*Presenter*) Nothing to Disclose
Eleanor L. Ormsby, MD, Davis, CA (*Presenter*) Nothing to Disclose

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eormsby@gmail.com

LEARNING OBJECTIVES

1) Implement newest LI-RADS categories when assessing liver observations in patients at risk for HCC. 2) Review LI-RADS major and ancillary features and learn how to apply them in LI-RADS categorization. 3) Demonstrate proficiency with the newly developed LI-RADS algorithm for assessing response of liver lesions to locoregional treatment. 4) Compare LI-RADS updates to AASLD updates.

ABSTRACT

Participants will review cases on their own devices and answer questions. The cases will then be reviewed by the presenters. Note: this activity is best done on a laptop or tablet. Although phones will work, their small size limits optimal image view. In this 1.5-hour Hands-On Workshop, the participants will be seated at stand-alone computers and have the opportunity to review up to 15 MRI, CT and ultrasound cases of livers in patients at risk for HCC and characterize the observations based on the most up to date version of LI-RADS. The workshop will be led by world-renown experts in the field, all of them members of the LI-RADS steering committee and/or members of a LI-RADS working group. A 20 minute didactic review of the most up to date LI-RADS will be offered at the start of the course to familiarize attendees. Following this introduction, workshop participants will have time to work through each case on their own, with support faculty available throughout the room to answer individual questions. Subsequently, each case will be reviewed by a faculty member in a didactic fashion, highlighting pearls for accurate use of LI-RADS in each case, with opportunity for questions. Focus will be on the overall integration of LI-RADS into daily practice. This workshop will initially focus on the major imaging features post-contrast enhancement and work through the algorithm of how to assign a LI-RADS score. This workshop will also encompass ancillary imaging features and how to apply them to ensure standardized LI-RADS reporting of various types of liver observations.

Active Handout:James T. Lee

http://abstract.rsna.org/uploads/2018/17002588/2018 RSNA LI-RADS Hands-On Workshop RCA52.pdf

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RCB52

Hands-on Introduction to Social Media: Core (Hands-on)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S401CD

IN

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

Participants
Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Royalties, Osler Institute
Saad Ranginwala, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Tirath Y. Patel, MD, Houston, TX (*Presenter*) Nothing to Disclose
Amy K. Patel, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Appreciate the professional relevance of social media for radiologists. 2) Understand the differences between social media in personal and professional roles. 3) Understand the differences between and advantages/disadvantages of multiple social media networks. 4) Set up and use a Twitter account.

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RCC52

Novel Discoveries Using the NCI's Cancer Imaging Archive (TCIA) Public Data Sets

Thursday, Nov. 29 10:30AM - 12:00PM Room: S501ABC

AI IN OI

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

Participants
Janet F. Eary, MD, Bethesda, MD (*Moderator*) Nothing to Disclose
Evis Sala, MD, PhD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose
Andriy Fedorov, PhD, Boston, MA (*Presenter*) Research funded, Siemens AG
Jayashree Kalpathy-Cramer, MS, PhD, Charlestown, MA (*Presenter*) Consultant, Infotech Software Solution
Daniel L. Rubin, MD, MS, Stanford, CA (*Presenter*) Nothing to Disclose
Aaron J. Grossberg, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose
Jeffrey F. Williamson, PhD, St. Louis , MO (*Presenter*) Nothing to Disclose
John B. Freymann, BS, Rockville, MD (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Critically appraise The Cancer Imaging Archive (TCIA)/MD Anderson Cancer Center Head and Neck Squamous Cell Carcinoma (HNSCC) data set. 2) Identify solutions to challenges in sharing and curating RT DICOM data collections. 3) Describe novel discoveries made using the HNSCC data set. 4) Apply TCIA data sets to derive imaging-based predictors of oncologic outcome. 5) Recommend innovative research approaches using extant and future TCIA collections. 6) Discuss updates in enriching TCIA collections of images with results of their annotation and analysis. 7) Discuss the importance of standardization as applied to image-derived data representation for its reuse and harmonization across TCIA collections.

ABSTRACT

This didactic session will highlight popular data sets and major projects utilizing TCIA with presentations from leading researchers and data contributors. Attendees will hear presentations about the following projects and data sets: • The Applied Proteogenomics OrganizationaL Learning and Outcomes (APOLLO) network • Cancer Proteomics Tumor Analysis Consortium (CPTAC) • Crowds Cure Cancer • Quantitative Imaging Network (QIN) Prostate MRI • Quantitative Image Informatics for Cancer Research (QIICR) • Digital Database for Screening Mammography • Head and Neck Squamous Cell Carcinoma (HNSCC) • 4D-Lung

URL

https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fdicom4qi.readthedocs.io%2Fen%2Flatest%2Fresources%2Fdatasets%2F&data=02%7C01%7Ccricchio%40rsna.org%7Cb8fff403a6a34d30d3f408d651874712%7Cfb5fefcd7ca642
https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fdicom4qi.readthedocs.io%2Fen%2Flatest%2Fresources%2Fsoftware%2F&data=02%7C01%7Ccricchio%40rsna.org%7Cb8fff403a6a34d30d3f408d651874712%7Cfb5fefcd7ca642

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SSQ01

Breast Imaging (Abbreviated MRI, Ultrafast Imaging and Artificial Intelligence)

Thursday, Nov. 29 10:30AM - 12:00PM Room: E450A

AI BR MR

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

Participants
Christiane K. Kuhl, MD, Aachen, Germany (*Moderator*) Nothing to Disclose
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Moderator*) Researcher, Siemens AG ; Researcher, Seno Medical Instruments, Inc; Researcher, Identification Solutions, Inc; Researcher, Micrima Limited; Researcher, Medtronic plc; Scientific Advisor, ScreenPoint Medical BV; Scientific Advisor, Transonic Imaging, Inc; Stockholder, Transonic Imaging, Inc

Sub-Events

SSQ01-01 Assessing the Accuracy of an Abbreviated Breast MRI Protocol Compared to a Full MRI Protocol in Women with a Personal History of Breast Cancer

Thursday, Nov. 29 10:30AM - 10:40AM Room: E450A

Participants
Jennifer Gillman, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME
Ari Borthakur, PhD,MBA, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. McDonald, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Alice Chong, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Women with a personal history of breast cancer have an elevated lifetime risk for a second breast cancer. However, the current American Cancer Society guidelines do not recommend MRI screening in this population. Multiple studies have demonstrated that the sensitivity of Abbreviated breast MRI (AB-MRI) is similar to full diagnostic protocols (FDP-MRI). In this study, we retrospectively evaluate the use of surveillance AB-MRI in women with a personal history of breast cancer.

METHOD AND MATERIALS

An IRB approved and HIPAA compliant reader study was performed on 398 consecutive women with a personal history of breast cancer who underwent full protocol clinical breast MRIs from 9/13-12/15. There were 14 cancers detected (3.8%). An enriched reader study was performed consisting of 68 cases including the 14 cancer cases. Non-cancer cases had at least 1 year of follow-up. Interpretations from a limited image set simulating an AB-MR protocol (T2, pre, and post contrast) were compared with interpretations of the FDP-MRI clinical study.

RESULTS

The AB-MR interpretations were compared with those from the full, clinical protocol. The sensitivity (SN), specificity(SP), positive predictive value (PPV), and the negative predictive value (NPV) for the simulated AB-MR vs the FDP-MRI interpretations were: SN - 50% vs 71%, SP - 96% vs 77%, PPV- 74% vs 43%, NPV - 88% vs. 91%. The mean difference between reader 1 and reader 2 was 0.29 with 95% confidence interval: [-0.33, 0.90]. There were significantly fewer false positives with AB-MRI than FDP-MRI, but more false negatives were observed with AB-MRI.

CONCLUSION

Our preliminary results show higher specificity at the expense of sensitivity in our simulated AB-MRI reads compared to FDP-MRI in women with a history of breast cancer. Further evaluation is warranted.

CLINICAL RELEVANCE/APPLICATION

A simulated AB-MRI protocol resulted in fewer false positive exams than with a full, clinical MR protocol in women with a personal history of breast cancer, however, more research is needed.

SSQ01-02 Abbreviated Breast MRI : 'Ultrafast' DISCO Acquisition for Lesion Characterization

Thursday, Nov. 29 10:40AM - 10:50AM Room: E450A

Awards
Student Travel Stipend Award

Participants
Audrey Milon, MD, Paris, France (*Presenter*) Nothing to Disclose
Isabelle Thomassin-Naggara, MD, Paris, France (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Julie Poujol, PhD, Vandoeuvre-les-Nancy, France (*Abstract Co-Author*) Nothing to Disclose
Asma Bekhouche, Paris, France (*Abstract Co-Author*) Nothing to Disclose

Saskia Vande Perre, Paris, France (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

audrey.milon.am@gmail.com

PURPOSE

The purpose of our study was to evaluate the diagnostic performance of a dynamic acquisition over-sampling the first minute after contrast administration in an abbreviated dynamic-contrast-enhanced (DCE) breast-MRI.

METHOD AND MATERIALS

153 women were retrospectively consecutively included between July 2016 and March 2017, regardless of indication. All these women had a full breast- MRI protocol, including a DISCO ultrafast acquisition with 7 phases, and an enhanced lesion histologically proven (age= 55 (28-88)). Two readers analyzed 179 lesions (73 benign, 5 B3, 101 malignant lesions) with BIRADS classification for each protocol: an abbreviated protocol (T1-weighted, T2-wheigthed, DISCO, T1-fat suppressed VIBRANT 2mn after contrast administration) and a standard full protocol with late post-contrast phases. Then readers studied DISCO's early enhancement curve with the following semi-quantitative parameters: Wash-In Rate (WIR), Maximal Slope Increase (MSI), Enhancement Amplitude (EA), and Time of Half Rising (THS). Heterogeneity was also assessed using Standard Deviation (STD) at the different DISCO phases.

RESULTS

176/179 (98%) lesions were detected by the abbreviated protocol regarding to the full protocol : 122 mass and 57 non-mass-like enhancement or foci (medium size : 18mm). The 3 undetected lesions were benign. Malignant lesions showed a WIR, a MSI a EA higher, a THS shorter and were more heterogeneous at all DISCO phases than benign lesions ($p<0.01$). In the group of masses with benign morphology (n= 42), THS was shorter for the malignant lesions (39.1 sec) than for the benign lesions (44.6 sec) ($p=0.01$).

CONCLUSION

Including an additional ultrafast-scan in an abbreviated breast-DCE-MRI protocol enables the early enhancement study that is useful for lesion characterization and is time efficient.

CLINICAL RELEVANCE/APPLICATION

DCE-abbreviated breast-MRI with ultrafast-scan is efficient for lesion detection and characterization; so might be considered as a screening tool in intermediate-risk women.

SSQ01-03 Ultrafast Breast DCE-MRI in the Evaluation of Tumor Size: Potential Utility in Moderate to Marked Background Parenchymal Enhancement

Thursday, Nov. 29 10:50AM - 11:00AM Room: E450A

Participants
Sooyeon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Rihyeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Sil Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Sun Bae, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Su Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, General Electric Company
Woo Kyung Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

river7774@gmail.com

PURPOSE

Ultrafast breast DCE-MRI allows imaging of early kinetics within the first 30 seconds after contrast injection, when the background parenchymal enhancement (BPE) is minimal. This study was performed to explore the clinical utility of ultrafast MRI focusing on tumor size evaluation according to the level of BPE.

METHOD AND MATERIALS

A total of 360 consecutive women (median age, 54 years; range, 26 - 82 years) with 361 tumors (49 DCIS and 312 invasive) who underwent both the ultrafast and conventional breast MRI before surgery were included. Ultrafast MR images were obtained using TWIST or 4D-TRAK sequence (temporal resolution, 4.5 sec; voxel size, 1.1×1.1×1.0 mm3, TR/TE 4.1/1.3 ms). Then, conventional DCE-MR images were obtained using 3D FLASH sequence (temporal resolution, 90sec; voxel size, 0.8×0.8×1.0 mm3, TR/TE 4.7/1.7 ms). Tumor size was independently measured on each scan, respectively. Agreement between tumor sizes on MRI and those on surgical histopathology was assessed using the intraclass correlation coefficient (ICC) analysis.

RESULTS

The ICC on ultrafast MRI was comparable to that on conventional MRI (ICC = 0.657 vs. 0.634, P =.598). For conventional MRI, the ICC was lower in women with moderate to marked BPE (ICC = 0.568) than in women with minimal to mild BPE (ICC = 0.650) with borderline significance (P =.080). However, no difference was found on ultrafast MRI (ICC = 0.625 for moderate to marked vs. 0.663 for minimal to mild BPE, P =.385). In women with moderate to marked BPE, the ICC was slightly higher on ultrafast MRI than that on conventional MRI, although the difference was not statistically significant (ICC = 0.625 vs. 0.568, P = .236). No difference was found for the ICC according to the age, menopausal status, family history, histologic type, ER positivity, HER2 positivity, and lesion type on MRI (mass vs. non-mass enhancement) (All P >.05).

CONCLUSION

In women with moderate to marked BPE, tumor size measurement might be more accurate on ultrafast MRI than on conventional MRI.

CLINICAL RELEVANCE/APPLICATION

In women with moderate to marked BPE, ultrafast MRI can be applied for more accurate evaluation of tumor extent.

SSQ01-04 Maximum Slope as a Kinetic Parameter Based on Ultrafast Dynamic Contrast-Enhanced MRI of the Breast Using K-Space Weighted Imaging Contrast

Thursday, Nov. 29 11:00AM - 11:10AM Room: E450A

Participants
Akane Ohashi, Kyoto-hu, Japan (*Presenter*) Nothing to Disclose
Masako Y. Kataoka, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Shotaro Kanao, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Mami Iima, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Makiko Kawai, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Natsuko Onishi, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yuta Urushibata, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsutoshi Murata, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Elisabeth Weiland, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Masakazu Toi, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kaori Togashi, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Nihon Medi-Physics Co, Ltd; Research Grant, Canon Medical Systems Corporation

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PURPOSE

To investigate the diagnostic performance and inter-reader agreement of the maximum slope (MS) in breast malignant from benign lesions obtained by ultrafast dynamic contrast-enhanced magnetic resonance imaging (DCE MRI). Comparison with washout index (WI) was performed with the focus on discrepant cases.

METHOD AND MATERIALS

In total, 141 enhancing lesions (89 malignant, 52 benign) were included. Ultrafast DCE MRI sequences were acquired using a k-space-weighted imaging contrast (KWIC) sequence, obtained 0 to 1 min after gadolinium injection (3.75 s/frame; 16 frames) and followed by standard DCE MRI. The MS was calculated its percentage relative enhancement per second (%/s). The inter-reader agreement of MS values by two radiologists were evaluated using intra-class correlation coefficients (ICC). As a semi-quantitative parameter for conventional DCE MRI, washout index (WI: signal intensity [SI] delay - SI early) / SI pre × 100 (%) was calculated. The diagnostic performance (malignant/ benign differentiation) of the MS and WI was compared using ROC analysis.

RESULTS

Intra-class correlation coefficients (ICC) of the reading was 0.98 (95% confidence interval 0.97-0.99) for all, 0.96 (0.95-0.98) for malignant lesions and 0.99 (0.97-0.99) for benign lesions. The average MS was 25.4%/s (standard deviation: SD, 11.2 %/s) for malignant lesions and 11.8%/s (SD, 10.7 %/s) for benign lesions. The AUC of the MS (ICC: 0.98) was almost same as that of the WI (0.83 vs. 0.82, respectively; P = 0.80). Using the optimal cut-off points determined by the Youden index (>9.76% /s for the MS and <-23 % for the WI), MS tended to have higher sensitivity (92.1%) and specificity (65.4%) compared with WI (91.1% and 61.5%, respectively). False positive cases based on MS were FA (n=5) and intraductal papilloma (n=1), while false positive cases based on WI were fibrocystic change (n=6), intraductal papilloma (n=2) and flat epitherial atypia.

CONCLUSION

The overall diagnostic performance of MS in breast lesion was similar to the conventional kinetic parameter, with AUC of over 0.8. Excellent ICC was obtained. MS helped to reduce false positive in fibrocystic change, while FA tended to be false positive on MS.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that maximum slope can be an alternative kinetic parameter to conventional kinetic curve, potentially shorten scan time, with excellent inter-reader agreement.

SSQ01-05 Combination of an Ultrafast TWIST VIBE Dixon Sequence Protocol and Diffusion-Weighted Imaging to a Highly Accurate Clinically Applicable Classification Tool for Suspicious Masses in Breast MRI

Thursday, Nov. 29 11:10AM - 11:20AM Room: E450A

Participants
Stephan Ellmann, MD, Erlangen, Germany (*Presenter*) Nothing to Disclose
Sandra Peter, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To develop a statistical model for classification of suspicious masses in breast MRI when using TWIST VIBE Dixon (TVD) dynamic sequences in combination with diffusion-weighted imaging (DWI) and compare it to a model based on a combination of conventional dynamic contrast enhancement (DCE) and DWI. As ultrafast TVD sequences offer the potential to shorten breast MRI protocols, diagnostic accuracy might be hampered due to reduced kinetic information. A special focus of this study was thus to maintain high diagnostic accuracy in lesion classification.

METHOD AND MATERIALS

65 patients underwent clinically indicated breast MRI between 02/2014 and 04/2015, with 83 reported lesions (60 malignant, 23 benign). Inclusion criteria were suspicion of breast cancer or pre-therapeutic staging. Patients with non-mass-enhancements only were excluded. The protocol consisted of our institute's standard protocol complemented by an ultrafast TVD sequence. The apparent diffusion coefficient (ADC) and the peak enhancement of the TVD sequences were used to calculate a generalized linear model (GLM) for prediction of malignancy. A second model was calculated using ADC and the curve type derived from the conventional DCE sequence for the sake of comparison. Generalizability was ensured by applying leave-one-out cross validations. For easy application of the GLMs in clinical workflows, nomograms were created.

RESULTS

The GLM based on peak enhancement of the ultrafast TVD sequences and ADC performed comparably accurate to the model based on conventional DCE and ADC (Sensitivity 93.3% vs. 93.3%, specificity 91.3% vs. 87.0%, positive predictive value 96.6% vs. 94.9%, negative predictive value 84.0% vs. 83.3%; no significant differences).

CONCLUSION

This study presents a method to integrate ultrafast TVD sequences into a breast MRI protocol and reduce examination time while maintaining diagnostic accuracy. A GLM based on the combination of TVD-derived peak enhancement and ADC provides high diagnostic accuracy. The GLM can easily be applied in clinical routine using the supplied nomograms.

CLINICAL RELEVANCE/APPLICATION

One limiting factor hampering the comprehensive application of breast MRI is time. This study presents a breast MRI protocol with less than 5 minutes duration along with a classification scheme reaching high diagnostic accuracy. Use of this protocol could improve patient throughput and strenghten the role of breast MRI in screening.

SSQ01-06 Ultrafast Dynamic Contrast-Enhanced MRI for Detection of Invasive Components in Cases of Breast Ductal Carcinoma in Situ by Biopsy

Thursday, Nov. 29 11:20AM - 11:30AM Room: E450A

Participants
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PURPOSE

To evaluate whether ultrafast dynamic contrast-enhanced (DCE) MRI could identify invasive components in cases with ductal carcinoma in situ (DCIS) diagnosed by percutaneous biopsy.

METHOD AND MATERIALS

Fifty-three consecutive women with 53 lesions diagnosed with DCIS by biopsy underwent IRB-approved ultrafast DCE-MRI including a pre- and 18 post-contrast ultrafast 3D bilateral scans using a 3T system. Ultrafast 3D bilateral scans were acquired with temporal resolution of 3 seconds per image. We evaluated the heterogeneity of enhancement in a target lesion using model-based analysis. Regions of interest (ROIs) were placed where the strongest and weakest signal increases were found in ultrafast DCE-MRI to obtain kinetic curves of maximum and minimum enhancement, respectively. The kinetic curve obtained from ultrafast DCE-MRI was analyzed using an empirical mathematical model: $\Delta S(t)=A*(1-e-at)$. Where A is the upper limit of the signal intensity, a (min-1) is the rate of signal increase. The initial slope of the kinetic curve is given by 'A*a'. Amax, Amin, amax, amin, A*amax, and A*amin were obtained from ROIs for maximum and minimum enhancement, respectively. We obtained the following derivations for diagnostic parameters showing heterogeneity of enhancement: A difference=Amax - Amin; a difference= amax -amin; A*a difference= A*amax - A*amin.

RESULTS

Surgical specimens revealed 32 lesions with pure DCIS and the remaining 21 lesions with DCIS with invasive components (DCIS-IC). The A difference for DCIS-IC (132±235) was significantly higher than that of pure DCIS (49±34) ($p = 0.013$). No significant difference was found for a difference and A*a difference ($p = 0.24$ and 0.46, respectively). Receiver operating curve analysis revealed that the area under the curve of A difference was 0.70. The most effective threshold for A difference was 68, and the sensitivity, specificity, positive predictive value and negative predictive value were 62% (13/21), 72% (23/32), 59% (13/22), and 74% (23/31), respectively.

CONCLUSION

The A difference could suggest the presence of invasive components in cases with DCIS diagnosed by biopsy.

CLINICAL RELEVANCE/APPLICATION

The A difference showing the heterogeneity of enhancement of lesions in ultrafast DCE-MRI might suggest the presence of invasive components in cases of DCIS by biopsy.

SSQ01-07 Ultrafast Dynamic Contrast Enhanced Breast MRI in Differentiating between Subcentimeter Carcinomas and Benign Lesions: Quantitative versus Qualitative Assessments

Thursday, Nov. 29 11:30AM - 11:40AM Room: E450A

Participants
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PURPOSE

Ultrafast dynamic contrast enhanced (UF-DCE) breast MRI, characterized by high temporal and spatial resolution, enables image acquisition at multiple time points starting simultaneously with the beginning of contrast injection. In a preliminary study comparing several quantitative parameters calculated from UF-DCE MRI, we determined bolus arrival time (BAT) and maximum slope (MS) were most useful in the differentiation between subcentimeter carcinomas and benign lesions. This study aims to compare the performance of these parameters with qualitative assessments of UF-DCE MRI.

METHOD AND MATERIALS

We identified female patients between February-October 2017 with a: 1) UF-DCE MRI as part of hybrid protocol with conventional DCE MRI performed with a 3.0T MRI with a 16-ch coil and 2) biopsy proven BI-RADS 4-6 lesion. UF-DCE MRI were acquired continuously 15 times during the approximately 60 sec (temporal resolution, 3.0-4.3 sec) starting simultaneously with the beginning of contrast injection. BAT and MS were computationally calculated based on 3D volumetric segmentation. Qualitative assessments were visually performed by a reader, identifying the time from scan start to the beginning of lesion enhancement (vBAT) and evaluating the degree of enhancement relative to background parenchymal enhancement (vE) by a 4-point grading scale from 'prominent' to 'indistinguishable'. Wilcoxon signed-rank test or Pearson's chi-squared test were used for the statistical analyses. P value <0.05 was considered satistically significant. The diagnostic performance was evaluated using areas under the receiver operating characteristic curve (AUC).

RESULTS

In total, 77 subcentimeter lesions (carcinomas, 33 [43%]; benign lesions, 44 [57%]) were analyzed. BAT, MS and vBAT presented significant difference between carcinomas and benign lesions (p=0.0004, p<.0001, p=0.0063), while vE did not (p=0.0607). AUCs of BAT (0.737) and MS (0.790) were higher than those of vBAT (0.683) and vE (0.605).

CONCLUSION

Quantitative assessments of UF-DCE MRI presented higher performance than qualitative assessments in differentiating between subcentimeter carcinomas and benign lesions.

CLINICAL RELEVANCE/APPLICATION

There is no standardized way to evaluate ultrafast DCE breast MRI. Although diagnostic utility of some quantitative parameters is known, little is known about the performance of qualitative assessment, especially for subcentimeter lesions.

SSQ01-08 Comparison of Machine Learning Based Measurement and Visual Assessment of Fibroglandular Tissue and Background Parenchymal Enhancement in Breast MR Imaging: A Preliminary Study

Thursday, Nov. 29 11:40AM - 11:50AM Room: E450A

Participants
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PURPOSE

To design and validate a machine learning model for the measurement of fibroglandular tissue (FGT) and background parenchymal enhancement (BPE) in breast MR imaging, and compare with estimation of radiologist according to BI-RADS categories.

METHOD AND MATERIALS

195 women (mean age, 54.9 years; range 30 - 86 years) who were diagnosed with invasive breast cancer and underwent preoperative breast MR, between January and December 2017 were enrolled in this study. Two radiologists independently assessed the categories of FGT and BPE of contralateral breast, using with axial precontrast, early dynamic contrast enhancement T1-weighted image, and subtraction image between them. In case of discordance, two radiologists reached consensus. Machine learning model was designed to measure the volume of whole breast, FGT and BPE, using nonnegative matrix factorization (NMF). In this study, 50 and 145 samples were assigned to train and valid, respectively. Areas under the receiver operating characteristic curve was used to assess model performance of predicting dense breast (FGT category c, d) and prominent BPE (BPE category c, d). Correlation between the visual assessment of radiologist and machine learning based measurement was assessed using Spearman correlation analysis.

RESULTS

With the machine learning model, AUC of prediction of dense breast were 0.971 (0.880-0.998) in training set and 0.902 (0.784-0.968) in validation set. AUC of prediction of prominent BPE were 0.959 (0.912-0.985) in training set and 0.819 (0.746-0.848) in validation set (P < .001). Correlation between machine learning based measurement and visual assessment by radiologist was r = 0.871 of FGT, and r = 0.523 of BPE, respectively (P < .001).

CONCLUSION

Machine learning model showed reliable predictive power for FGT and BPE assessment and close correlation with FGT assessment by radiologist.

CLINICAL RELEVANCE/APPLICATION

FGT and BPE are known as risk factors for breast cancer and are associated with poor prognosis. Machine learning can provide quantitative and objective information of FGT and BPE volume in breast MR imaging and can be helpful to predict patient's prognosis.

SSQ01-09 Deep Learning of Breast MRI Tumor Volume Improves Tumor Proliferation Marker Ki-67 Estimation

Thursday, Nov. 29 11:50AM - 12:00PM Room: E450A

Participants
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PURPOSE

Ki-67 is a commonly used immunohistochemistry marker for cellular proliferation in invasive tumors. A few recent studies showed some association between Ki-67 and DCE-MR imaging features. We performed an investigation to compare effects of a 3D deep learning approach versus conventional radiomic features in deriving breast DCE-MRI information to predict Ki-67 rate.

METHOD AND MATERIALS

In an IRB-approved retrospective study of 141 patients, we identified 141 breast DCE-MRI scans (2011-2016) at our institution. All patients have the Ki-67 proliferation rates measured that are further categorized into High vs Low category according to a clinically defined threshold of 14. Breast tumor volume were automatically segmented in 3D space from the first post-contrast breast MR sequence images. From the segmented 3D tumor volume, we extracted 30 common radiomic features, including morphological and contrast enhancement kinetic characteristics of the tumor volume; those features were fed to a logistic least absolute shrinkage and selection operator (LASSO) regression model to predict High vs Low Ki-67 categories. Also, a 3D convolutional neural network (CNN) deep learning model was used to perform the same prediction but directly using the original image of the segmented 3D tumor volume (i.e., here no any pre-defined imaging features extracted nor used). We performed 10-fold cross-validation for both logistic regression and deep learning model evaluation and used average AUC as the metric of model classification accuracy.

RESULTS

There are 102 and 39 patients in the High and Low Ki-67 category, respectively. The average of the Ki-67 was 28.05%±21.63. The AUC of the logistic regression model was 0.74 (95% CI: 0.73-0.75) for 4 LASSO-selected top ranked radiomic features (1 morphological and 3 contrast-enhancement related), while the 3D deep learning model achieved an AUC of 0.80 (95% CI: 0.75-0.85).

CONCLUSION

In this study, the 3D CNN deep learning-based approach that automatically identifies and organizes hierarchical imaging features for predicting Ki-67 outperformed the LASSO regression model coupled with pre-defined radiomic features.

CLINICAL RELEVANCE/APPLICATION

Deep learning of breast DCE-MRI tumor volume using CNN models may improve interpretation on the association between radiological images and the immunohistochemistry tumor proliferation marker Ki-67.

SSQ02

Cardiac (Great Vessels and Cardiopulmonary Disease)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S404AB

CA CH CT MR VA

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

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Sub-Events

SSQ02-01 3rd Generation Dual Source CT Pulmonary Angiographic Study at Very Low Contrast Doses: A New Frontier

Thursday, Nov. 29 10:30AM - 10:40AM Room: S404AB

Participants
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PURPOSE

Pulmonary Angio-CT is the first diagnostic choice for the evaluation of pulmonary embolism and usually performed with iodinated contrast media (CM) injection. The purpose of this study is to evaluate the lower amount of iodinated CM required in order to obtain a diagnostic quality pulmonary Angio-CT with the new Dual Source CT technology.

METHOD AND MATERIALS

36 patients (16 males, 20 females; mean age 40 years) were enrolled with medium-high pre-test probability of pulmonary embolism and underwent a 3rd generation Dual Source CT (Somatom Force Siemens Healthineers) scan. Three groups of 12 patients each one were randomized using 400 mgI/mL iodinated CM with different doses: group A (<5 ml), group B (<10 ml) and group C (<15 ml). The Hounsfield Unit (HU) values were sampled at predefined points of the pulmonary arteries. Each exam was also assessed qualitatively with a 5-point scale.

RESULTS

HU evaluation did not show statistically significant difference between groups A and B, while they showed statistically significant difference between group C and groups A-B (Kruskal-Wallis, p=0.025). Qualitative analysis did not find statistically significant difference between groups A, B and C (Kruskal-Wallis, p=0.12).

CONCLUSION

The new 3rd Dual Source CT technology allows for an optimization of pulmonary angio-CT study in order to obtain a diagnostic quality images with low doses of iodinated CM.

CLINICAL RELEVANCE/APPLICATION

The purpose of this study is to evaluate a reduced contrast media administration in patients with suspected pulmonary embolism in an emergency setting, especially in patients with higher risk of contrast-induced nephropathy (CIN) (i.e. nephropatic or type 2 diabetic patients).

SSQ02-02 2D-PC MRI Measurement of Pulmonary Artery Blood Flow and Left Atrial Function in Smokers: A Correlational Research

Thursday, Nov. 29 10:40AM - 10:50AM Room: S404AB

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PURPOSE

To investigate the correlation between main pulmonary artery blood flow and left atrium functional parameters in smokers using two-dimensional phase contrast magnetic resonance imaging (2D-PCMRI).

METHOD AND MATERIALS

Twenty-eight smokers (all men, mean age: 39.8±7.0 years) were enrolled in this study. All of them underwent main pulmonary artery 2D-PC and cardiac scan at 3.0T MR from December 2017 to March 2018. Blood flow parameters include Peak Positive Velocity (PPV) (cm/s), Peak Negative Velocity (PNV) (cm/s), Average flow (AF) (ml/beat), Average Positive Flow (APF) (ml/beat), and Average Negative Flow (ANF) (ml/beat). The correlation between main pulmonary artery blood flow and left atrial functional parameters was analyzed.

RESULTS

There is a statistically correlation between pulmonary artery PPV and left atrial active ejection fraction (LAEFa) (p=0.022, r=0.431), and left atrium total ejection fraction (LAEFt) (p=0.032, r=0.406) respectively. Similarly, there is a statistically correlation between pulmonary artery AF and left atrium maximum volume (LAVi max) (p=0.048, r=0.378), LAEFa (p=0.040, r=0.391) and LAEFt (p=0.008, r=0.488) respectively. There is a statistically correlation between APF and LAVi max (p=0.039, r=0.392), LAEFt (p=0.028, r=0.415), respectively.

CONCLUSION

There is a positive correlation between the main pulmonary artery blood flow and left atrium function in smokers.

CLINICAL RELEVANCE/APPLICATION

This correlational research of pulmonary artery blood flow and left atrium function is helpful in further to understand and reveal the effect of smoking on the cardiovascular system.

SSQ02-03 Quantification of Pulmonary Emboli Burden by Novel 3D-Based Computed Tomography Method: Comparison with Qanadli Score, Biomarkers, and Clinical Information

Thursday, Nov. 29 10:50AM - 11:00AM Room: S404AB

Participants
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PURPOSE

Dedicated descriptions of pulmonary emboli (PE) morphology, total emboli burden, and the possible impacts on hemodynamics and diagnostic biomarkers remained largely unexplored.

METHOD AND MATERIALS

We consecutively studied subjects suffered from acute PE who visited emergency department. On arrival hemodynamics, oxygenation status, and markers of Troponin-I/D-dimer were all obtained. Contrast enhanced spiral computed tomography (CT) for pulmonary vasculature and 3-dimensional (3D) measures of emboli burden were performed (IntelliSpace Portal [ISP] 9.0 Philips Medical Systems Nederland B.V.).

RESULTS

Among 116 subjects (mean age: 70.1±16.0, 64% female) with clinical information and CT-based 3D embolism quantification available, the mean total emboli size were 8.6cm3, Qanadli scores was 7.4, 4.6, and 12.1 for right, left side and total pulmonary trunk (reference range: 0-20), respectively. Both greater total emboli mass and pulmonary emboli Qanadli score were positively associated with higher Troponin I level (r=0.23 & 0.33, both p<0.05), and marginally associated with lower on arrival oxygenation saturation (SpO2) (by blood gas, r=-0.38, p=0.05). Instead, total emboli burden within lung parenchyma was strongly inversely associated with SpO2 (r=-0.48 & -0.42, both p<0.05).

CONCLUSION

Total thromboemboli burden assessed by quantitative CT-based modality served as a useful index for stressed cardiopulmonary circulation, and possibly provide insights into oxygenation/perfusion status.

CLINICAL RELEVANCE/APPLICATION

Total thromboemboli burden assessed by quantitative CT-based modality served as a useful index for stressed cardiopulmonary circulation.

SSQ02-06 Evaluation of Coronary Artery in Kawasaki Disease By 3D Magnetic Resonance Coronary Angiography

Thursday, Nov. 29 11:20AM - 11:30AM Room: S404AB

Participants
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PURPOSE

Kawasaki disease causes inflammation that is inclined to cause heart complications, such as coronary artery vasculitis, myocarditis, and heart valve problems. Our study is aimed to assessment of coronary arteries in Kawasaki disease by 3D magnetic resonance imaging

METHOD AND MATERIALS

The study group consisted of 16 pediatric patients aged 2 to 10 years (males, 87.5%; mean age, 4.8 year) with Kawasaki diseases from Jan. 2017 to Mar. 2018. All patients underwent three-dimensional (3D) whole-heart magnetic resonance imaging (1.5T, Phiilps;) using two different sequences (3D TEE sequence; 3D BTEE sequence;). Sweep time were record and the image quality was graded (from 0 to 5).

RESULTS

there were six patients with enlarged left and right ventricles (37.5%), three patients with enlarged whole-heart (18.75%), two patients with double superior vena cavas and enlarged left atrium and ventricle (12.5%). The scan time of 3D TEE sequence was One minute and forty seconds to two minute and thirty seconds (1min 40s to 2 min 30s), The scan time of 3D BTEE sequence was five minute and twenty seconds to six minute and thirty seconds (5 min 20s to 6 min 30s). For the grade of imaging quality, five patients were classes as 0-2 grade (31.25%), 11 patients were 3-5 grade (68.75) by the 3D TEE sequence, and six patients were 0-2 grade (37.5%), 11 patients were 3-5 grade (62.5%) by the 3D BTEE sequence.

CONCLUSION

3D whole-heart coronary arteries magnetic resonance imaging could obtain similar imaging quality with less scan time, it may be an excellent method to image, evaluate, diagnose, and follow-up coronary arteries lesions in pediatric patients with Kawasaki diseases.

CLINICAL RELEVANCE/APPLICATION

(dealing with 3D coronary arteries magnetic resonance imaging) 3D whole-heart coronary arteries magnetic resonance imaging could obtain similar imaging quality with less scan time.

SSQ02-07 Automatic Segmentation of Lung Volumes in Population-based Whole-Body MR Imaging: Association with Subclinical Cardiac Impairment

Thursday, Nov. 29 11:30AM - 11:40AM Room: S404AB

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PURPOSE

Both cardiac and pulmonary morphology and function can be simultaneously assessed during a single MR scan. Previous studies have shown an association between obstructive lung disease with cardiac dysfunction. Our aim is to evaluate the relationship between lung volumes and cardiac impairment in a population-based cohort study using whole-body MR scans.

METHOD AND MATERIALS

We studied 400 subjects who underwent whole-body MRI as part of the KORA FF4 cohort study, excluding subjects with established cardiovascular disease. Lung volumes were derived semi-automatically through an in-house algorithm (coronal acquired T1w sequences). Using Pearson correlation and multivariate regression (adjusted for age, sex, smoking status and BMI), lung volumes were compared with cardiac parameters of left and right ventricle (LV/RV, acquired from cine-SSFP sequences using cvi42), and standardized to body surface area.

RESULTS

A total of 356 subjects presented an average MRI-based lung volume of 4.0±1.1L and mostly standard values for cardiac parameters. In univariate analysis, a negative correlation of LV and RV stroke volume to lung volume was observed. After multivariate adjustment, stroke volume as well as end-diastolic volume of both LV (ß=-2.75, p=0.001; ß=-1.71, p=0.001) and RV (ß=-2.14, p=0.02; ß=-1.45, p=0.004) showed negative associations with lung volume, while ejection fraction, peak ejection rate and myocardial mass were not associated with lung volumes (Figure 1). These values were stronger for the LV than for the RV. In addition, for the LV, early but not late diastolic filling rate was negatively associated with lung volume.

CONCLUSION

Cardiac function and volume parameters derived from non-dedicated whole-body MRI, such as stroke volumes and biventricular end-diastolic volumes were significantly associated with lung volumes in a patient cohort without cardiovascular disease.

CLINICAL RELEVANCE/APPLICATION

These results suggest, that MRI could be an accurate, radiation-free, and possibly one-stop-shop screening tool, with the potential for early detection of subclinical heart disease in patients with emphysema and subclinical cardiovascular dysfunction.

SSQ02-08 Double Region of Interest Timing Bolus Technique to Perform Aortic CT Angiography with 40 Ml of Contrast Medium

Thursday, Nov. 29 11:40AM - 11:50AM Room: S404AB

Participants
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PURPOSE

We developed a novel method to track the peak of the injected contrast medium by placing two regions of interest (ROI) at the timing bolus image. The purpose of this study was to compare the enhancement of the aorta when CT angiography was performed with 40 mL of contrast medium using the novel double ROI timing bolus (DRTB) technique with the enhancement using the conventional method.

METHOD AND MATERIALS

We prospectively included 21 patients from February to March 2018 who underwent repeated CT angiography of the aorta. In the prior scan, a total of body weight × 1.7 mL of contrast medium was injected for 25 s, and the scan timing was determined by the bolus tracking technique. The tube potential was 120 kVp and the table speed was set as fast as possible to acquire the entire aorta. In the DRTB method, timing bolus technique was performed using 9 mL of contrast medium at the level of the aortic root. An ROI was placed at the ascending and descending aorta, respectively. Time density curves of the two ROIs were drawn and the difference of the peak time (Tdiff) was recorded. The blood flow of the aorta was calculated by dividing the length of the thoracic aorta by Tdiff. The main scan was performed with a tube potential of 100 kVp. We injected 40 mL of contrast medium for 9 s and adjusted the table speed to follow the peak of the injected contrast bolus. We evaluated the attenuation of the aorta at the level of aortic root, arch, descending, celiac trunk, and iliac bifurcation.

RESULTS

The injected contrast medium during the main scan significantly reduced from 87 ± 11 to 40 mL (p <0.001). The attenuation of the aorta at the level of the aortic root, arch, descending, celiac trunk, and iliac bifurcation using the DRTB method were 408 ± 125, 425 ± 99, 421 ± 96, 414 ± 96, 417 ± 101 HU, respectively, which were all significantly higher than using the conventional method (341 ± 72, 370 ± 61, 362 ± 59, 349 ± 96, 362 ± 70 HU, respectively, all p <0.05).

CONCLUSION

DRTB method could dramatically reduce the contrast medium during aortic CT angiography while improving the enhancement than the conventional method.

CLINICAL RELEVANCE/APPLICATION

Aortic CT angiography using the DRTB method would reduce the risk of contrast induced nephropathy and also widen the indication of aortic CT to patients with chronic kidney disease.

SSQ02-09 Subclinical Changes in Cardiac Functional Parameters as Determined by Cardiovascular Magnetic Resonance (CMR) Imaging in Patients with Sleep Apnea and Snoring: Findings from UK Biobank

Thursday, Nov. 29 11:50AM - 12:00PM Room: S404AB

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PURPOSE

Obstructive sleep apnea (OSA) is a common disorder that shows an increased risk for left ventricular (LV) and, more rarely, right ventricular (RV) dysfunction. Most studies to date have examined populations with manifest cardiovascular disease and have used echocardiography to analyze ventricular dysfunction, with little or no reference to ventricular volumes or myocardial mass. We hypothesized that there would be stepwise increase in LV mass and RV volumes from the unaffected, to the snoring and the OSA group.

METHOD AND MATERIALS

We analyzed cardiac MRI data from 4493 UK Biobank participants free from cardiovascular disease. Participants were allocated into three cohorts: (i) with OSA; (ii) with self-reported snoring; and (ii) without OSA or snoring (n=38; 1919; and 2536 respectively). We determined ventricular volumes, ejection fraction and LV mass from balanced cine-SSFP sequences.

RESULTS

Trend analysis showed a stepwise increase for LV mass in both genders ($p<0.001$) and for LV and RV ejection fraction (EF) and stroke volume (SV) as well as LV end diastolic volume in males ($p<0.02$). There was no significant difference when comparing the OSA group to the unaffected group but we found a significant difference when comparing snoring to unaffected in LV mass of females (ß=1.45±0.55g; $p=0.009$) and in LVEF and RVEF as well as LVSV and RV end systolic volume of males (ß=0.80±0.28%; $p=0.005$, ß=1.17±0.28%; $p<0.001$, ß=1.68±0.76ml; $p=0.027$ and ß=-2.41±0.90ml; $p=0.008$) respectively.

CONCLUSION

Our study suggests that the transition from snoring to OSA is an evolving process which is associated with LV hypertrophy. The different results based on the gender in the pilot data point to a gender specific progression. Separate prospective studies are needed to further explore the direction of causality.

CLINICAL RELEVANCE/APPLICATION

Sleep apnea and snoring lead to gender specific alterations in cardiac function which may require diversified prevention and treatment strategies.

SSQ03

Science Session with Keynote: Cardiac (Coronary Artery Disease: CT and MR Techniques)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S404CD

CA CT MR

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

FDA Discussions may include off-label uses.

Participants
Borek Foldyna, MD, Boston, MA (*Moderator*) Nothing to Disclose
Cristina Fuss, MD, Portland, OR (*Moderator*) Spouse, Officer, ViewRay, Inc

Sub-Events

SSQ03-01 Cardiac Keynote Speaker: Technical Advances in Coronary Artery Imaging

Thursday, Nov. 29 10:30AM - 10:50AM Room: S404CD

Participants
Borek Foldyna, MD, Boston, MA (*Presenter*) Nothing to Disclose

SSQ03-03 Free-Breathing Coronary CT Angiography Using 16-Cm Wide-Detector for Challenging Patients: Comparison with Invasive Coronary Angiography

Thursday, Nov. 29 10:50AM - 11:00AM Room: S404CD

Participants
Tao Shuai, Chengdu, China (*Presenter*) Nothing to Disclose

PURPOSE

To detected the superiority of free-breathing coronary computed tomography angiography (CCTA) with 16-cm wide-detector CT for challenging patient who cannot hold breath.

METHOD AND MATERIALS

A total of 76 patients (62% with either heart rate >75bpm or arrhythmia) unable to hold breath underwent both free-breathing CCTA and ICA were included. Two reviewers evaluated coronary arteries on the per-segment (using 18-segment model), per-vessel and per-patient basis for image quality using a four-point scale and stenosis degree. CCTA results were compared with ICA to calculate the diagnostic accuracy, sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV).

RESULTS

Out of 1368 total segments, 228(16.7%) were less than 1.5mm in diameter and were excluded in CT, 32(2.3%) with calcification and 26(1.9%) with motion artifacts and were considered positive in CT. 1082 segments (79.1%) were evaluated both on CCTA and ICA and 128(11.8%) segments had stenosis >=50% on ICA. The diagnostic accuracy, sensitivity, specificity, PPV, and NPV of CCTA were 90.8%, 88.3%, 91.1%, 57.1% and 98.3% on a per-segment basis; 93.4%, 90.6%, 94.2%, 80.5% and 97.4% on a per-vessel basis; and 92.1%, 100%, 85%, 85.7% and 100% on a per-patient basis. For patients with high heart rates or arrhythmia, 81% (vs. 79.1%) segments were evaluable, and the accuracy, sensitivity, specificity, PPV, and NPV were statistically the same as the entire study population.

CONCLUSION

Free-breathing CCTA using 16-cm wide-detector CT has high accuracy for detecting coronary artery stenosis for challenging patients in comparison with ICA.

CLINICAL RELEVANCE/APPLICATION

Wide-detector CT has high clinical value for detecting coronary artery stenosis in CCTA for patients unable to hold breath.

SSQ03-05 Influence of Contrast Media Parameters on Image Quality in Cardiac Computed Tomography: Insights from a Multicenter Registry

Thursday, Nov. 29 11:10AM - 11:20AM Room: S404CD

Participants
Ludovico La Grutta, MD, Palermo, Italy (*Presenter*) Nothing to Disclose
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PURPOSE

A retrospective, multicenter, observational study on the use of contrast media (CM) in patients undergoing cardiac computed tomography (CCT) was conceived. The primary aim of the registry was to determine the influence on image quality of CM use.

METHOD AND MATERIALS

The registry included 1842 consecutive patients (>=50 per site; CCT indicated for suspected coronary artery disease) in 20 cluster sites. Every center collected demographics, CT scan parameters, CM administration protocols, radiation dose records, and adverse reactions reports. Image datasets were sent to a core lab who evaluated qualitative (intracoronary enhancement, motion artifacts) and quantitative (HU attenuation values, signal-to-noise ratio - SNR, and contrast-to-noise ratio - CNR) parameters.

RESULTS

The registry enrolled 891 men and 951 women (mean age 63±14 years, mean body mass index 26±4) who underwent CCT performed with >=64 detector rows CT scanners and several iodine contrast media protocols and molecules (iodixanol, iopamidol, iohexol, iobitridol, iopromide, and iomeprol). The core lab reported the following mean vascular attenuation: 504±147HU in the aorta, 451±146HU in the right coronary artery, 474±146HU in the left main, 451±146HU in the left anterior descending artery, and 441±149HU in the circumflex artery. SNR and CNR were improved with high iodine concentration CM (29±17 vs. 24±13 of low iodine concentration CM, p<0.0001; 35±19 vs. 30±15, p<0.0001) and >5ml/s flow rate (29±17 vs. 26±14 of <=5ml/s flow rate, p<0.0001; 35±19 vs. 32±16, p<0.0001), while they were not affected by decrease in CM volume <=80ml (28±17 vs. 27±14 of CM volume >80ml, p=0.0681; 34±20 vs. 32±16, p=0.1175). If compared to 120kV scanning, the use of low kV (n=393) improved SNR (33±21 vs. 25±13, p<0.0001) and CNR (39±23 vs. 31±16, p<0.0001). The use of iterative reconstructions (n=562) improved SNR (33±19 vs. 25±13, p<0.0001) and CNR (39±22 vs. 30±15, p<0.0001). In 80 patients the image quality was not satisfactory due to poor intra-coronary enhancement.

CONCLUSION

In a multicenter CCT registry image quality is influenced by the selection of CM parameters. The CM bolus geometry is affected by iodine concentration and flow, but it can be further refined by low kV scanning and iterative reconstructions.

CLINICAL RELEVANCE/APPLICATION

Optimization of CM parameters in conjunction with low kV scanning and iterative reconstructions improves image quality of CCT.

SSQ03-07 Deep Learning Analysis in Coronary Computed Tomographic Angiography Imaging for the Evaluation of Patients with Coronary Artery Atherosclerosis Stenosis

Thursday, Nov. 29 11:30AM - 11:40AM Room: S404CD

Participants
Dan Han, MMed, DMRD, Beijing, China (*Presenter*) Nothing to Disclose

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PURPOSE

To evaluate the feasibility of using deep learning and transfer learning approaches for coronary computed tomographic angiography (CCTA) imaging (termed coronary artery heart disease-artificial intelligence (CHD-AI)) in coronary artery atherosclerosis stenosis.

METHOD AND MATERIALS

A CCTA reconstruction pipeline was built by using deep learning and transfer learning approaches to generate simulated CCTA images from a series of two-dimensional (2D) CT images. A deep semantic segmentation network (SSN) was trained to identify coronary artery branch vessels, coronary lumen with more than 10,000 CCTA cases, which was treated as the Coronary BASE model. Based on the BASE model, retrospective CCTA images of 100 patients diagnosed with CHD by DSA were used to train a new model by transfer learning to further identify calcified plaque, non-calcified plaque and various degrees of coronary stenosis. The new model was then evaluated in 50 CHD patients by comparing the simulated CCTA images to CCTA images with digital subtraction angiography (DSA) images as the gold standard. Analysis of Kappa consistency test was used for statistical analysis to compare CHD-AI reconstruction with CCTA and DSA in detecting various degrees of coronary stenosis.

RESULTS

With only 100 CCTA cases as the training dataset, based on transfer learning, CHD-AI provided a relatively accurate simulated CCTA imaging with a Kappa value of 0.327 for detecting calcified plaque and non-calcified plaque compared to CCTA (P<0.001). For detecting coronary artery atherosclerosis with moderate and above stenosis, CHD-AI provided good sensitivity of 72% (11% more than CCTA) and negative predictive values of 80% (only 4% less than CCTA). Specificity (51%), coincidence (58%) and positive predictive values (40%) were relatively low.:

CONCLUSION

The proposed CHD-AI allows the generation of simulated CCTA images from a series of 2D CT images. This approach provides good sensitivity and negative predictive value for detecting stenosis and is relatively accurate for detecting calcified plaque and non-calcified plaque compared to CCTA. But it is still relatively high in false-positive rate.

CLINICAL RELEVANCE/APPLICATION

This CHD-AI can omit some CCTA reconstruction steps to some extent, reduce diagnostic time and the error of human eyes in assessing the degree of coronary stenosis compared with current CCTA imaging.

SSQ03-08 Deep Learning Enables Inline Image Reconstruction of Accelerated, Single-shot Coronary QISS MRA in Patients with Congenital Heart Disease

Thursday, Nov. 29 11:40AM - 11:50AM Room: S404CD

Participants
Daming Shen, Evanston, IL (*Presenter*) Nothing to Disclose
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Robert R. Edelman, MD, Evanston, IL (*Abstract Co-Author*) Nothing to Disclose
Cynthia K. Rigsby, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Daniel Kim, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Our previous study demonstrated the feasibility of 1-shot, real-time coronary Quiescent-Interval Slice-Selective (QISS) MRA in children with congenital heart disease using compressed sensing (CS). While CS produced clinically acceptable image quality, it is a poor fit for inline image reconstruction because of its slow reconstruction time (~60 s per image). Deep learning (DL) is an alternative framework for reconstructing MR images with considerably higher speed. The purpose of this study is to demonstrate the feasibility of inline image reconstruction of accelerated coronary QISS MRA using DL.

METHOD AND MATERIALS

This study entailed 2-fold accelerated, 2-shot coronary QISS MRA data sets obtained from 26 pediatric patients (mean age = 16.4 ± 7.9 years; 16 boys and 10 girls) scanned on a 1.5T scanner (Aera, Siemens). The QISS data were undersampled by an additional factor of 2 (i.e., 1-shot, real-time) and reconstructed using CS with total variation (TV) and a deep convolutional neural network adapted from a U-Net (layer depth = 5, 64 features on the first layer, GPU based tensorflow framework in Python). We fed 1-shot and 2-shot QISS images from first 20 patients (283 images) as input and output pairs to train the U-Net. Subsequently, images from the remaining 6 patients (69 images) were used to validate the trained U-Net. Using the 2-shot QISS with CS as control, we measured the DICE coefficients as a metric of reproducibility for 1-shot QISS with zero padding, 1-shot QISS with CS and 1-shot QISS with U-Net.

RESULTS

Both 1-shot QISS with CS and DL produced image quality that is comparable to 2-shot QISS (Fig. 1). The mean DICE coefficients for 1-shot QISS with zero padding, 1-shot QISS with CS and 1-shot QISS with U-Net images were 77.3 ± 7.4%, 90.0 ± 4.4% and 87.3 ± 4.1%, respectively. While the differences in DICE were significantly different for all pairs ($p < 0.05$), the difference between CS and U-Net was only 3%. The reconstruction time for U-Net (0.42 ± 0.04 s) was significantly lower ($p < 0.05$) than CS (52.3 ± 2.1 s).

CONCLUSION

This study demonstrates the feasibility of performing inline reconstruction of single-shot coronary QISS MRA using DL.

CLINICAL RELEVANCE/APPLICATION

Pediatric patients with congenital heart disease who require non-invasive evaluation of coronary origins for planning a surgical intervention may benefit from non-contrast, 1-shot coronary QISS MRA with inline image reconstruction using deep learning.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

SSQ04

Chest (Radiomics)

Thursday, Nov. 29 10:30AM - 12:00PM Room: E353A

BQ CH CT OI

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

FDA Discussions may include off-label uses.

Participants

Brett W. Carter, MD, Houston, TX (*Moderator*) Editor, Reed Elsevier;
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, Lunit Inc

Sub-Events

SSQ04-01 Nodule Malignancy Prediction: A Systematic Comparison of Deep Learning and Radiomics

Thursday, Nov. 29 10:30AM - 10:40AM Room: E353A

Participants
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PURPOSE

Radiomics is a field of study that extracts features from medical images using data characterization algorithms. It has been applied to classify pulmonary nodule malignancy. Recent development in computer vision shows that deep learning is a powerful tool to extract image features. This paper systematically compares a deep learning (DL) method and previously established radiomics methods to extract features from chest CT scans to predict nodule malignancy.

METHOD AND MATERIALS

We collected CT scans of 463 patients from LIDC (a public dataset) and of 915 patients from a collaborating hospital. Each CT scan contained one nodule whose malignancy was pathology proven. The whole dataset was randomly separated into a training dataset (1154: 391 from LIDC) and a testing dataset (224: 72 from LIDC). Three methods were used to extract nodule features. (1) radiomics condition, all nodules were segmented first, and 1008 features were extracted from each nodule using PyRadiomics (van Griethuysen et al, 2017). PCA was applied to select 95.3%, 96.2%, 97.8%, 98.4% and 99.2% information from the original features. (2) DL condition, we used a 3D-CNN model and average pooling to extract 128 features based on the same segmented nodules. The same PCA method was applied to DL features. (3) radiomics&DL condition, we concatenated the features from both (1) and (2) after the PCA processing. In all 3 conditions, we trained a random forest classifier based on outputs from PCA to predict nodule malignancy. We replicated the experiment 10 times to average out randomness caused by random forest.

RESULTS

As shown in Table 1, (1) radiomics condition achieved classification AUCs between 0.840 and 0.845; (2) DL method's AUCs ranged from 0.841 to 0.858. (3) radiomics&DL condition (AUCs: 0.855 to 0.872) outperformed the above two conditions. Figure 1 shows ROC plot of the 98.4% situation in Replication 1.

CONCLUSION

Radiomics combined with DL consistently achieved significantly higher AUCs than the DL or radiomics method alone, and DL performed marginally better than radiomics at nodule malignancy prediction. This study suggests that features extracted by DL can to some extent complement information extracted by radiomics.

CLINICAL RELEVANCE/APPLICATION

This paper shows that deep learning methods could extract extra features from CT images to complement traditional radiomics methods to improve clinical evaluation of pulmonary nodule malignancy.

SSQ04-02 A Novel Prediction Model for Pulmonary Nodule Diagnosis Combining Plasma Biomarkers, Radiomics, Conventional Imaging Features, and Clinical Data

Thursday, Nov. 29 10:40AM - 10:50AM Room: E353A

Awards
Trainee Research Prize - Medical Student

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Paul E. Kinahan, PhD, Seattle, WA (*Abstract Co-Author*) Research Grant, General Electric Company; Co-founder, PET/X LLC

PURPOSE

For both screening and incidental findings it is important but also challenging to classify pulmonary nodules as benign or malignant at first presentation. The objective of this study is to develop a novel prediction model for lung cancer diagnosis combining plasma biomarkers, radiomics, conventional imaging features and clinical data.

METHOD AND MATERIALS

We performed a retrospective study with 121 NSCLC patients and 117 controls. Specific tumor-derived autoantibodies were analyzed in plasma of all patients. The nodules were contoured by a thoracic radiologist from chest CT images and texture features were extracted using the PORTS radionics library. Another thoracic radiologist (blinded to the outcomes) evaluated semantic features including size, shape, density, emphysema, etc. All plasma biomarker variables, texture features, clinical and semantic features were input into a LASSO penalized logistic regression model. The most significant input variables for this regression are then determined and used to generate a new logistic regression model. We performed 5-fold cross-validation for the model to generate ROC curves. The AUC for these ROC curves was computed and the 95% confidence interval determined.

RESULTS

There were 11 plasma tumor biomarkers, 8 clinical and semantic features and 4 texture features selected by the LASSO penalized logistic model. The cross-validated AUCs for the model with all 23 plasma tumor biomarkers, clinical and imaging variables was 90% (CI:0.807-0.972), higher than the model with only clinical and imaging features with the AUC of 86%(CI:0.746-0.961).

CONCLUSION

Using a novel combination of plasma tumor biomarkers, radiomic texture features, conventional clinical and semantic features, our model classifies nodules with a AUC of 90% after cross-validation, which is higher than the performance reported by other models. The combination of these 4 sets of features outperforms each separate set of features in pulmonary nodule diagnosis.

CLINICAL RELEVANCE/APPLICATION

Combining plasma biomarkers, radiomics, conventional imaging features and clinical data has the potential to improve and facilitate management of pulmonary nodules.

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/ Sudhakar N. Pipavath, MD - 2013 Honored EducatorSudhakar N. Pipavath, MD - 2015 Honored Educator

SSQ04-03 Combination of Intra- and Peri-Tumoral Radiomic Features on Baseline CT are Prognostic of Recurrence and Overall Survival in Early Stage Non-Small Cell Lung Cancer (ES-NSCLC) Patients

Thursday, Nov. 29 10:50AM - 11:00AM Room: E353A

Participants
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PURPOSE

ES-NSCLC has up to a 55% risk of recurrence following curative resection with a OS ranging between 35-50%. The ability to predict aggressiveness and prognosticating survival of ES-NSCLC from pre-treatment CT scans can aid oncologists in identifying which patients will benefit from adjuvant chemotherapy following curative resection.

METHOD AND MATERIALS

The single site study comprised 316 ES-NSCLC patients who had curative surgery and/or chemotherapy. Following retrospective chart review, pre-treatment CT scans with clinical follow-up and outcome data was obtained for each patient. All patients underwent surgery with the primary tumor having relapsed in 75 total cases. This cohort was randomly divided into a training

(n=60) and independent validation set (n=256). A total of 124 intratumoral (IT) and peritumoral (PT) radiomic textural features were extracted from every patient.

RESULTS

The top six most predictive features included a combination of two intratumoral (Gabor, Haralick) and four peritumoral (Laws-Laplace, Collage, Gabor) from an annular ring 0-12 mm outside the nodule. These features were also found to be relatively stable with an ICC of 0.8 calculated on the RIDER CT test-retest dataset. These features separated patients who recurred from those who did not (AUC=0.65; p<0.001) and also were prognostic of 5-year recurrence-free survival (RFS) (p<0.005) on the independent validation set (n=256).

CONCLUSION

We identified radiomic texture features from within and outside the lung nodule that are able to predict recurrence in early stage non-small cell lung cancer. These features were also found to be prognostic of 5-year RFS.

CLINICAL RELEVANCE/APPLICATION

ES-NSCLC patients who were predicted to recur based off diagnostic CT scans would be ideal candidates for treatment escalation including adjuvant chemotherapy following curative surgical resection.

SSQ04-04 CT-Based Quantitative Radiomic Features Predict Brain Metastasis in T1 Stage Lung Adenocarcinoma

Thursday, Nov. 29 11:00AM - 11:10AM Room: E353A

Participants
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PURPOSE

To retrospectively evaluate the use of computed-tomography (CT) based quantitative radiomic features (QRF) to predict brain metastasis (BM) in patients with T1 stage lung adenocarcinoma (LAD).

METHOD AND MATERIALS

Eighty patients with pathologically confirmed lung adenocarcinoma were collected. T1 stage was established by the 8th edition of the TNM staging system. All patients had brain MRI scans (BM+: 26; BM- :54). In total, 1160 QRFs were calculated from the primary lung cancer tumor in each patient. Three machine-learning algorithms were applied sequentially to build the radiomic prediction model. Firstly, unsupervised hierarchical clustering was used to exclude highly correlated QRFs; secondly, the minimum Redundancy Maximum Relevance (mRMR) feature selection algorithm was employed to rank QRFs according to their relevance to BM and redundancy with other features; finally, the K-Nearest-Neighbor (k=5) classification algorithm was adopted to construct model by using the informative and non-redundant QRFs. The area under the receiver operating characteristic (ROC) curve (AUC) and the ten-fold cross-validation were employed to evaluate the prediction model. Yuden's Index for the ROC curve was calculated to determine the optimal sensitivity and specificity.

RESULTS

The radiomic prediction model achieved AUC (95% CI) of 0.879 (0.694, 0.959), and sensitivity and specificity of 0.808 and 0.815, respectively. The most significant QRFs to build the prediction model were LoGU ('Uniformity of Laplacian of Gaussian Filter') and MGE ('Maximal Gabor Energy'), which were designed to characterize tumor homogeneity and boundary sharpness, respectively. We found that tumors with BM+ were of higher LoGU and MGE values than those with BM- (both p-values <0.001).

CONCLUSION

CT-based radiomic features could be used to predict brain metastasis in T1-stage LAD. For T1-stage LAD, solid tumor with sharp boundary were more prone to BM than those with ground glass opacity and unclear boundary.

CLINICAL RELEVANCE/APPLICATION

Radiomic features extracted from noninvasive and routinely acquired CT can be applied to help radiologists to predict brain metastasis in patients with T1 stage lung adenocarcinoma.

SSQ04-05 The Radiomics Prognostic Score (RadScore): The New Prognostic Imaging Biomarker After Stereotactic Body Radiation Therapy in Patients with Lung Cancer

Thursday, Nov. 29 11:10AM - 11:20AM Room: E353A

Participants
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Hiroshi Onishi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To develop the radiomics prognostic score (RadScore) for the patients with lung cancer treated with stereotactic body radiation therapy (SBRT) and to evaluate prognostic impact on progression free survival

METHOD AND MATERIALS

In this retrospective study approved by our institutional review board, we reviewed 241 patients who underwent SBRT for lung cancer between July 2006 and November 2016. After excluding patients who had no pathological diagnosis, no pretreatment computed tomography (CT) and clinical diagnosis of Stage III/IV, 43 patients were analyzed. The RadScore was developed using the linear predictor of multivariate Cox proportional hazard regression with LASSO (Least Absolute Shrinkage and Selection Operator) method for shrinkage of variables. The variables for the regression were the results of histogram (kurtosis and skewness) and texture analysis (gray level co-occurrence matrix) for solid part within the region of interest for the lung cancer which was placed on pre- and post-contrast-enhanced axial CT images. To reveal the impact of RadScore in the prediction of progression free survival (local / distant recurrence or death), an another multivariate Cox proportional hazard regression analysis was performed.

RESULTS

Among the 132 variables by histogram and texture analysis, 2 variables by histogram analysis and 2 variables by texture analysis were selected. In the multivariate Cox regression, the RadScore was the only significant predictive factor for progression free survival (95% confidence interval of hazard ratio: 1.89-24.14, p<0.005), whereas the following variables were not significant: male (0.53-4.34, p=0.44), age (0.94-1.12, p=0.53), pathological diagnosis of adenocarcinoma (0.81-7.06, p=0.11), and clinical stages (IB: 0.59-3.96, p=0.38; IIA: 0.17-15.33, p=0.67; IIB: 0.42-56.65, p=0.21).

CONCLUSION

The RadScore was an independent prognostic factor for progression free survival in patients of post-SBRT for lung cancer.

CLINICAL RELEVANCE/APPLICATION

The RadScore was a prognostic factor for progression free survival in patients of post-SBRT for lung cancer. The RadScore have potential to become one of indications of SBRT for lung cancer.

SSQ04-06 CT-Based Quantification of Lung Disease in Cystic Fibrosis Using Radiomics

Thursday, Nov. 29 11:20AM - 11:30AM Room: E353A

Participants
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PURPOSE

To build imaging biomarkers from chest computed tomography (CT) using radiomics to evaluate the severity of lung disease in adults with cystic fibrosis (CF).

METHOD AND MATERIALS

This single-center, retrospective, observational study was approved by an institutional ethics committee and the need for patient consent was waived. One hundred and sixty-two CF outpatients referred for unenhanced chest CT during follow-up between January 2013 and December 2015 were included and randomly divided into 2 equal cohorts. After lung segmentation, 38 imaging features were extracted. Chest CT from the development cohort were used to build 5 CT scores, each with a different machine learning technique (lasso, ENET, ridge regression, decision tree and SVM). The aim was to correlate these scores with a clinical prognostic score (Nkam score). Correlations between radiomics-based CT scores and 3 prognostic scores (Nkam, Liou and CF-Able), forced expiratory volume in 1 second (FEV1) and respiratory tract exacerbations were evaluated in the validation cohort.

RESULTS

Four of the 5 radiomics-based CT scores correlated well with the Nkam score in the validation cohort (R = 0.54 to 0.69; p<0.001) while they all correlated well with the Liou (R=-0.64 to -0.74; p<0.001), and moderately with the CF-able (R=0.46 to 0.62; p<0.001) scores. All CT scores correlated well with FEV1 (R=-0.65 to -0.77; p<0.001) and moderately with the number of pulmonary exacerbations in the 12 months after the CT exam (R=0.47 to 0.56; p<0.001).

CONCLUSION

Radiomics can be used to build imaging biomarkers that correlate well with clinical prognostic scores in adult CF patients

CLINICAL RELEVANCE/APPLICATION

Radiomic models were trained to predict the Nkam score, and were also well correlated with FEV1 and the Liou score, another prognostic score for CF, as well as with individual variables known to be markers of CF lung disease severity.

SSQ04-07 Radiomics Approach for Survival Prediction in Chronic Obstructive Lung Disease

Thursday, Nov. 29 11:30AM - 11:40AM Room: E353A

Awards
Trainee Research Prize - Fellow

Participants
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PURPOSE

To apply radiomics analysis on overall survival (OS) prediction in patients with chronic obstructive lung disease (COPD) and to evaluate prediction performance of the generated radiomics signature (RS).

METHOD AND MATERIALS

The study included 371 adult COPD patients (mean age, 64.2). Patients were followed up for an average of 68 months and 45 cases of mortality were observed. From 3-D volumetric chest CT data of each patient, 525 radiomics features were semi-automatically extracted. Radiomics features were extracted from four phenotypical compartments of COPD; emphysema, airway measurement, pulmonary vessels, and air-trapping. In order to remove features that were highly related to one and another, pairs with correlation coefficients greater than 0.9 were identified and the feature with lower c-index (Harrell's concordance index) was eliminated. Then, least absolute shrinkage and selection operator (LASSO) Cox regression model and used to select the features most useful for OS prediction. Afterward, a RS was generated through the summation of selected features multiplied by their respective coefficients and cut-off value was determined by X-tile plot analysis. The difference of survival between low and high RS groups was evaluated with Kaplan-Meier survival analysis.

RESULTS

Five features which remained after LASSO analysis were as follows: (1) Low attenuation area (LAA-950), (2) PI-10 at 6th generation bronchi, (3) Average vessel cross-section area at 18mm from pleural surface, (4) Lobar heterogeneity of PI-10, (5) Z-axis heterogeneity of WA%. On multivariate Cox regression analysis, prediction performance (c-index) of the 5 features was 0.774. The c-index for pulmonary function test (PFT) results alone (DLCO, FEV1, FEV1/FVC) was 0.758. When radiomics features were combined with PFT, c-index was increased to 0.805. Patients who were classified into the high-risk group based on the generated RS demonstrated significantly worse OS than the low-risk group (log-rank test, $p < 0.001$; hazard ratio, 7.18:1).

CONCLUSION

The radiomics signature demonstrated good survival prediction performance in COPD patients and adequately classified patients into high and low-risk groups.

CLINICAL RELEVANCE/APPLICATION

The radiomics approach yielded a reliable survival prediction performance in this study and could potentially be adopted as an effective imaging biomarker for estimation of OS in COPD patients after further validation.

SSQ04-08 Radiomic Prediction of Survival in Patients with Rheumatoid Arthritis-Associated Interstitial Lung Disease Based on Deep-Learning, Hyper-Curvature, and Texture Features of Lung CT Images

Thursday, Nov. 29 11:40AM - 11:50AM Room: E353A

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PURPOSE

To evaluate the comparative performance of deep-learning, hyper-curvature, and texture features of lung CT images in the prediction of the overall survival of patients with rheumatoid arthritis-associated interstitial lung disease (RA-ILD).

METHOD AND MATERIALS

We retrospectively collected 70 RA-ILD patients with thin-section lung CT and serial pulmonary function tests. After automated extraction of the lung regions on the CT images, an experienced observer delineated regions of interest (ROIs) and labeled them into one of four ILD patterns (ground-class opacity, reticulation, consolidation, and honeycombing). We computed deep-learning features by training a 5-layer convolutional neural network on these ROIs for classifying the 4 patterns and by extracting the output of the last convolutional layer. We also computed hyper-curvature features including principal curvatures, curvedness, bright/dark sheets, cylinders, blobs, and curvature scales for the lungs as well as gray-level co-occurrence matrix texture features on the ROIs. An elastic-net penalty method was used to select and combine these features with a Cox proportional hazards model for predicting patient survival. Concordance index (C-index) was used as a measure of the prediction performance of the feature combinations with bootstrapping by 1,000 replications, in comparison to an established clinical prognostic biomarker known as the gender, age, and physiology (GAP) index by a two-sided t-test.

RESULTS

Bootstrap evaluation yielded C-index values of (a) GAP: 78.3%, [95% confidence interval (CI): 70.1, 86.5]; (b) hyper-curvature features: 80.8% [CI: 71.9, 89.7], P<0.01 in comparison with (a); (c) deep-learning features: 81.8% [CI: 71.9, 89.7], P<0.01; and (d) combined radiomic features: 86.9% [CI: 81.3, 93.1], P<0.0001. Kaplan-Meier survival curves of patients stratified to low- and high-risk groups based on combined radiomic features showed statistically significant (P < 0.0001) difference.

CONCLUSION

The combined radiomic features yield higher performance than GAP in the prediction of overall survival. Thus, they can be an effective imaging biomarker for predicting overall survival of patients with RA-ILD.

CLINICAL RELEVANCE/APPLICATION

Combined radiomic features that are automatically calculated from lung CT images can provide an effective prognostic imaging biomarker for precise management of patients with RA-ILD.

SSQ04-09 Radiogenomics of Non-Small Cell Lung Cancer: Predictive Modeling of miRNA Signature and CT Imaging Features

Thursday, Nov. 29 11:50AM - 12:00PM Room: E353A

Participants
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PURPOSE

Radiomics and genomics characteristics have been widely explored to predict tumor responses to radiotherapy and in recent years, the combined application of them, radiogenomics, have increased. In this study, we developed a radiogenomics signature to estimate tumor responses to radiotherapy in patients with non-small cell lung cancer (NSCLC) and optimize management of this disease.

METHOD AND MATERIALS

This study consisted of 87 patients with non-small cell lung cancer and was approved by the institutional ethical board. The CT-based radiomics features were extracted by LIFEx. MiRNAs associated radiosensitivity was obtained from our previous study and literature retrieval. Then a radiogenomics signature was generated by LASSO and was associated with tumor responses to radiotherapy in non-small cell lung cancer patients. The Recist 1.1 was used for short-term effect and the overall survival (OS) was used for long-term effect evaluation. Multivariate Cox regression validated the radiogenomics signature as an independent biomarker. Then a radiogenomics nomogram with this signature was constructed, which was assessed to validation, calibration and discrimination.

RESULTS

The radiogenomics signature was significantly associated with radiosensitivity and OS, independent of other clinic pathologic factors. The radiogenomics nomogram has displayed a good performance for estimation of OS (C-index: 0.78, 95% confidence interval [CI]: 0.75, 0.80). Calibration curve for it was almost satisfactory, which indicated its clinical usefulness.

CONCLUSION

The radiogenomics signature is an independent biomarker and the nomogram combining it with other clinic pathologic factors could be used as a model to predict tumor responses to radiotherapy in non-small cell lung cancer, which might make a step forward individualized medicine.

CLINICAL RELEVANCE/APPLICATION

a biomarker to predict the radiosensitivity in non-small cell lung cancer

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SSQ05

Chest (Functional Lung Imaging/Dual-Energy CT/Radiation Dose Reduction)

Thursday, Nov. 29 10:30AM - 12:00PM Room: E353B

BQ CH CT MR NM OI SQ

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

FDA Discussions may include off-label uses.

Participants
Jeffrey B. Alpert, MD, New York, NY (*Moderator*) Nothing to Disclose
Mannudeep K. Kalra, MD, Boston, MA (*Moderator*) Research Grant, Siemens AG; Research Grant, Canon Medical Systems Corporation

Sub-Events

SSQ05-01 Assessment of Changes in Regional Xenon Ventilation, Perfusion, and Ventilation-Perfusion Mismatch Using Dual-Energy Computed Tomography after Pharmacological Treatment in Patients with COPD

Thursday, Nov. 29 10:30AM - 10:40AM Room: E353B

Participants
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PURPOSE

To assess the changes of regional ventilation (V) and perfusion (Q) status in COPD patients after pharmacologic treatment using combined xenon-enhanced V and iodine-enhanced Q dual-energy CT (DECT).

METHOD AND MATERIALS

Combined V and Q DECT were performed at baseline and after 3-month pharmacologic treatment in fifty-three COPD patients. Virtual noncontrast images, V and Q maps were anatomically co-registered with in-house software. Normalization of V and Q values of each pixel were performed. For visual analysis, V/Q pattern was determined to be matched, mismatched, or reversed-mismatched and compared with the regional disease patterns-emphysema, bronchial wall thickening, or normal lung-in each segment in baseline and follow-up. Mean V, Q, and V/Q values, standard deviation of V/Q (V/QSD), and proportions of lung area with reversed-mismatch (Rev), mismatch (Mis) and match (Mat) of each patient were quantified and compared with pulmonary function test (PFT) parameters in baseline and follow-up. Changes of quantified CT parameters and PFT results between baseline and follow-up were compared.

RESULTS

Most of segments showed a matched V/Q, whereas about thirty percent of segments with bronchial wall thickening showed a reversed-mismatched V/Q. On follow-up, V/Q pattern did not change in most of segments with matched and mismatched V/Q. In about forty percent of segments with reversed-mismatched V/Q, V/Q pattern changed into matched. Quantified mean V, Q, V/Q and Rev values of baseline and follow-up CTs were positively correlated with PFT parameters, respectively ($r = 0.286$-0.630, $p < 0.05$), while V/QSD values were negatively correlated with PFT parameters ($r = -0.528$ and -0.375; $p < 0.05$). Changes of mean V, V/Q and Mat were positively correlated with change of FEV1 ($r = 0.315$-344; $p < 0.05$) and changes of Rev were negatively correlated with change of FEV1 ($r = -0.353$; $p = 0.010$).

CONCLUSION

Quantitative and visual analysis of combined V and Q DECT showed that the improvement of ventilation and V/Q mismatch may be associated with the response to pharmacological treatment in COPD patients.

CLINICAL RELEVANCE/APPLICATION

Combined V and Q DECT imaging can be applied to assessment of changes of regional V and Q status after pharmacologic treatment in COPD patients.

SSQ05-02 Quantitative Assessment of Emphysema Heterogeneity in Patients with Lung Cancer Using Volumetric Chest CT

Thursday, Nov. 29 10:40AM - 10:50AM Room: E353B

Participants
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PURPOSE

In COPD patients, distribution of emphysema shows various patterns (diffuse, unilateral, or focal), however, there is no report about distribution of emphysema in lung cancer patients. The purpose of the research is to compare heterogeneity of emphysema between lung cancer patients and lung cancer screening patients.

METHOD AND MATERIALS

Total 109 subjects with smoking history and thin section chest CT (51 patients with lung cancer M : F = 29 : 22, age = 68.10 ± 9.26, 58 lung cancer screening patients; M : F = 31 : 27, age = 64.03 ± 6.65) were retrospectively enrolled. Using commercial software (AVIEW, Coreline soft, South Korea), volume and low attenuation area under -950 HU were semi-automatically quantified in whole lung and each lobe by two radiologists. Emphysema index (EI) and emphysema heterogeneity were calculated. Intra-class correlation coefficient (ICC) and independent t-test were performed. ANOVA was performed for subgroup analysis according to cancer pathology.

RESULTS

ICC of each lobe volume among two radiologists were 0.993, 0.987, 0.999, 0.999, and 0.999. EI in RUL, RML, RLL, LUL, and LLL of two groups were 6.43 ± 9.94, 6.80 ± 9.28, 3.66 ± 5.54, 5.86 ± 6.60, and 3.83 ± 5.86 in the cancer group, and 6.56 ± 7.82, 8.24 ± 8.44, 5.68 ± 7.08, 7.16 ± 7.05, and 5.28 ± 6.66 in the screening group. EI and emphysema heterogeneity in whole lung of two groups were 5.10 ± 6.56, and 12.20 ± 5.14 respectively in the cancer group, and 6.43 ± 6.95, 8.44 ± 4.92 in the screening group. EI showed no significant difference between two groups. However, emphysema heterogeneity of the cancer group was significantly larger than that of the screening group ($p < 0.001$). In subgroup analysis, emphysema heterogeneity of the cancer subtypes of adenocarcinoma and squamous cell carcinoma were significantly larger than that of screening group ($p = 0.006$ and 0.042).

CONCLUSION

Semi-automated quantification of emphysema in each lobe was feasible. Smokers with lung cancer showed more heterogeneous distribution of emphysema than smokers without lung cancer.

CLINICAL RELEVANCE/APPLICATION

Quantification of regional and whole lung heterogeneity of emphysema may potentially help in risk stratification of COPD patients in developing lung cancer.

SSQ05-03 Hyperpolarized Xenon-129 MRI for Detection of Gas Exchange in Healthy Subjects and Lung Cancer Patients

Thursday, Nov. 29 10:50AM - 11:00AM Room: E353B

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PURPOSE

To determine whether a novel functional magnetic resonance imaging (MRI) technique using hyperpolarized Xenon-129 (HPX) can quantify the xenon gas transfer dynamics (XGTD) from alveoli into the Pulmonary Tissue and Blood Plasma (PTBP), and Red Blood Cell (RBC) compartments of the lungs, and identify XGTD differences in patients with COPD and lung cancer pre and post radiation.

METHOD AND MATERIALS

A novel spectroscopic MRI technique was developed using Iterative Decomposition of water and fat with Echo Asymmetry and Least-square estimation (IDEAL) approach. This technique allowed acquisition of the time-series IDEAL gas, PTBP and RBC compartment images of lungs with various gas transfer times in a single breath-hold interval. The time-series IDEAL gas, PTBP and RBC compartment images were acquired from five healthy subjects at two different time points. XGTD curves were obtained from 10 scans (n=10) that represented the control group. The control group was compared to two lung-cancer patients before radiation therapy started and after radiation therapy ended.

RESULTS

In the control group, there was no statistical difference in XGTD between the left and right lungs (P-value >0.4). XGTD in the control was statistically different than the lung cancer patients (P-value <0.01) suggesting that the novel time-series IDEAL technique was sensitive to the gas exchange abnormalities. Additionally, the ratio of XGTD from the irradiated lung to un-irradiated lungs was compared pre and post radiation therapy. We found that xenon gas in the alveoli diffused into the PTBP compartment with a slower rate of 20-35% in the radiated lungs from the lung cancer patients.

CONCLUSION

The feasibility of the novel IDEAL MRI technique has been successfully demonstrated in healthy subjects and lung cancer subjects. To our knowledge, this is the first-in-man study showing the time course of arrival of Xenon-129 gas from the alveoli to PTBP and RBC compartments of the lungs and to the pulmonary vasculature and the left ventricle of the heart in healthy subjects and patients with COPD and lung cancer.

CLINICAL RELEVANCE/APPLICATION

This technique may have potential clinical applications ranging from the detection of regional differences in gas transfer on imaging to the detection of early-stage radiation-induced lung injury.

SSQ05-04 Effect of Aging and Smoking on Regional Air Volume Change Distributions in Normal Chest CT

Thursday, Nov. 29 11:00AM - 11:10AM Room: E353B

Participants
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PURPOSE

Image registration has been increasingly used to assess pulmonary dynamics between paired inspiratory and expiratory CT images in patients with pulmonary disease. However, information of pulmonary dynamics of normal subjects is insufficient. The purpose of the study is to describe regional air volume change distributions of subjects with normal CT and to investigate the effects of aging and smoking.

METHOD AND MATERIALS

242 subjects (114 male, 128 female) over the age of 18 years with normal inspiration and expiration CTs were included in the study. VIDA Apollo software (Coralville, IA) and an image registration technique were used to compute regional distribution of air and tissue volumes, air volume fractions, and the relative regional changes between inspiration and expiration, including relative regional air volume changes (RRAVC). In each lobe, the upper lobes, the lower lobes, and the whole lung, the mean values and standard deviations were correlated with aging and compared to those of smoking groups. Regional volumetric changes were further analyzed using 3D visualization of acinar scale parenchymal units.

RESULTS

Inspiratory air volume of the lower/upper lobes decreased with age in both nonsmoking males and females ($r=-0.388$; $p=0.006$ and $r=-0.258$; $p=0.004$, respectively). RRAVC map demonstrates the increase of air volume change from apico-ventral to dorso-basal region in non-smokers, representing gravitational dependency in normal pulmonary dynamics. In comparison, the directionality of gravitational dependency of regional volume change tends to against normality in smokers, and the coefficient of variation (CV) of RRAVC decreased in the whole lung in the smokers (0.64 and 0.35, $p=0.020$).

CONCLUSION

The air volume of the lower/upper lobes tends to decrease with aging, and the directionality of gravitational dependency of the air volume change appeared to be against normality in smokers. Visualization of RRAVC map helped recognize these findings more easily.

CLINICAL RELEVANCE/APPLICATION

Regional air volume change distribution helped understand the gravitational volume change of the lung in normal adults, and so it is expected that the localized functional abnormalities of the lung effected by aging and smoking are easily comprehended.

SSQ05-05 Whole-Lung Dynamic Contrast-Enhanced Perfusion Area-Detector CT: Capability for Pulmonary Function Assessment and Morphological Change Evaluation in Stage IA Non-Small Cell Lung Cancer

Thursday, Nov. 29 11:10AM - 11:20AM Room: E353B

Participants
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PURPOSE

To prospectively and directly compare the capability of whole-lung dynamic contrast-enhanced (CE-) perfusion area-detector CT

(ADCT) for pulmonary functional loss assessment and morphological change evaluation in Stage IA non-small cell lung cancer (NSCLC) patients.

METHOD AND MATERIALS

63 consecutive NSCLC patients (39 males, 24 females; mean age 68 years) underwent dynamic CE-perfusion ADCT performed at two or three different positions as single examination, pulmonary function test, surgical treatment, and pathological examination. From all perfusion ADCT data in each subject, whole lung total perfusion (TP), pulmonary arterial perfusion (PAP) perfusion, systemic arterial perfusion (SAP) maps were computationally generated based on dual-input maximum slope method by previously reported software. In each subject, regional perfusion parameters were assessed by ROI measurements, and averaged to determine mean values. According to pathological examination results, all ROIs within operated lung were divided into following four structure groups: normal lung, emphysema, non-specific interstitial pneumonia (NSIP) and usual interstitial pneumonia (UIP). To determine the capability of each perfusion parameter for pulmonary function, Pearson's correlation was performed. To compare each perfusion parameter among all structure groups, Tukey's HSD test was performed. Finally, discrimination accuracy for morphological change evaluation was compared among all indexes and combined method.

RESULTS

All perfusion parameters except SAP had significant correlation with each pulmonary function parameter (TP: 0.47 **CONCLUSION**

Whole-lung dynamic first-pass CE-perfusion ADCT is useful for pulmonary functional loss assessment and morphological change evaluation in stage IA NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

Whole-lung dynamic first-pass CE-perfusion ADCT is useful for pulmonary functional loss assessment and morphological change evaluation in stage IA NSCLC patients.

SSQ05-06 Denoised Ultra Low Dose for Screening Lung Cancer

Thursday, Nov. 29 11:20AM - 11:30AM Room: E353B

Participants
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PURPOSE

To assess the effect of a denoising method (D) for ultra low dose CT (ULDCT) LungRADS categorization.

METHOD AND MATERIALS

36 consented patients, referred for an outpatient chest CT, underwent 2 scans: a normal dose CT (NDCT), 120 kVp and automatic current modulation, with or without contrast media, immediately followed by an ULDCT, 120 kvp and fixed current at 10 mA for bmi <29 and 20 mA for bmi>=29. Reconstruction for lung and soft tissue kernels were performed for each scan. Consecutively, each ULDCT was denoised using a locally-consistent non-local-mean (LCNLM) algorithm to obtain a high signal to noise ratio (SNR) version of the ULDCT. The LCNLM algorithm leverages large databases of image patches extracted from high-SNR chest CT scans to denoise ULDCTs while enforcing local spatial consistency to preserve fine details and structures in the image. Blinded to all clinical information, a chest radiologist separately assessed the NDCT, ULDCT, and denoised ULDCT (D), documented findings, assigned a LungRADS category and a subjective suspicion for highly suspicious lesions for lung cancer (H).

RESULTS

Radiation dose using NDCT reduced the radiation for patients with a BMI > 29 by an average of 93% and for those with a BMI of up to 29 by an average of 96% . For patients with a BMI > 29 the average effective radiation dose for ULDCT was 0.41 mSv, whereas for those with a BMI of up to 29 it was 0.24mSv. For the three imaging methods, the same score was seen in 63.9% (n=23) and a different score in 36.1% (n=13). There was complete agreement on LungRADS 4A (or higher) between NDCT and D, but ULDCT categorized one of the 4A patients as LungRads 2. One lesion assigned as LungRads 4X by ULDCT was assigned LungRads2 by D and NDCT. Of the 8 patients highly suspicious for lung cancer by NDCT, D indicated so in all 8 whereas ULDCT indicated so only in 4.

CONCLUSION

Interpretation of ULDCT may cause errors in LungRADS categorization but implementation of the LCNLM algorithm for denoising improves ULDCT images so that LungRADS categorization is similar to normal dose scans.

CLINICAL RELEVANCE/APPLICATION

Denoising ULDCT with the LCNLM algorithm enables screening for lung cancer with dose reductions of greater than 90%.

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/ Edith M. Marom, MD - 2015 Honored EducatorEdith M. Marom, MD - 2018 Honored Educator

SSQ05-07 Comparison of SENCEFUL-MRI and Lung Scintigraphy for Detection of Lung Perfusion Defects in

CTEPH Patients

Thursday, Nov. 29 11:30AM - 11:40AM Room: E353B

Participants
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PURPOSE

To compare self-gated non-contrast enhanced functional lung MRI (SENCEFUL) and V/Q (ventilation/perfusion) scintigraphy regarding detection of lung perfusion defects in patients with chronic thromboembolic pulmonary hypertension (CTEPH).

METHOD AND MATERIALS

Following review board approval and informed consent, 16 patients diagnosed with CTEPH and pathologic findings in V/Q scans were included into this prospective study. Patients were scanned at 3T using the SENCEFUL approach based on a 2D-FLASH sequence. Color-coded maps of the lung perfusion and the local blood arrival time i.e. the pulsation phase were manually segmented and rated for perfusion defects in lung quadrants by three independent radiologists using a 6-point Likert scale. Coronal V/Q scan images were rated by a nuclear medicine physician accordingly. Due to variation of slice thickness between both techniques, covered lung volumes were divided into four sectors in coronal orientation each containing four quadrants to improve comparability. Statistical tests included intraclass correlation coefficient (ICC) and Mann-Whitney-U-test.

RESULTS

Comparison of quadrant-wise rating between SENCEFUL-MRI and V/Q scans revealed good agreement between all raters when the lung perfusion and pulsation phase maps were rated simultaneously (ICC 0.75, 95% CI 0.69-0.80, $p<0.05$) and an improvement to perfusion rating alone (ICC 0.61, 95% CI 0.52-0.69, $p<0.05$). Interrater reliability of the radiologists for combined perfusion/pulsation phase rating was good (ICC 0.77, 95% CI 0.69-0.82, $p<0.05$). Analysis of a peak-to-offset ratio of pulsation phase histograms showed a significant difference between lung quadrants rated pathologic in scintigraphy and quadrants rated healthy ($p<0.05$).

CONCLUSION

SENCEFUL-MRI showed good agreement for detection of perfusion defects compared with V/Q scans being the current screening method for CTEPH. Analysis of MRI maps by a peak-to-offset ratio of pulsation phase showed a significant difference between quadrants rated pathologic and healthy by V/Q scans suggesting a quantifiable value for future determination of threshold values in SENCEFUL-MRI.

CLINICAL RELEVANCE/APPLICATION

SENCEFUL-MRI could be an alternative screening method for detection of lung perfusion defects in patients with suspected CTEPH without the need of contrast agent administration or radiation exposure.

SSQ05-08 Applicability of Monochromatic Energy with 40 keV for Pulmonary Embolism Detection in the Pulmonary Embolism CT Angiography: Experience Using a Dual-Layer Detector Spectral CT

Thursday, Nov. 29 11:40AM - 11:50AM Room: E353B

Participants
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PURPOSE

Previous studies have shown that the optimal energy level of virtual monoenergetic images (VMI) for pulmonary artery (PA) enhancement is 40 keV in spectral CT. The aim of this study is to evaluate the applicability of VMI at 40 keV for pulmonary embolism (PE) detection in the CT angiography (PECT).

METHOD AND MATERIALS

A total of 876 consecutive PECT using spectral CT were identified between August 2016 and March 2018. Of these, PE at least 4 mm in diameter was detected in 73 PECT. Among these, suboptimal enhancement of PA (<250 HU) was shown in 19 cases. Contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR) of VMI at 50 keV, 60 keV, 70 keV, and conventional 120-kVp images (COV) were compared with VMI at 40 keV in all PECT and suboptimal PECT. Readers' subjective scores for PE detection was also recorded. The mean diameters of PE were measured, and they were compared between VMI at 40-70 keV and COV. The frequency of significant PE diameter reduction (>40%) in VMI compared with COV was also recorded and compared between VMIs. The cut off

value of the minimum visible PE diameter at 40 keV was investigated in COV.

RESULTS

There was no significant difference in CNR between 40 keV and 50 keV, although the highest CNR and SNR were obtained at 40 keV. In the suboptimal subgroup, there were no significant differences in both CNR and SNR between 40 keV and 50 keV. The subjective scores was significantly lower at 40 keV, compared with other algorithms in both all PECT and the suboptimal subgroup ($P<0.05$). The mean diameters of PE were significantly decreased in 40 keV and 50 keV, compared with those in COV (40 keV, 5.6±5.8 mm; 50 keV, 7.2±5.3 mm; COV, 8.9±4.9 mm; all $P<0.05$). The frequency of significant PE diameter reduction was significantly higher in 40 keV than in 50 keV (36.8% vs.12.8%, $P<0.001$). The cut off value of the minimum visible PE diameter at 40 keV was 6.4 mm in COV.

CONCLUSION

VMI at 40 keV was not the best option for PE detection, although the best CNR and SNR were obtained at 40 keV. The diameter of PE was often decreased and small PE was not even detected at 40 keV.

CLINICAL RELEVANCE/APPLICATION

We propose that not only 40 keV but also other algorithms such as 50 keV should be used for PE detection to ensure that we do not miss small PEs.

SSQ05-09 Fluorine-19 MRI Ventilation Defect Analysis in Cystic Fibrosis

Thursday, Nov. 29 11:50AM - 12:00PM Room: E353B

Awards
Student Travel Stipend Award

Participants
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PURPOSE

The purpose of this study is to investigate the ability of novel fluorine-19 (19F) based MRI to characterize ventilation in subjects with cystic fibrosis.

METHOD AND MATERIALS

Coronal images of nine healthy controls and twelve subjects with CF were acquired using a multinuclear capable 3.0 T MRI scanner (PRISMA, Siemens) along with spirometry. Subjects inhaled 19F labelled perfluoro-propane (PFP) gas mixed with 21% O2 or room air during the wash-in phase of the scan. Fifteen second 19F GRE vibe breath hold images were obtained following three breaths of PFP for five cycles. This was repeated five times after switching PFP gas to room air for the wash-out phase. A 19F maximum intensity projection image over time was created and segmented using a semi-automatic approach with an empirically determined ventilation threshold. Anatomic 1H series taken at full inspiration were then manually segmented for all subjects. After correcting for differences in respiratory effort by comparing apex-base measurements of the lung in 19F and 1H series, the ventilation defect volume (VDV) was computed by subtracting 19F segmentation volume from 1H volume and a ventilation defect percentage (VDP) was also computed relative to 1H volume.

RESULTS

In healthy controls, the mean ventilation defect percentage (VDP) was 10% (SD 11%); for mild CF 13% (SD 25%); and for severe CF 31% (SD 24%). A significant difference was found when comparing all CF patients to normal ($p=0.0275$ via t-test with Satterthwaite correction). VDP had a negative correlation with FEV1 (-0.56 via Spearman correlation, $p=0.011$). The rate constant for gas filling ($\tau 1$) was significantly increased in CF patients compared with controls, suggesting delay in filling. No safety concerns were detected throughout the study.

CONCLUSION

This study showed the ability of novel 19F ventilation MRI to rapidly and safely quantify regional ventilation defects and gas wash-in and wash-out dynamics. 19F MRI identified ventilation defects in cystic fibrosis subjects even in the setting of normal spirometry with some variability in healthy volunteers.

CLINICAL RELEVANCE/APPLICATION

This novel imaging technique has advantages over xenon ventilation MRI including cheaper contrast material and inert compound allowing functional imaging with multiple image sets. We anticipate applications for many other lung diseases including pediatric lung malformations, lung resection, COPD monitoring, and bronchiectasis.

SSQ06

Gastrointestinal (General Abdominal Imaging)

Thursday, Nov. 29 10:30AM - 12:00PM Room: E350

CT GI MR

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

Participants
William C. Small, MD, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose
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Erik K. Paulson, MD, Durham, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSQ06-01 Abdomen Radiographs in the CT/MR Era: What the Surprising Numbers Tell Us

Thursday, Nov. 29 10:30AM - 10:40AM Room: E350

Participants
David J. DiSantis, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

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PURPOSE

To quantify 21st century abdomen radiograph volume trends as an indicator of that examination's current relevance, both clinically and in our training curriculum.

METHOD AND MATERIALS

Nationwide Medicare procedure data from 2000 through 2016 were analyzed to quantify volume trends for the three most common abdomen radiograph studies: • SINGLE VIEW ABDOMEN • TWO VIEW ABDOMEN (SUPINE plus UPRIGHT OR DECUBITUS) • COMPLETE ABDOMEN SERIES (TWO VIEW ABDOMEN plus FRONTAL CHEST)

RESULTS

In the latest year with data available (2016), 11.29 million abdomen radiographs were performed in the United States. Single view abdomen volume grew by a quite surprising 37% between 2000 and 2016, to 7.55 million. In contrast, two view abdomen 2016 volume fell 43% from its peak year of 2002, to 2.04 million. Similarly, 2016 acute abdomen series volume fell 55% from its peak year of 2004, to 1.7 million .

CONCLUSION

Despite the ascendancy of cross-sectional imaging, supine frontal abdomen radiograph volume has shown not merely resilience but remarkable growth in the 21st century.

CLINICAL RELEVANCE/APPLICATION

With over 11 million studies yearly, abdomen radiograph interpretation will remain a necessary skill in radiology practice, and our residency curricula must reflect that reality.

Honored Educators

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

SSQ06-02 A Comparative Study Between Pseudomyxoma Peritonei and Ascites Due to Cirrhosis Using Spectral CT Imaging

Thursday, Nov. 29 10:40AM - 10:50AM Room: E350

Participants
ChunYan Zhang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To explore the feasibility of differentiating pseudomyxoma peritonei from ascites due to cirrhosis on the basis of quantitative spectral features using spectral CT imaging.

METHOD AND MATERIALS

Six patients with pseudomyxoma peritonei and 5 patients with ascites due to cirrhosis were examined by spectral imaging of revolution CT. And pseudomyxoma peritonei was confirmed by subsequent operation and pathology. Using GSI viewer, various CT imaging parameters(CT values of different mono energy level , iodine-water concentration) were calculated and compared between the 2 groups. Thirty-seven regions of interest (ROI) were placed on pseudomyxoma peritonei and 52 ROIs were placed on cirrhotic ascites. The difference of these spectral parameters between the 2 groups was calculated statistically by independent sample t test.

RESULTS

From 40 to 140 keV images, the mono energy CT values of the 2 groups has statistical significant difference ($P<0.05$). On 60keV images, the difference of CT values of the 2 groups was the largest, the mean CT values of pseudomyxoma peritonei [(18.45±4.58)Hu] was significantly higher than that of cirrhotic ascites[(10.54±4.14)Hu] ($t=-8.32$, $P<0.00$). The iodine-water concentration of pseudomyxoma peritonei [(3.28±0.99)g/L] was significantly higher than that of cirrhotic ascites[(2.72±1.10) g/L] ($t=-2.22$, $P=0.01$).

CONCLUSION

The CT spectral curve and spectral imaging parameters of pseudomyxoma peritonei is found to be different from ascites due to cirrhosis. Revolution spectral CT imaging may provides a new multiparameter method to differentiate pseudomyxoma peritonei and ascites due to cirrhosis.

CLINICAL RELEVANCE/APPLICATION

The CT spectral curve and spectral imaging parameters may be helpful in differentiating pseudomyxoma peritonei and ascites due to cirrhosis.

SSQ06-03 Automated Spleen Volumetry Based on MR Hepatic Proton Density Fat Fraction Imaging in Patients with Nonalcoholic Fatty Liver Disease

Thursday, Nov. 29 10:50AM - 11:00AM Room: E350

Awards
Student Travel Stipend Award

Participants
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PURPOSE

In patients with nonalcoholic fatty liver disease (NAFLD), spleen volume is a marker of disease progression and can predict the likelihood of nonalcoholic steatohepatitis (NASH) and portal hypertension. Manual spleen segmentation for accurate spleen volumetry is laborious and impractical for routine use. Convolutional neural networks (CNNs) can automatically segment spleen volume using dedicated spleen imaging sequences, but are not well suited to estimate hepatic proton density fat fraction (PDFF) and are not routinely acquired in NAFLD research exams. It would be more practical to measure spleen volume on MR hepatic PDFF imaging sequences already obtained, even though the sequences are not optimized for spleen imaging. Here we assess the

feasibility of using an automated CNN method to measure spleen volume based on PDFF sequences.

METHOD AND MATERIALS

We retrospectively identified 172 patients (ages 28 to 71; 67% female) with confirmed NAFLD who underwent MR PDFF exams for clinical care at our institution. Each exam included a magnitude-based PDFF sequence comprising six gradient-echo images at sequential nominally out- and in-phase echo times. Manual-segmentation-determined spleen volumes were measured by an image analyst on 5th echo images for all 172 exams to serve as ground truth. We developed a spleen-segmentation CNN using a 2D U-Net to compute spleen volume separately on each of the six echoes to capture a range of T2* weighting. We trained the CNN in 100 of the 172 patients selected at random and then evaluated its accuracy (Dice score, linear regression, and Bland-Altman analyses) against the ground truth in the other 72 patients.

RESULTS

In the test cohort, spleen volumes were 318±148 mL for manual segmentation of the 5th echo, and 300±137 mL for automated segmentation of all six echoes. Mean Dice score was 0.88 ± 0.09. Regression slope and intercept were 0.90 and 13.0 mL with R2=0.94. The CNN underestimated spleen volume by 17 mL (p<0.0001) with Bland-Altman 95% limits of agreement of [-88 mL, 52 mL].

CONCLUSION

Automated spleen segmentation based on MRI-PDFF is feasible, but further CNN refinement is needed to ensure robust spleen volumetry amongst all patients and signal weightings.

CLINICAL RELEVANCE/APPLICATION

A CNN can measure spleen volume automatically based on MR PDFF images. With further refinement, this CNN may aid in monitoring disease progression in NAFLD and other diseases.

SSQ06-04 Characterization of Abdominal Lymph Node Enlargement: Value of Dual-Energy CT-Based Iodine and Fat Quantification

Thursday, Nov. 29 11:00AM - 11:10AM Room: E350

Participants
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PURPOSE

To investigate the potential of dual-energy computed tomography (DECT)-derived iodine and fat quantification for the differentiation of varying entities in patients with abdominal lymph node enlargement.

METHOD AND MATERIALS

In this retrospective study, 94 patients (51 men; mean age, 64.5 years) with histopathologically confirmed diagnosis of malignant lymphoma, lymph node metastasis, or inflammatory lymph node enlargement were included. For each lesion, contrast-enhanced attenuation, as well as DECT-derived iodine density and fat fraction measurements were recorded. Mean attenuation and material density values were compared between different entities. The receiver operating characteristic (ROC) curve analysis was adopted to estimate the optimal threshold for the diagnosis of lymph node metastasis. A control group (n = 95) was analyzed for comparison of attenuation and material density values of normal abdominal lymph nodes.

RESULTS

Assessment of DECT-derived iodine density and fat fraction values revealed significant differences between lymph node metastases (1.7±0.4 mg/ml and 15.5±7.3%), malignant lymphomas (2.5±0.5 mg/ml and 26.7±12.2%), and inflammatory lymph nodes (2.9±0.7 mg/ml and 20.1±10.3%) (P<=0.022). Attenuation values showed no significant differences between the different entities (P>=0.054). Normal lymph nodes revealed an iodine density of 2.4±0.8 mg/ml and fat fraction of 24.1±10.8% with no significant differences compared to malignant lymphomas (P<=0.1.65). An iodine concentration of 2.0 mg/ml represented the optimal threshold for the diagnosis of lymph node metastasis with a sensitivity of 91% and a specificity of 89%.

CONCLUSION

The differentiation of enlarged lymph nodes due to inflammation, primary and secondary malignancy is feasible using DECT iodine density and fat fraction analysis.

CLINICAL RELEVANCE/APPLICATION

DECT material density analysis optimizes the clinical workflow in patients with abdominal masses as iodine density and fat fraction values differ significantly between malignant abdominal lymphomas, lymph node metastases, and inflammatory lymph nodes. This may be beneficial in order to reduce the frequency of additional MRI and ultimately, lymph node biopsy.

SSQ06-05 CT-Based Quantification of Abdominal Aortic Calcification is Superior to the Framingham Risk Score for Predicting Cardiovascular Events in Asymptomatic Adults

Thursday, Nov. 29 11:10AM - 11:20AM Room: E350

Participants
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PURPOSE

Determine if abdominal aortic calcification (AAC) predicts cardiovascular (CV) events independent of Framingham risk score (FRS).

METHOD AND MATERIALS

This retrospective HIPAA-compliant study was approved by the institutional review board. Electronic health records for 829 asymptomatic patients (mean age, 57.9 years; 451 women, 378 men) who underwent unenhanced screening CT colonography between April 2004-March 2005 were reviewed to identify patients with subsequent CV events (defined as MI, CVA, CHF, or death); mean follow-up interval was 11.2±2.8 years. CT-based AAC was quantified as a modified Agatston score using a semi-automated tool (V3D-Calcium Scoring, Viatronix). Kaplan-Meier curves and Cox proportional hazards models were used for time-to-event analysis; ROC curves and net reclassification improvement (NRI) were used to compare predictive abilities of AAC and FRS.

RESULTS

An index CV event occurred after CT in 156 (18.8%) of 829 subjects (6.7±3.5 years after CT). AAC was significantly higher in the CV event cohort (mean AAC, 3478 vs 664). AAC was a strong predictor of CV events at both univariate and multivariate Cox modeling, independent of FRS ($p<0.0001$). KM plots showed better separation with AAC over FRS. The ROC-AUC was higher for AAC than FRS at all evaluated time points (eg, AUC =0.819 versus 0.642 at 2-years; AUC for FRS-AAC combined =0.819). Using a cut-point of 200, AAC improved upon FRS risk categorization with NRI of 35.4%.

CONCLUSION

CT-based AAC is a strong predictor of future cardiovascular events, outperforming the FRS. This suggests a potential opportunistic role in abdominal CT scans performed for other clinical indications.

CLINICAL RELEVANCE/APPLICATION

Abdominal aortic calcification (AAC), which can be quantified at abdominal CT performed for other indications, can serve as a useful biomarker for estimating risk for future cardiovascular events.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Perry J. Pickhardt, MD - 2014 Honored EducatorPerry J. Pickhardt, MD - 2018 Honored Educator

SSQ06-06 Reduction of Artifacts in the Hepatic Arterial Phase of Gadoxetic Acid-Enhanced MR Imaging: Effect of Warming Before Injection

Thursday, Nov. 29 11:20AM - 11:30AM Room: E350

Participants
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PURPOSE

To investigate if the warming of gadoxetic acid affects the frequency and degree of artifacts in the arterial phase of magnetic resonance (MR) imaging.

METHOD AND MATERIALS

Two hundred and seventy-one patients who underwent gadoxetic acid-enhanced abdominal MR imaging were included in the study. All dynamic MR imaging was performed with a 1.5 T MR scanner (Achieva, Philips). Either warmed (37°C, n = 137) or non-warmed (24°C, n = 134) gadoxetic acid (Primovist; Bayer HealthCare) was intravenously injected at a dose of 0.025 mmol/kg for 5 seconds, followed by 20 mL of saline. Breath-hold time of each phase was fixed at approximately 20 s. Two abdominal radiologists evaluated the severity of artifact of precontrast, arterial and portal phase images in a consensus fashion as follows: 1 = none; 2 = mild; 3 = moderate; and 4 = severe. Comparison of artifact scores in precontrast, arterial and portal phases as well as patient background was performed between the 37 °C group and the 24 °C group.

RESULTS

There was no significant difference between the 37 °C and the 24 °C groups in terms of age, sex, body weight, body mass index or frequency of underlying medical conditions (liver cirrhosis, ascites, pleural effusion and pulmonary disease). The mean artifact score of the arterial phase in the 37 °C group was significantly lower than that in the 24 °C group (1.38 ± 0.78 vs 1.62 ± 0.92, $p < 0.05$), whereas those of the precontrast and portal phases did not show a significant difference between the two groups. The rate of substantial artifact (score = 3 or 4) in the arterial phase was significantly lower in the 37 °C group than in the 24 °C group (11.2% vs 21.1%, $p < 0.05$). The rate of patients that showed high artifact score in the arterial phase compared to the precontrast image was also lower in the 37 °C group than in the 24°C group (21.6% vs 36.0%, $p < 0.01$).

CONCLUSION

Warmed gadoxetic acid could reduce the artifact in the arterial phase of dynamic MR imaging. Since the viscosity of gadoxetic acid decreases as temperature increases, we speculate the warmed gadoxetic acid may get more homogenous in the vessel early after injection than non-warmed one. This homogeneity could influence the degree or frequency of the artifact.

CLINICAL RELEVANCE/APPLICATION

(dealing with MR artifacts) The artifact in the arterial phase of dynamic MR imaging can be easily reduced by warming of gadoxetic acid without spending time and effort.

SSQ06-07 Leakage After Laparoscopic Sleeve Gastrectomy (LSG): What Is the Role of Routine Postoperative CT Scan?

Thursday, Nov. 29 11:30AM - 11:40AM Room: E350

Participants
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PURPOSE

LSG has become one of the most common bariatric procedures; even so, gastric leak remains the most feared complication of this procedure with a difficult treatment. Our aim was to investigate the role of routine postoperative CT scan in the early identification of factors representing potential substrates of leakage after LSG.

METHOD AND MATERIALS

We enrolled 170 patients(112F,58M;43±12years;43±6.4kg/m2)who underwent primary LSG between September 2015 and February 2018. CT scan was performed within 72 hours from surgery; CT protocol included the use of intravenous and oral contrast. Imaging post processing consisted in measurement of the distance proximal from the pylorus to the first staple firing(stapler to pylorus distance - StP). We also evaluated the presence of perigastric hematoma and of any twisting of the stomach remnant(defined as rotation of all or part of the stomach around its longitudinal axis).

RESULTS

8 patients suffered from gastric leak(4.7%). The mean StP was 38.7±16.7mm; this distance was significantly lower in patients who suffered from gastric leak(24.2±11.9mm vs. 40.3±16.4mm; p=.005). By means of ROC analysis we identified as best threshold for StP 29.9mm below which patients demonstrate a higher risk of gastric leak(AUC:.83;Se:81.8%;Sp:75.4%). Hematoma was found in 9 patients(5.3%); patients with hematoma were found to be more likely to develop gastric leak after LSG(33.3%; p=.005). 15 patients developed twist of stomach remnant(8.8%); we identified two types of twist: type A(10 patients,5.9%), if the twist involves the first third of the gastric remnant; type B(5 patients,2.9%), if it involves its middle and distal part. 4 out of 5 type B patients suffered from gastric leak, while no gastric leak was found in type A group. Type B twisting of the gastric remnant significantly increases the probability of gastric leak after LSG(p=.004). A stepwise multivariate analysis identified this CT sign as the strongest risk factor for gastric leak after LSG(p=.005).

CONCLUSION

On routine postoperative CT scan the assessment of Stp<3cm and the presence of perigastric hematoma and type B twisting of gastric remnant are to be considered risk factors for leakage after LSG.

CLINICAL RELEVANCE/APPLICATION

Routine postoperative CT scan has a promising role in the risk stratification of patients who underwent LSG.

SSQ06-08 Real-Time MRI of the Gastroesophageal Junction: Dynamic Imaging in Patients with GERD-Like Symptoms After Surgical Fundoplication

Thursday, Nov. 29 11:40AM - 11:50AM Room: E350

Participants
Lorenz Biggemann, Goettingen, Germany (*Presenter*) Nothing to Disclose
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PURPOSE

To assess the diagnostic potential of dynamic real-time MRI in patients with persistent or recurrent GERD-like (gastroesophageal reflux disease) complaints after surgical fundoplication.

METHOD AND MATERIALS

22 consecutive patients (male n=11; female n=11; median age 59y) presenting with recurrent or persistent GERD-like symptoms after surgical fundoplication were enrolled between 2015-2017. Median duration of GERD-like symptoms was 21 months. MRI was performed at a median of 5 years after initial surgery. Real-time MRI at 3.0 Tesla was performed with temporal resolution of 40 ms. based on undersampled radial fast low angle shot (FLASH) acquisitions with iterative image reconstruction by regularized nonlinear inversion (NLINV). Dynamic MRI movies visualized bolus transit of pineapple juice through the gastroesophageal junction, position of the fundoplication wrap as well as recurring hernia or reflux during Valsalva maneuver. MRI results were compared to endoscopic findings.

RESULTS

Real-time MRI was successfully completed in all patients without adverse events and average examination time of 15 minutes. A morphological correlate for GERD-like symptoms was evident in 20 patients (90.1%): Gastric reflux was present in 19 of these cases. Nine patients (40.1%) were diagnosed with wrap disruption and recurrent gastric hernia. Wrap migration or telescoping hernia were detected in 9 patients (40.1%). Only 1 patient presented with continued reflux despite intact wrap. Esophageal dysmotility with delayed bolus passage was observed in 1 case. On endoscopy, gastric hernia or wrap migration were diagnosed in 6 cases. Repeated fundoplication was performed in 12 patients (54.4%) with gastric hernia or wrap migration based on MRI findings.

CONCLUSION

Real-time MRI is a fast and safe modality for dynamic imaging after fundoplication, without radiation exposure or administration of gadolinium-based contrast media. In a relevant number of cases real-time MRI reveals correlates for GERD-like symptoms.

CLINICAL RELEVANCE/APPLICATION

Dynamic real-time MRI is a novel imaging technique for postsurgical detection and characterization of fundoplication failure. Different patterns on MRI may assist planning of redo fundoplication.

SSQ06-09 Novel Murine Model of Liver Microbleeding Using Electric Field Ablation

Thursday, Nov. 29 11:50AM - 12:00PM Room: E350

Participants
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PURPOSE

Approximately 5% of gastrointestinal bleeding (GIB) cannot be identified on initial workup. Over two years, an average of 7.3 diagnostic tests, 5 hospitalizations, and 46 units of blood per patient are required during workup. Improved diagnostic approaches of obscure GIB are needed. To evaluate emerging diagnostic agents, we describe a novel murine GIB model using irreversible electroporation (IRE) which can be detected with contrast enhanced micro-computed tomography (micro-CT).

METHOD AND MATERIALS

C57BL/6 mice (n=10) were placed under anesthesia. Prior to the IRE procedure, 200U/kg heparin was injected followed by 300µl 1:1 v/v heparinized saline and 350mg/ml iohexol. The mice were divided into two experimental groups: 60 and 120V/mm IRE treatment. IRE was performed using 1cm2 tweezer electrodes applied to both sides of the right median liver lobe. Microperfusion was measured using Laser Speckle Contrast Analysis (LASCA) at baseline and at 2, 10, 20, 30 min post-IRE. Prior to euthanasia, another 300µl of heparinized saline-ioxhexol was injected. Whole body contrast enhanced micro-CT scan was performed with settings of: 32µm pixel size, 55kV, 181µA, rotation step 0.25°, frame average 3, with a 0.5mm aluminum filter. Liver tissues were harvested for additional micro-CT and histology.

RESULTS

Visual inspection of the IRE site showed evidence of contusion within the tissue in both groups. LASCA imaging demonstrated decreased, but maintained perfusion. 30min post-IRE perfusion for 60V/mm and 120V/mm was 71% and 35% of baseline, respectively (p=0.006). Micro-CT showed increased attenuation at the liver IRE site, suggestive of bleeding. Extravasation of erythrocytes within the hepatic parenchyma was evident on microscopy with a greater effect seen in the 120V/mm group.

CONCLUSION

We demonstrate a novel, non-traumatic model of liver microbleeding which can be identified using non-invasive micro-CT imaging and confirmed by histology. Although trauma induced animal hemorrhage models exist, this is the first described model of microbleeding of the abdomen. This model can be useful to test emerging bioengineered hemostatic and imaging agents.

CLINICAL RELEVANCE/APPLICATION

A GIB model can help test emerging diagnostic and therapeutic agents which can be targeted to sites of microbleed. New agents have potential to improve costs, morbidity and mortality of obscure GIB.

SSQ07

Gastrointestinal (Gastric Cancer)

Thursday, Nov. 29 10:30AM - 12:00PM Room: E351

CT GI OI

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

FDA Discussions may include off-label uses.

Participants
Rony Kampalath, MD, Houston, TX (*Moderator*) Nothing to Disclose
Olga R. Brook, MD, Boston, MA (*Moderator*) Nothing to Disclose
Desiree E. Morgan, MD, Birmingham, AL (*Moderator*) Institutional Research Grant, General Electric Company

Sub-Events

SSQ07-01 CT Detected Extramural Vessel Invasion combined with N Staging as the Prognostic Predictor in Patients with T4a Gastric Cancer

Thursday, Nov. 29 10:30AM - 10:40AM Room: E351

Participants
Jin Cheng, MD, Beijing, China (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate the 3-year progressive-free survival (PFS) of extramural vessel invasion (EMVI) and the nodal status detected with contrast MDCT in patients with clinical T4a gastric cancer.

METHOD AND MATERIALS

Between January 2009 and February 2015, 143 patients with preoperative ceMDCT diagnosed T4a gastric cancer based on the criteria of the AJCC 8th were included in this retrospective study. All patients underwent curative D2 gastrectomy, adjuvant chemotherapy and conventional follow-up. Potential prognostic factors including clinical and pathological N status, EMVI tumor location/growth pattern, histological type/tumor differentiation and tumor size were recorded. Disease progression was defined as the presence of radiological or/and pathology-confirmed metachronous metastases, local recurrence, or gastric cancer related death. Survival estimated for PFS were obtained in patients according to the following four categories: ctEMVI+/ctN+, ctEMVI+/ctN-, ctEMVI-/ctN+, ctEMVI-/ctN-, by using the Kaplan-Meier product limit. Hazard ratios for 3-year PFS were generated using a Cox proportional hazard regression on ceMDCT tumor characteristics.

RESULTS

The prevalence of EMVI detected with ceMDCT was 55.9% (80/143) in the entire cohort of patients with clinical T4a patients. The 3-year PFS according to ctEMVI and CT detected nodal status were ctEMVI+/ctN+ 25.0%, ctEMVI+/ctN- 53.1%, ctEMVI-/ctN+ 75.6% and ctEMVI-/ctN- 64.7%, respectively. There was significant difference in 3-years PFS with ctEMVI+/ctN+ (as the reference) and the other three groups (ctEMVI+/ctN-, ctEMVI-/ctN+, and ctEMVI-/ctN-) (Logrank test, $P<0.05$). In a Cox proportional hazards regression analysis, ctEMVI+/ctN+ was demonstrated as the independent factors for reduced 3-year PFS with HR of 2.169 (95%CI:1.300-3.618, $P=0.003$) .

CONCLUSION

EMVI combined with nodal status detected with ceMDCT, could be an more valuable preoperative factor to counsel patients regarding ongoing risks of metastatic disease, implications for surveillance, and systemic chemotherapy.

CLINICAL RELEVANCE/APPLICATION

Clinical N staging combined with the status of CT detected EMVI could be used as an independent poor prognostic predictors for the T4a gastric cancer patients. EMVI and ctN both positive might be a useful risk-stratified factors to balance benefit of survival with induced long-term toxicities from neoadjuvant chemotherapy for regional advanced gastric cancer.

SSQ07-02 Diffusion Kurtosis Imaging: Assessment of Poor Response to Neoadjuvant Chemotherapy in Advanced Gastric Cancer

Thursday, Nov. 29 10:40AM - 10:50AM Room: E351

Participants

Lei Tang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To assess effectiveness of diffusion kurtosis (DK) imaging in treatment response to neoadjuvant chemotherapy in locally advanced gastric cancer.

METHOD AND MATERIALS

This study was approved by the local institute review board. A total of 28 patients (median age, 60.3years; age range, 35-79years) with gastric cancer were enrolled in this prospective study, and underwent MR imaging on a 1.5T MR scanner. All patients were underwent DKI examination (b=0,200,500, 800, 1000, 1500, 2000s/mm2) and conventional diffusion-weighted imaging (b = 0, 800s/mm2) before and after chemotherapy. ADC value, diffusivity (D), Kurtosis (K) were measured. Change value (ΔX) and ratio (%ΔX) of these parameters were calculated. The response to neoadjuvant chemotherapy was evaluated according to pathological tumor regression grade scores (NCCN) as the standard reference (good responders TRG 0-2, poor responders, TRG 3). Mann-Whitney U test, ROC curve were used for statistical analysis.

RESULTS

There were 16 cases of good response and 12 cases of poor response. The Kpre and Kpost values in poor response group were significantly higher than those in good response group [(0.671±0.026) and (0.641±0.019) vs. (0.584 ± 0.023) and (0.519±0.018) respectively, p<0.001)]. ADCpost and Dpost in the poor response group were significantly lower than those in good response group (p<0.05). In addition, significant difference were also observed for parameters %ΔK, ΔD andΔK between the two groups (p<0.05). The operating characteristic curve for the assessment of poor response was highest using Kpost (0.958, cutoff value=0.614) compared with other parameters. The Kpre and Kpost respectively had highest sensibility (91.70%) and specificity (93.8%) compared with other image indices.

CONCLUSION

Both DKI and conventional DWI exhibit potential in evaluation of treatment response in gastric cancer with neoadjuvant chemotherapy. The DKI parameters, especially K, showed better performance in differentiating poor response.

CLINICAL RELEVANCE/APPLICATION

DKI is a non-invasive imaging technique that may be useful in monitoring poor responser for advanced gastric cancer.

SSQ07-03 Predicting Gastric Cancer Response to Neoadjuvant Chemotherapy Using a Non-Gaussian Fractional Order Calculus Diffusion Model

Thursday, Nov. 29 10:50AM - 11:00AM Room: E351

Participants
Muge Karaman, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate whether pre-treatment MRI can predict tumor response grade (TRG) to neoadjuvant chemotherapy (NAC) of gastric cancer using a non-Gaussian fractional order calculus (FROC) diffusion model.

METHOD AND MATERIALS

With IRB approval, 30 patients (9 females and 21 males) with gastric cancer underwent MRI scans at 1.5T prior to NAC. The histologic TRG was evaluated based on the following grading system: TRG0: complete, TRG1: moderate, TRG2: minimal, and TRG3: poor response. According to this criterion, 3 patients were identified with TRG0, 2 with TRG1, 12 with TRG2, and 13 with TRG3. For analysis, TRG0-TRG2 groups were combined as low-TRG to be compared with high-TRG (TRG3) group. The MRI protocol included T1-weighted (VIBE), T2-weighted (turbo spin echo with respiratory trigger), and diffusion-weighted (DW) imaging with 11 *b*-values (0 to 2000 s/mm2). Diffusion coefficient *D*, fractional order parameter *ß* (which correlates with tissue heterogeneity), and a microstructural quantity *μ* were calculated by fitting the DW images to a FROC model. Apparent diffusion coefficient (ADC) was also computed using *b*=50 and 800 s/mm2 images. For group analysis, the test parameters were computed as the mean value from the tumor region-of-interest for *ß* and *μ*. For D or ADC, the mean values were computed from the lower 25% of their histograms to improve robustness against contamination from the body fluid. The low- and high-TRG groups were compared using a Mann-Whitney U test. A receiver operating characteristic analysis was performed to assess the performance of FROC model for predicting TRG in comparison with ADC.

RESULTS

The FROC parameters, *D* and *μ*, were significantly lower in high-TRG than low-TRG group (*p*-values<0.05), whereas ADC or *ß* did not show significant difference between the groups. The combination of *D* and *μ* produced higher accuracy (76% vs. 64%), specificity

(70% vs. 60%), sensitivity (80% vs. 70%), and area under the curve (80% vs. 60.6%) than ADC in differentiating low- and high-TRG groups.

CONCLUSION

The combination of pre-treatment FROC parameters, *D* and *μ*, improved the performance over ADC in predicting TRG in gastric cancer patients receiving NAC.

CLINICAL RELEVANCE/APPLICATION

The pre-treatment FROC diffusion model parameters can be used to predict gastric cancer response to NAC.

SSQ07-04 Prognostic Ability of Risk-Stratification Defined By ceMDCT of Patients with Gastric Cancer

Thursday, Nov. 29 11:00AM - 11:10AM Room: E351

Participants
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PURPOSE

To investigate the risk-stratification defined by preoperative abdominal contrast-enhanced multiple-row detector computed tomography (ceMDCT) in predicting 1-year DFS of patients with gastric cancer.

METHOD AND MATERIALS

Between January 2009 and December 2015, 237 patients with pathological-proved gastric cancer were included in this retrospective study. Two radiologists reviewed all abdominal ceMDCT images and reached a consensus on categories of tumor and lymph node (ctT/ctN), the presence of ctEMVI, tumor location/growth pattern, and tumor size. Kaplan-Meier method was used to compare the 1-year DFS rate between ctEMVI-positive and ctEMVI-negative group. Cox proportional hazard regression was used to find the independent risk factors of 1-year DFS rate. According to the number of independent risk factors, the patients were classified to the different risk stratifications, and the difference of 1-year DFS rate between different risk stratifications was compared.

RESULTS

The ctEMVI-positive group had significantly lower 1-year DFS rate (55.3%) than the ctEMVI-negative group (90.2%) (Log-rank test, $P < 0.0001$). In a Cox proportional hazards regression analysis, ctT, ctN and ctEMVI were identified as independent prognostic factors of 1-year DFS with hazard ratio (HR) of 3.35 (95% CI: 1.25-8.99, $P = 0.018$), 1.99 (95% CI: 1.08-3.63, $P = 0.0269$) and 3.40 (95% CI: 1.79-6.47, $P = 0.0002$), respectively. The risk stratification analysis showed that with the increase of the number of independent risk factors, 1-year DFS rate decreased gradually in patients with gastric cancer ($P < 0.0001$).

CONCLUSION

Preoperative TN stage and EMVI diagnosised by ceMDCT were independent risk factors for the prognosis of gastric cancer, and can be used for risk stratification to predict 1-year DFS rate of gastric cancer.

CLINICAL RELEVANCE/APPLICATION

Preoperative risk stratification based on TN stage and EMVI defined by ceMDCT can be used to predict 1-year DFS rate of gastric cancer.

SSQ07-05 CT-Based Radiomics Analysis for Evaluation of Serosa Invasion in Gastric Cancer

Thursday, Nov. 29 11:10AM - 11:20AM Room: E351

Participants
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PURPOSE

The purpose of this study was to develop and validate a radiomics model for evaluating serosa invasion in gastric cancer.

METHOD AND MATERIALS

We enrolled 428 patients (252 in the primary cohort and 176 in the validation cohort) with pathological confirmed T3 or T4a gastric cancer, the contrast enhanced CT images of three phases (arterial, portal, and delayed) of lesions were manually segmented. The subjective CT findings (nodular, cord, perigastric fat infiltration, high enhanced serosa sign) of serosa invasion were evaluated. Conventional hand-crafted features and convolutional neural network (CNN) based deep learning features were all automatically extracted based on CT images. The 2-sample t-test and the min-redundancy and max-relevance method were used for feature selection, whereupon 3 radiomics signature were built with support vector machines. Multivariable logistic regression analysis was

then used to develop a radiomics model incorporating the radiomics signature and subjective CT findings. A nomogram was displayed. The receiver operating characteristic (ROC) curve was constructed for each cohort and the area under the curve (AUC) was calculated to measure the diagnostic ability. DeLong test was used to verify whether there were statistical differences between the ROC curves.

RESULTS

The radiomics signature comprised 273 hand-crafted features and 30 features extracted based on the CNN. The individualized radiomics model, which incorporated the arterial radiomics signature and three CT findings (nodular, perigastric fat infiltration, high enhanced serosa sign) showed moderate discrimination. The AUC (95% confidence interval) in primary and validation cohort was 0.815 (0.759-0.870) and 0.804 (0.739-0.868), respectively. The accuracy, sensitivity and specificity of the primary cohort was 0.770, 0.798, 0.719, respectively. The prediction accuracy, sensitivity, and specificity of the validation cohort was 0.744, 0.756 and 0.734, respectively.

CONCLUSION

Based on the contrast enhanced CT images of three phases, we developed a radiomics model, which may be used to identify serosa invasion and provide reference for individualized clinical treatment.

CLINICAL RELEVANCE/APPLICATION

The radiomics model we developed and the derived nomogram that incorporates the radiomics signature and CT findings provides patients and doctors with an effective tool for evaluating serosa invasion and for determining further treatment plans.

SSQ07-06 Diagnostic Accuracy of Dual-Energy CT-Based Nomogram to Predict Lymph Node Metastasis in Gastric Cancer

Thursday, Nov. 29 11:20AM - 11:30AM Room: E351

Participants
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PURPOSE

To develop and validate a dual-energy CT based nomogram for the preoperative prediction of lymph node metastasis (LNM) in patients with gastric cancer (GC).

METHOD AND MATERIALS

A total of 210 surgical confirmed GC patients (159 males, 51 females; mean age: 59.8 ± 7.7 years, range: 28-79 years) who underwent spectral CT scans were retrospectively enrolled and split into a primary cohort (n=140) and validation cohort (n=70). Clinical information and follow up data including overall survival (OS) and progression free survival (PFS) were collected. The iodine concentration (IC) of the primary tumours at the arterial phase (AP) and venous phase (VP) were measured and then normalized to aorta (nICs). Univariate analysis, multivariable logistic regression analysis and Cox regression analysis were performed to screen predictive indicators for LNM and outcome. A nomogram for risk factors of LNM was developed and its performance was measured using ROC, accuracy and Harrell's concordance index (C-index).

RESULTS

Tumour thickness, Borrmann classification and ICVP were independent predictors for LNM. The nomogram was significantly associated with LN status (P <0.001). The AUCs for predicting LNM were 0.760 (95% confidence interval [95% CI], 0.680-0.840) in primary cohort and 0.793 (95% CI, 0.678-0.908) in validation cohort. The nomogram also exhibited a prognostic ability with C-indices of 0.675 (95% CI, 0.571-0.779; P <0.001) for PFS and 0.643 (95% CI, 0.518-0.768; P =0.025) for OS.

CONCLUSION

This study presented a dual-energy quantification based nomogram, which can be used to facilitate the preoperative individualized prediction of LNM in patients with GC.

CLINICAL RELEVANCE/APPLICATION

Dual-energy CT based nomogram enables superior preoperative individual prediction of LNM in GC.

SSQ07-07 Evaluation of Iodine Concentration Measurement by Dual Energy CT Scan on Predicting Prognosis for Patients with Advanced Gastric Adenocarcinoma

Thursday, Nov. 29 11:30AM - 11:40AM Room: E351

Participants
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PURPOSE

To evaluate iodine concentration measurement by dual energy CT scan on tumor angiogenesis and predicting prognosis for patients with advanced gastric adenocarcinoma.

METHOD AND MATERIALS

This retrospective study included 97 patients with advanced gastric adenocarcinoma who had preoperative enhanced dual-energy CT scan. Standardized iodine concentration (SIC) of the primary tumor was measured. The correlations between SIC and clinical, pathological, angiogenic findings compared with patient survival were analyzed. The Kaplan-Meier test was employed to evaluate the patients' disease free survival (DFS) and overall survival (OS) . COX regression model was adopted to improve the multiple factors analysis .

RESULTS

Different values of SIC values were found 0.81 at diffuse, 0.54 at both intestinal and mixed type (F=18.717,P<0.001); 0.52 at non-T4 and 0.66 at T4 group (t=-2.728,P=0.008); 0.53 at N0 and 0.64 at N1-3 group (t=-2.084,P=0.040); 0.50 at non-III staging and 0.68 at III staging group (t=-4.135,P<0.001); 0.48 at VEGF negative and 0.69 at positive expression group (t=-4.684,P<0.001); 0.55 at low and 0.67 at high MVD group (t=-2.802,P<0.05); 0.72 at recurrence and 0.55 at non-recurrence group (t=3.791,P<0.001), respectively. DFS of low SIC (< mean value of 0.62) and high SIC (>= 0.62) groups were 28 and 22 months (X2=11.920,P=0.001). OS of the two groups were 29 and 26 months (X2=12.907,P<0.001). Invasion, metastasis, pTNM and SIC were identified as the independent risk factors affecting to DFS (0.195,0.379,6.623 and 2.802, respectively). Invasion, pTNM and SIC independent risk were affecting to OS (0.281, 7.225 and 2.835, respectively).

CONCLUSION

The SIC of advanced gastric adenocarcinoma has the relationship with Lauren classification, invasion depth, lymph node metastasis, pathological TNM staging and tumor angiogenesis. The SIC as a independent risk factor could affect DFS and OS, and has the potential to be used for predicating the patient prognosis.

CLINICAL RELEVANCE/APPLICATION

The SIC of advanced gastric adenocarcinoma has the relationship with Lauren classification, invasion depth, lymph node metastasis, pathological TNM staging and tumor angiogenesis. The SIC as a independent risk factor could affect DFS and OS, and has the potential to be used for predicating the patient prognosis.

SSQ07-08 Diagnostic Value of Multiparameter Dual-Energy CT in Regional Lymphatic Metastasis of Gastric Cancer

Thursday, Nov. 29 11:40AM - 11:50AM Room: E351

Participants
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PURPOSE

To evaluate the value of dual-energy CT iodine concentration and overlay combining with conventional morphological measurements in metastatic lymph nodes of gastric cancer.

METHOD AND MATERIALS

A total of 141 regional lymph nodes were collected from 40 gastric cancer patients who underwent dual-energy CT scan and confirmed by surgery and pathology. The short diameter, length, and CT value, iodine concentration, and overlay value of each lymph node were measured, and the short length ratio and enhanced CT value at the arterial phase were calculated. Independent sample t-test was used to compare the short diameter, short length ratio, CT enhancement values, iodine concentration and overlay values between the two groups.The ROC analysis was used with statistically significant parameters and diagnostic efficacy was calculated with each individual parameter and joint parameters.

RESULTS

Of the 141 regional lymph nodes, 73 were metastatic lymph nodes and 68 were non-metastatic lymph nodes. The iodine concentration, overlay value, short diameter and enhanced CT values of the metastatic lymph node at the arterial phase were (1.64±0.68) mg/ml, (29.06±11.42) HU, (7.35±3.38) mm, (26.34±14.98) HU, respectively; while the corresponding values of the non-metastatic lymph nodes were (2.51±0.68) mg/ml, (38.90±14.61) HU, (5.32±1.34) mm, (33.57±15.91) HU, and the difference was statistically significant (all P<0.05). There was no significant difference in short length ratio (P>0.05). The AUC of the diagnosing lymph node metastasis was 0.708, 0.650, 0.808, 0.695 for short diameter, CT enhancement, iodine concentration, and overlay value at the arterial phase, respectively. Four indicators combining to diagnose lymph node metastasis, the series sensitivity and specificity were 21.9% and 98.5%, and the parallel was 100.0% and 80.9%.

CONCLUSION

Multiparameter dual-energy CT combining with conventional morphological measurements can improve the diagnostic efficiency of lymph nodes in gastric cancer and has a role in the differential diagnosis of regional lymph nodes in patients with gastric cancer.

CLINICAL RELEVANCE/APPLICATION

It has a role in the differential diagnosis of preoperative regional lymph nodes in patients with gastric cancer.

SSQ07-09 Diagnostic Accuracy of CT for Lymph Node Metastasis in Gastric Cancer: Comparison of Spectral Parameters Developed Dual-Energy CT and Conventional CT

Thursday, Nov. 29 11:50AM - 12:00PM Room: E351

Participants
Yaru Chai, MD, Zhengzhou, China (*Presenter*) Nothing to Disclose

PURPOSE

To investigate the optimal diagnostic threshold and accuracy of spectral parameters for metastatic lymph nodes of gastric cancer with dual energy CT and to compare with conventional CT parameters.

METHOD AND MATERIALS

This study received institutional review board approval, and all participants provided written informed consent. From December 2014 to December 2016, 86 patients with gastric cancer confirmed by gastroscope pathology underwent preoperative enhanced CT that included precontrast, arterial phase(AP) and venous phase(VP) in Discover GSI CT scanner. The spectal parameters(iodine value of lymph nodes in AP and VP) and the conventional parameters(short diameter, long diameter, the ratio of short to long diameter and CT number in AP and VP) were measured and recorded in iodine based images and monochromatic images at 70 keV respectively. The diagnostic efficiency of each factor to lymph nodes metastasis was assessed by using t test and receiver operating characteristic(ROC) curve analysis.

RESULTS

Among 552 lymph nodes found in CT images, 338 nodes were positive and 214 were negative with pathological results as the gold standard. The results of t test showed that the short diameter, the ratio of short to long diameter, the CT number and iodine value in AP and VP of positive lymph nodes were higher than these of negative lymph nodes(all $P<0.05$). The area under curve of the short diameter, the ratio of short to long diameter, the CT number in AP and VP, the iodine value in AP and VP of lymph nodes were 0.600, 0.880, 0.832, 0.755, 0.864, 0.835, respectively. The diagnosis accuracy of iodine value in AP and VP were 86.9%, 82.2%, respectively with threshold of 9.65,15.65(100ug/cm3). These were higher than the CT number in AP and VP(86.9% vs 69.9%, 66.9% vs 82.2%, both $P<0.05$). Taking the ratio of short to long diameter over 7.25 as optimal diagnosis threshold, the diagnosis accuracy was 75.6%. Combined the ratio of short to long diameter with the iodine value in AP, the diagnosis accuracy was 89.2%.

CONCLUSION

The diagnosis accuracy of dual-energy CT parameters was higher than conventional CT for lymph nodes metastasis in gastric cancer and could be improved by combining size and spectral CT parameters.

CLINICAL RELEVANCE/APPLICATION

Multifunctional parameters of spectral CT can improved the diagnosis accuracy of lymph node metastasis in gastric cancer.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

SSQ08

Gastrointestinal (Advanced CT Techniques)

Thursday, Nov. 29 10:30AM - 12:00PM Room: E352

CT GI PH SQ

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

FDA Discussions may include off-label uses.

Participants

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Andrew D. Hardie, MD, Charleston, SC (*Moderator*) Nothing to Disclose
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Sub-Events

SSQ08-01 Can Fully Iterative Reconstruction Technique Enable Routine Abdominal CT at Less Than 1 mSv?

Thursday, Nov. 29 10:30AM - 10:40AM Room: E352

Participants
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PURPOSE

We assessed effect of a new fully iterative reconstruction technique (FIRST) on lesion detection and image quality of routine abdominal CT at radiation dose <1 mSv

METHOD AND MATERIALS

24 patients (age 64±1 years, BMI 27±3 kg/m) undergoing routine abdomen CT on 640-slice MDCT (Aquillion One, Canon Medical System), gave written informed consent for acquisition of an additional ULD CT series immediately after their clinically-indicated regular dose CT (SD). The ULD CT series were reconstructed with FIRST (at STD (Standard) and STR (Strong) levels), and SD CT series with filtered back projection (FBP). Two radiologists performed the subjective image evaluation on a five-point scale (1 = image quality better than SD CT; 5 = image quality unacceptable) to assess subjective image quality,and presence of artifacts on all image series (SD (n=24) and ULD (n=72). Lesions were first detected on ULD FBP images. ULD FIRST (STD and STR) and ULD FBP images were then compared side-by-side to SD-FBP images in an independent,randomized, and blinded fashion. Patient demographics, radiation dose descriptors (CTDIvol, DLP) and image noise were recorded. Descriptive statistics and inter-observer variability were calculated for data analysis

RESULTS

Mean CTDIvol for SD and ULD CT were 13±3 mGy and 2.2±0.4 mGy, respectively. There were 46 'true positive' lesions detected on SD CT. Radiologists detected 38/46 lesions on ULD FIRST STD series compared to 26/46 lesions on ULD FIRST STR series. Twenty lesions (0.5-1.5 cm) missed on ULD FIRST STR images (pancreatic lesions, liver and kidney cysts) were seen in patients with BMI >27.6. Eight lesions (liver and kidney cysts, pancreatic lesions, sub-cm peritoneal lymph node) missed on ULD FIRST STD were seen in patients with BMI>25.8. Diagnostic confidence for lesion assessment was optimal in ULD FIRST STD setting in most patients regardless of their size. The inter-observer agreement (kappa-value) for overall image quality were 0.98 and 0.84 for ULD FIRST STD and STR levels, respectively

CONCLUSION

FIRST enabled optimal lesion detection, and diagnostic confidence in submSv abdominal CT in most non-obese adult patients compared to SD CT at 85% lower radiation dose levels

CLINICAL RELEVANCE/APPLICATION

The new fully iterative reconstruction (FIRST) technique can allow routine abdominal CT at less than 1 mSv with sufficient diagnostic confidence in smaller patients (<27.6 BMI)

SSQ08-02 Contrast Volume Reduction Using Measured Lean Body Weight and Related to Image Quality for Abdomen CT Examinations: Preliminary Results of a Prospective Multicentric Study

Thursday, Nov. 29 10:40AM - 10:50AM Room: E352

Participants
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PURPOSE

To assess i.v. contrast media (CM) volume differences correlated to image quality (IQ) when using lean body weight (LBW) or total body weight (TBW) for abdomen CT examinations.

METHOD AND MATERIALS

A CT scanner i.v. contrast media (CM) volume optimization protocol based on LBW was implemented in a multicenter medical imaging group (8 CT scanners) following a dose optimization program according to clinical indication. Patients assessed for a suspected liver, pancreas or renal lesion, were prospectively included. A single i.v. CM (iopamidol 370mg/ml) was used. In phase 1, a 600mg/kg of TBW injection protocol was applied. 948 prospective patients were included (Group 1): M:438/F:510, mean age: 59, mean BMI: 26.06 (range 13.8-44.6). In phase 2, a 750mg/kg of LBW injection protocol was applied. 124 prospective patients were included (Group 2): M:59/F:65, mean age: 60, mean BMI: 26.3 (range 16.45 - 37.55). LBW was measured using a bi-frequency tetrapolar bioelectrical impedance technique (BIA-ACC®, Biotekna, Italy). Contrast volume and injection rate were recorded in a single dose management software (Dosewatch™, GE). IQ (level of enhancement) was assessed by two independent readers in pre- and post-contrast portal phase images on 3mm axial reconstructions, with quantitative HU measurements for liver parenchyma enhancement (Δ target: 50HU), using ROIs of identical size and location. Image noise was also quantitatively reported using image Hounsfield unit standard deviation (SD) values indicated with the ROI density measurement. Mann-Whitney U Test and One way Annova test were used to assess differences as appropriate.

RESULTS

Injected i.v. CM volume is statistically significantly different (-26%) between group1 (median: 118.3ml) and 2 (median: 87.6ml) ($p<0.001$). Enhancement of liver parenchyma (median group1/group2: 60/50, SD:15.7/17.3) presents a statistically significant difference ($p<0.05$), but remains in target range. There is no statistically significant difference between readers for image quality assessment (parenchymal enhancement): reader 1/2, group 1: 60/61 (SD16.3/15.1), group 2 : 49/50 (SD17.6/17).

CONCLUSION

For abdomen CT examinations, injected i.v. CM volume is significantly less when using LBW instead of TBW, without impairing image quality.

CLINICAL RELEVANCE/APPLICATION

Excessive amounts of i.v. CM is delivered when using TBW instead of LBW for abdominal CT examinations.

SSQ08-03 Personalized Contrast Media Injection Protocols for Abdominal CT Studies

Thursday, Nov. 29 10:50AM - 11:00AM Room: E352

Participants
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PURPOSE

To compare Abdomen CT exams performed using power injector generated customized contrast media (CM) injection protocols based on total body weight (TBW) and kV to fixed CM injection protocols.

METHOD AND MATERIALS

A total of 384 patients underwent abdominal CECT studies (GE Revolution and Siemens Edge). 263 of 384 patients were scanned using 100kV and 121 with DECT (65 keV). CM (370 mgI/mL, Iopamidol) was administered using a software platform (P3T, Certegra, Medrad), connected to the power injector, which customized the CM injection (*Cinj*) based on TBW in kg's. In 149-*Cinj* patients (80 with 100kV; 69 with DECT) a comparison with 120kV exams was available using fixed CM injections (*Finj*) using TBW based thresholds ([TBW]<= 59 kg, 80 ml= Group A; 60-89 kg, 90 ml= Group B; >=90 kg, 120 ml= Group C). Subjective image quality and mean HU and CNR were calculated from ROIs within the liver, pancreas, portal vein, and aorta.

RESULTS

In the 384-*Cinj* patients a mean CM volume of 85.7±14.8 was injected, 9.4% lower than using TBW. Group A received a mean CM volume of 70.3±1.2 vs 80ml (-12%), group B of 82.3±9.3 vs 90ml (-8.5%), and group C 108±6.9 vs 120ml (-10%). All exams were

judged diagnostic. In comparison to 120 kV *Finj*, 100kV-*Cinj* images showed comparable HU mean and significantly higher CNR (+36-87%; p=<0.05) in all three groups. DECT-*Cinj* images showed significantly higher HU (+7-22%; p=<0.05) and CNR (+14%-86%) mean.

CONCLUSION

The software platform (P3T) with power injector enables personalized CM injection protocols using substantially lower iodine dose for low kV/keV exams while yielding diagnostic quality images with comparable/higher attenuation and CNR values compared to 120kV exams using fixed CM injection volumes.

CLINICAL RELEVANCE/APPLICATION

Automation of Customized CM injection protocols using a power injector platform entails reduction of the iodine load with optimized image quality. There are potential benefits for the patients safety, CT workflow and lowering exam cost.

Honored Educators

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SSQ08-04 Improvement of Diagnostic Image Quality of Abdominal CT by Using a Deep-Learning Based Reconstruction: Initial Clinical Trial Targeting Hypervascular Hepatocellular Carcinoma

Thursday, Nov. 29 11:00AM - 11:10AM Room: E352

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PURPOSE

Deep learning is part of a broader family of machine learning methods based on learning data representations, as opposed to task-specific algorithms. We developed a new image processing reconstruction method, Deep Learning based Reconstruction (DLR), which could generate CT image with better quality using deconvolution neural network trained by CT images which are scanned with sufficient radiation dose and reconstructed with model-based iterative reconstruction. The purpose of this study was to confirm clinical feasibility of our method compared with conventional hepatic CT images targeting hypervascular hepatocellular carcinoma.

METHOD AND MATERIALS

We evaluated 43 hypervascular hepatocellular carcinomas in 40 patients who had undergone hepatic dynamic CT. The CT images at arterial phase were reconstructed with DLR and hybrid iterative reconstruction (Hybrid-IR). A radiologist measured standard deviation of the attenuation measured in the paraspinal muscle as image noise, and calculated contrast-to-noise ratio (CNR) = (ROIL - ROIT)/N, where ROIL is the mean attenuation of the liver parenchyma, ROIT is the mean attenuation of the tumor, and N is noise. Each liver lesion was reviewed by other two radiologists and graded on a 5-point confidence scale ranging from 1 = cannot identify to 5 = can detect lesion without diagnostic compromise. The difference between CT images processed with Hybrid-IR and DLR was determined using two-sided Wilcoxon signed-rank test.

RESULTS

Image noise was significantly lower on images with DLR compared to Hybrid-IR (median 12.8 and 20.0 HU for DLR and Hybrid-IR, respectively, p<0.01). In addition, CNR on images with DLR was significantly higher than that on images with Hybrid-IR (median 2.3 and 1.5 for DLR and Hybrid-IR, respectively, p<0.01). Confidence score for liver lesions was significantly higher on images with DLR compared to those with Hybrid-IR (p<0.01).

CONCLUSION

The DLR improved quantitatively and qualitatively image quality of abdominal CT for evaluation of hypervascular hepatocellular carcinoma.

CLINICAL RELEVANCE/APPLICATION

DLR yielded better image quality of abdominal CT compared to Hybrid-IR, indicating that DLR can improve identification and characterization of hypervascular hepatocellular carcinoma.

SSQ08-05 Prior Iterative Reconstruction (PIR) to Lower Radiation Dose and Preserve Radiologist Performance for Multiphase Liver CT: A Multi-Reader Pilot Study

Thursday, Nov. 29 11:10AM - 11:20AM Room: E352

Participants
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PURPOSE

Prior Iterative Reconstruction (PIR) is an iterative reconstruction technique for multiphase CT (MCT) exams that spatially registers the multiple phases and uses them collectively to inform the image reconstruction and reduce image noise. We evaluated PIR in contrast-enhanced MCT imaging of the liver.

METHOD AND MATERIALS

Patients with archived projection MCT data with proven malignant or benign liver lesions by reference criteria were included. Reference criteria for malignancy included histopathology or progression/regression, with stability on CT/MR > 6 months required for benign lesions. A validated noise insertion tool created reduced dose MCT images (50% dose in 2 phases, 25% dose in 1 phase). For each patient, the phase of enhancement most relevant to the diagnostic task was selected for evaluation. Four abdominal radiologists reviewed routine dose and lower dose PIR images in randomized and blinded fashion in two reading sessions, interpreting a patient's images once/session, and marking benign and malignant lesions, rating confidence for malignancy, and scoring image quality metrics. JAFROC Figures of Merit (FOM) were calculated for each dose/reconstruction using -0.10 as a limit of non-inferiority.

RESULTS

30 patients with 27 primary liver malignancies, 6 metastases, and 26 benign lesions were included. Pooled JAFROC FOM for malignancy for routine dose MCT was 0.615 (95% CI: 0.464, 0.767) compared to 0.662 for PIR (95% CI: 0.527, 0.797). The estimated difference between the routine dose and lower dose PIR images was + 0.047 (95% C.I.: -0.023, + 0.116). GEE sensitivity and specificity for routine dose images was 70%/68% compared to 73%/66% for lower dose PIR. Lower dose PIR had lower diagnostic image quality (mean 3.8 vs. 4.2, p = 0.0009) and was less sharp (mean 2.3 vs. 2.0, p = 0.0071).

CONCLUSION

PIR is a promising method to substantially reduce radiation dose for multiphase contrast-enhanced abdominal CT, preserving observer performance despite small reductions in image quality. Further work to develop and validate this technique is warranted.

CLINICAL RELEVANCE/APPLICATION

While multiphase CT is of great diagnostic importance, radiation is of concern. PIR is a promising method to reduce radiation dose while maintaining observer performance for multiphase exams.

Honored Educators

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SSQ08-06 Prospective Colorectal Hepatic Metastases Detection in Abdominal CT Between Reduced Radiation Dose ASIR-V and Standard Dose FBP Including Reader Confidence, Characterization and Comparison to ASIR/MBIR

Thursday, Nov. 29 11:20AM - 11:30AM Room: E352

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PURPOSE

To prospectively evaluate colorectal cancer (CRC) hepatic metastasis detection and characterization between reduced-dose (RD) and standard dose (SD) contrast-enhanced CT (CECT) of the abdomen and to qualitatively compare between reconstruction algorithms.

METHOD AND MATERIALS

Fifty-one adults with biopsy-proven CRC and hepatic metastases by prior CT underwent portal venous phase SD-CECT followed by RD-CECT in the same breathhold. Three readers, blinded to reconstruction details and comparison examinations, performed detection and characterization of lesions 2-15 mm in size on the SD filtered back projection (SD FBP) and RD adaptive statistical iterative reconstruction-V 60 % (ASIR-V 60%) series. Readers then qualitatively assessed overall image quality and lesions side-by-side between 8 different reconstructions (SD FBP, SD ASIR 80%, SD ASIR-V 30%, SD ASIR-V 60% and RD model-based iterative reconstruction (MBIR), RD ASIR 80%, RD ASIR-V 30%, RD ASIR-V 60%) on a 0 to -4 Likert scale with 0 being best. Two, non-blinded consensus reviewers established the reference standard.

RESULTS

RD-CECT mean CTDIvol was 11.77 ± 3.28 mGy resulting in a mean radiation dose reduction of 53.86% compared to SD-CECT. Of the 260 lesions detected by reference standard (233 metastatic; 27 benign), RD-CECT only detected 82% of lesions, while SD-CECT detected 97% of lesions ($p<0.0001$); pooled data demonstrated a sensitivity of 0.79 and 0.93 ($p<0.0001$) and accuracy of 0.75 and 0.84 ($p=0.0005$), respectively. Mean qualitative scores for each series, in order from best to worst, were SD ASIR-V 60%, SD ASIR-V 30%, SD ASIR 80%, SD FBP, RD ASIR-V 60%, RD ASIR-V 30%, RD ASIR 80%, and RD MBIR.

CONCLUSION

Reduced radiation dose CECT demonstrates inferior diagnostic performance for detecting low-contrast liver lesions. Qualitative image evaluation suggests that performance of the RD scan may have been worse had FBP, ASIR or a lower percentage ASIR-V been utilized; the findings also suggest that SD exams benefit from iterative reconstructions.

CLINICAL RELEVANCE/APPLICATION

Oncologic CT evaluation of low contrast liver lesions is compromised in the setting of modest radiation dose reduction and iterative reconstructions appear to only partially mitigate this reduced performance. If the clinical task requires the detection of possible small, low-contrast liver lesions, proper radiation dose levels should be maintained with reference to the ACR dose index registry.

SSQ08-07 Comparison of Iterative Model-Based Reconstruction (IMR) with Hybrid Iterative Reconstruction (iDose-4) Technique for Assessing Small Hypervascular Hepatocellular Carcinomas Using Low Tube Voltage 256 Slice Multi-Detector Computed Tomography

Thursday, Nov. 29 11:30AM - 11:40AM Room: E352

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PURPOSE

To compare iterative model-based reconstruction (IMR) with hybrid iterative reconstruction (iDose-4) technique for assessing small hypervascular hepatocellular carcinomas (HCCs) using low-tube voltage (100 kVp) 256 slice multi-detector Computed Tomography scans.

METHOD AND MATERIALS

We prospectively evaluated 50 patients (Male:Female:45:5;average age- 60.68yrs) with 50 HCCs (3cm or less) between January 2016-December 2017,who underwent standard multiphase CT(HCC protocol) using 256 slice CT.Arterial phase (AP) was taken with 100kVp,two delayed phases(DP) at 90sec (100kVp,IMR) and 104sec (120 kVp,iDose-4) respectively. Reconstructed images with iDose-4,IMR were evaluated for tumor conspicuity, image noise.For subjective analysis,tumor conspicuity is graded on a 5-point scale on the AP and DP,with 5(definitely distinct),4(fairly distinct),3(moderately distinct,2(barely distinct), and 1(not distinct).Subjective image noise with diagnostic confidence is graded as follows:5(well seen with minimum/no noise),4(mild noise with high diagnostic confidence),3(average noise with moderate diagnostic confidence),2(above average noise with low diagnostic confidence),and 1(unacceptable noise).

RESULTS

Contrast-to-noise ratio of HCCs (CNR-HCC) in AP was significantly higher in IMR (9.1+/-6.6) compared to iDose-4 (5.6+/-3.5) , $P<0.0001$. CNR-HCC in DP was significantly higher in IMR (2.5+/-2.1) compared to iDose-4(1.7+/-1.4), $P<0.0001$. Image noise was significantly lower in IMR (arterial-6.8+/-3.7; delayed-7.4+/-4.2) than in iDose-4 (arterial-9.8+/-3.4; delayed-9.3+/-3.2), in both AP ($P<0.0001$) and DP ($P<0.0001$).The subjective analysis showed that, tumor conspicuity was significantly better in IMR both in AP(IMR-4.8+/-0.3; iDose-4 -4.3+/-0.5 ,P=0.012) and DP (IMR-4.8+/-0.4 ; iDose-4 -4.5+/-0.5, P=0.001) with the good interobserver agreement (kappa value for IMR: AP-0.78; DP-0.86,and iDose-4:AP-0.91, DP-0.91).The subjective analysis also showed that Image noise was significantly lower both in AP (IMR-4.8+/-0.3; iDose-4 -3.9+/-0.2, P=0.0004) and DP (IMR-4.8+/-0.4; iDose-4 -4.1+/-0.3, P=0.04) with the good interobserver agreement (kappa value for IMR:AP-0.81, DP-0.85,and iDose-4: AP-0.77,DP- 0.78).

CONCLUSION

IMR provides better tumor conspicuity than iDose-4 for small HCCs with a considerable decrease in noise, even at low kVp.

CLINICAL RELEVANCE/APPLICATION

IMR confidently detects small HCCs,even with low kVp CT and can positively impact treatment.

SSQ08-08 Participants Quantitative Comparison of Metal Artifact Reduction Techniques in Abdominopelvic CT

Thursday, Nov. 29 11:40AM - 11:50AM Room: E352

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PURPOSE

To compare the performance of various metal artifact reduction (MAR) approaches for different metals on low-tube voltage single energy CT, and dual-energy CT exams.

METHOD AND MATERIALS

In this phantom study, seven metal implants from titanium [Ti] or cobalt chromium [CoCr] (n=2 hip prosthesis, n=2 embolization coil, and n=3 spinal hardware) were suspended, sequentially, in an iodinated gelatin medium (0.4%; CT density 40-50HU). The phantom was scanned on three CT scanners (Somatom Definition Flash (scanner A) and Edge (scanner B); Siemens HC, and Discovery 750HD (scanner C); GE HC) using SECT (120/100/80kVp), and DECT (80/140 kVp) acquisitions. SECT images and high-energy (110-140keV) VMC images from DECT were reconstructed with and without vendor-specific MAR algorithms (iMAR; Siemens HC, and MARS; GE HC). Metal-related artifacts/noise (SD) was measured in the near (<3cm) and far (>3cm) fields. Differences among MAR approaches were tested using ANOVA.

RESULTS

Metal-related noise was comparable for Ti and CoCr on 120kVp images from all scanners ($p=0.23$), except on scanner C, where lower near-field noise was observed for Ti (48±12SD vs. 122±24SD; $p<0.01$). Higher near- and far-field noise on low-kVp images (37-54%) decreased substantially (63-72%) when using different modes of iMAR ($p<0.001$). High-keV VMC reduced both near- (16 to 32%) and far-field noise (32-41%) for both metals, with a slight variability between vendors. MARS (on scanner C) showed significant near-field noise reduction (59-91%) for both metals when added to VMC images ($p<0.001$). However, no effect on far-field noise was observed for Ti (14±8 vs. 13±1SD; $p=0.51$).

CONCLUSION

CT platforms from different vendors show variable metal-related noise, depending on the metal type. MAR algorithms applied to 80 or 100kVp have significant benefit for noise/artifact reduction and yield lower noise than 120kVp without MAR. While high-keV VMC alone reduce metal-related noise, further reduction is achieved by including MAR algorithms.

CLINICAL RELEVANCE/APPLICATION

Knowledge about existing MAR-approaches is desired for consistent IQ across vendors and to use MAR algorithms tailored to specific types of metallic implants.

Honored Educators

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SSQ08-09 Reducing Bowel Peristalsis Artifact with Dual-Energy CT: A Phantom Study Across Multiple Dual-Energy CT Platforms

Thursday, Nov. 29 11:50AM - 12:00PM Room: E352

Participants
Markus M. Obmann, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
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Yuxin Sun, BS,MSc, San Francisco, CA (*Abstract Co-Author*) Stockholder, Nextrast
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Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Consultant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc; Research Grant, Koninklijike Philips NV; Research Grant, Guerbet SA; ;

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PURPOSE

The purpose of this study was to evaluate the ability of different dual-energy CT (DECT) platforms to reduce peristalsis artifact in a bowel phantom.

METHOD AND MATERIALS

In a water filled cylinder we placed a z-direction 1.7 Hz oscillating air filled 3 cm diameter corrugated tube to simulate peristalsing bowel. We scanned the phantom at similar CTDIvol 5 times on each of four different DECT platforms: spectral-detector (SD), rapid-

kVp-switching (RS), split-filter (SF) and dual-source (DS) DECT. Material decomposition (iodine and virtual unenhanced (VUE)) and 120 kVp-like images were reconstructed. On 50 random slices for each scanner, both material decomposition images and 120 kVp-like images were rated for overall artifacts (4-Point Likert-scale: none (0), mild (1), moderate (2), severe (3)) on 50 random slices. The value of material decomposition images to assess pseudoenhancement was rated (reveals pseudoenhancement (0), no added value (1), falsely confirms true enhancement (2)). Comparisons between images and scanners were made using ANOVA with Bonferroni correction.

RESULTS

120kVp-equivalent images showed moderate to severe artifacts on all 4 DECT platforms, but were less severe for the DS (1.5±0.84) and SF (1.72±0.78) systems than for SD (2.56±0.73, $p<0.001$) and RS (2.52±0.65, $p<0.001$). Peristalsis artifacts were markedly reduced in iodine images for SD- (1.00±0.08, $p<0.001$) and RS-DECT (1.34±0.07, $p<0.001$), and were unchanged or worse on the VUE images. For DS and SF-DECT artifacts were more severe on both the iodine (2.36±0.14 & 2.6±0.09, respectively) and VUE images (2.38±0.14 & 2.62±0.09, respectively) ($p<0.001$ for each). Iodine images helped reveal true from pseudoenhancement on SL-detector and RS-DECT on all evaluated slices, but at DS and SF-DECT did not exclude pseudoenhancement.

CONCLUSION

DECT scanners reduce bowel peristalsis artifact. For SD and RS-DECT, iodine images minimize peristalsis artifact and reveals artificial hyperdensities as pseudoenhancement. For DS and SF-DECT, mixed 120 kVp-like images are preferred. Inter-scanner differences likely relate to geometry and postprocessing.

CLINICAL RELEVANCE/APPLICATION

Peristalsis artifact reduction is a valuable benefit of DECT, knowledge of scanner-type allows for selection of appropriate image reconstructions to minimize artifact and associated pseudoenhancement.

SSQ09

Genitourinary (Functional Renal Imaging)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S103CD

GI GU MR

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

Participants
Harriet C. Thoeny, MD, Bern, Switzerland (*Moderator*) Advisory Board, Guerbet SA
Hilton M. Leao Filho, MD, Sao Paulo, Brazil (*Moderator*) Nothing to Disclose

Sub-Events

SSQ09-01 T1ρ Mapping for Assessment of Fibrosis in Renal Allografts

Thursday, Nov. 29 10:30AM - 10:40AM Room: S103CD

Participants
Stefanie Hectors, PhD, New York, NY (*Presenter*) Nothing to Disclose
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Paul Kennedy, MSc,PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Sara Lewis, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To investigate the utility of T1ρ MRI for the assessment of fibrosis in renal allografts.

METHOD AND MATERIALS

T1ρ imaging was performed at 1.5T in 15 patients with stable functional allograft (M/F 9/6, mean age 56y) and 10 patients with chronic dysfunctional fibrotic allograft (M/F 4/6, mean age 50y). Repeatability of the T1ρ measurement, as determined by coefficient of variation (CV) measurements, was tested in 4 patients. Average T1ρ values in ROIs in the cortex and medulla were quantified. Differences in T1ρ values between the groups were assessed using Student t-tests. ROC analysis was employed to determine the diagnostic performance of T1ρ for differentiation between functional and fibrotic allografts. In 12 patients who had renal biopsy within one year of the MRI exam, quantitative analysis of Masson's trichrome stained sections was performed to determine collagen content. The correlation between T1ρ and Masson's trichrome stained fractions was assessed using Spearman correlation analysis.

RESULTS

T1ρ measurements were more repeatable in the cortex than in the medulla (mean CV T1ρ cortex 6.4%, medulla 14.6%). While T1ρ values were not significantly different between functional and fibrotic allografts in the medulla (T1ρ medulla functional 122.6±20.8 ms, fibrotic 128.0±16.9 ms, P=0.503), significant differences were observed in the cortex (T1ρ cortex functional 99.0±11.0 ms, fibrotic 113.3±17.6 ms, P=0.020). ROC analysis showed an AUC of 0.80 (sensitivity 80.0%, specificity 86.7%, T1ρ threshold 106.9 ms) for differentiation between functional and fibrotic allografts. Cortical T1ρ was significantly associated with Masson's trichrome stained fractions (r=0.629, P=0.032).

CONCLUSION

In this preliminary study, we observed significant elevation of cortical T1ρ in fibrotic renal transplants. The significant correlation between cortical T1ρ and Masson's trichrome stained fraction suggests a direct association of cortical T1ρ with collagen content.

CLINICAL RELEVANCE/APPLICATION

T1ρ may be a suitable MRI biomarker for noninvasive assessment of fibrosis in renal transplants.

SSQ09-02 T1-Mapping and Diffusion-Weighted Imaging for Evaluation of Chronic Renal Allograft Rejection in a Translational Mouse Model

Thursday, Nov. 29 10:40AM - 10:50AM Room: S103CD

Participants
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Faikah Gueler, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Katja Hueper, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Non-invasive assessment of renal pathology in a mouse model of chronic rejection after allogenic and isogenic kidney transplantation (ktx) using T1-mapping und diffusion-weighted imaging (DWI).

METHOD AND MATERIALS

Chronic rejection was induced by allogenic transplantation of BALB/c-kidneys into C57BL/6-mice with short ischemia times (n=13). Mice after isogenic ktx without rejection (n=8) and non-transplanted, healthy animals (n=22) served as control group. Using a 7T MRI system respiratory-gated DWI- (7 b-values, 0-800 s/mm2) and inversion recovery EPI-sequences (13 inversion times, 30-8000 ms) were acquired 3 and 6 weeks after ktx and in healthy controls. T1-relaxation times and apparent diffusion coefficients (ADCs) were calculated. Mean values and the heterogeneity of parameters within kidneys were determined using ROI- and histogram-based analysis. MRI results were compared to histopathological analysis of inflammation and fibrosis.

RESULTS

Chronic rejection after allogenic ktx was associated with a significant prolongation of T1-relexation time after 3 (1995 vs 1457 ms, p<0.001) and 6 weeks (1899 vs 1397 ms, p<0.001) compared to isogenic kidney grafts. Mean ADC after isogenic and allogenic ktx was similarly reduced compared to healthy controls (week 3: 1.27 and 1.41*10-3 mm2/s vs 1.61*10-3 mm2/s, week 6: 1.39 and 1.44*10-3 mm2/s vs 1.61*10-3 mm2/s). However, in the allogenic group, increased heterogeneity of ADC-values was observed compared to isogenic kidneys (standard derivation, entropy and interquartile range, p<0.001). In accordance with MRI results, only allogenic kidney grafts showed serve inflammation and graft fibrosis (p<0.001 vs controls and isogenic ktx).

CONCLUSION

T1-mapping und DWI enable assessment of renal pathologies in chronic renal allograft rejection. The combined quantitative assessment of mean values and data heterogeneity provides additional information on renal allograft pathology.

CLINICAL RELEVANCE/APPLICATION

Functional MRI allows assessment and monitoring of chronic renal allograft rejection. In patients, it may refine characterization of renal allograft pathology and help to improve patient management.

SSQ09-03 Multiparametric MRI of Renal Transplant: Preliminary Comparison of Advanced MRI Parameters in Renal Transplant Patients with Stable Allograft Function and Chronic Allograft Dysfunction with Established Fibrosis

Thursday, Nov. 29 10:50AM - 11:00AM Room: S103CD

Participants
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PURPOSE

The goal of our study is to develop a quantitative multiparametric MRI (mpMRI) protocol for the evaluation of renal transplant fibrosis.

METHOD AND MATERIALS

25 patients including 15 with functional renal allografts (M/F 9/6, mean age 55y, MDRD serum eGFR 47.6-87 ml/min/1.73m2) and 10 with chronic dysfunction and fibrosis (M/F 4/6, mean age 50y, eGFR 11.8-62.7 ml/min/1.73 m2, biopsy 150 ± 48 d before MRI) were enrolled in this prospective study. All patients underwent mpMRI at 1.5T (Aera, Siemens) including intravoxel-incoherent motion DWI (IVIM-DWI), diffusion tensor imaging (DTI), blood oxygen level dependent (BOLD) and T1 mapping. Parameters were measured from circular ROIs placed in the cortex (Cx) and medulla (Med) at the upper, middle and lower renal Tx poles. IVIM-DWI parameters (true diffusion D, pseudodiffusion D*, perfusion fraction PF) were obtained by Bayesian fitting. Corticomedullary differences [100 x (cortex-medulla)/cortex] in ADC (ΔADC), FA (ΔFA), R2* (ΔR2*), and T1 (ΔT1), were calculated. Banff scores ci for interstitial fibrosis (IF), ct for tubular atrophy (TA) and iIFTA for inflammation in area of IF/TA were evaluated by an expert renal pathologist on biopsies from 13 patients (stable/fibrosis 4/9).

RESULTS

Cx ADC (functional/fibrosis 2.10±0.14/1.90±0.15 10-3 mm2/s, p=0.006) and D (functional/fibrosis 1.78±0.16/1.65±0.18 10-3

Cx ADC (functional/fibrosis 2.10±0.14/1.90±0.15 10-3 mm2/s, p=0.006) and D (functional/fibrosis 1.78±0.16/1.65±0.18 10-3 mm2/s, p=0.033) as well as Med ADC (functional/fibrosis 2.07±0.11/1.90±0.13 10-3 mm2/s, p=0.006) were significantly decreased in fibrotic allografts. Cx T1 was significantly elevated (functional/fibrosis 1149.34±185.10/1354.53±226.8ms,p=0.038) and ΔT1 significantly decreased (-36.95±15.14/-11.52±14.62 %,p=0.0031) in fibrotic allografts. Cx D was negatively correlated with ci (Fig. 1; Spearman's r=-0.64, p=0.017), and T1 had a strong positive correlation to ct (Fig. 1; r=0.72, p=0.008).

CONCLUSION

Our study confirms earlier findings of decreased diffusion parameters and ΔT1 with renal allograft fibrosis. The negative correlation of true diffusion coefficient D with IF shows restricted water diffusion due to collagen deposition in fibrosis, while the positive correlation of T1 with the TA score shows prolonged T1 in the context of edema and inflammation associated with TA.

CLINICAL RELEVANCE/APPLICATION

IVIM-DWI and T1 parameters are sensitive to renal allograft fibrosis. The value of MRI metrics in combination for characterizing renal transplant fibrosis will be confirmed in a larger study.

SSQ09-04 High Renal Donor Visceral Adipose Tissue Predicts Decreased Donor Recovery of Function and Functional Decline

Thursday, Nov. 29 11:00AM - 11:10AM Room: S103CD

Participants
Ryan Ward, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
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PURPOSE

High donor Body Mass Index (BMI) has long been recognized as a risk factor for adverse outcomes in kidney donation. Recent data has shown a significant short-term decline in donor renal function in patients with an elevated visceral adipose tissue (VAT) to subcutaneous adipose tissue ratio on preoperative computerized tomography (CT). We evaluated the relationship between donor VAT with histologic changes in the renal allograft and mid-term renal function decline.

METHOD AND MATERIALS

VAT was measured on pre-donation CT scans at a single lumbar level in 210 donors from 2010 to 2015 using semiautomated segmentation (Terarecon). Kidney histology, obtained from implant biopsy during transplant, was available in 162 patients. Chronic histologic change was defined as the presence of at least 2 of the following 3 features: > 5% global glomerulosclerosis, interstitial fibrosis, or arteriosclerosis. The decline in renal function from pre-donation to 2 years post-donation was assessed using estimated glomerular filtration rate (eGFR) with paired T-testing, repeated measures analysis (MANOVA), and linear regression analyses.

RESULTS

Mean donor age was 42 and 60% were female. Mean BMI and VAT were 27±3 kg/m2 and 96±64 cm2, respectively. On univariate linear regression, there was a significant association between elevated VAT and decreased recovery of donor renal function, ($p < 0.0001$, Figure). On MANOVA, high VAT predicted decreased renal recovery at 1, 6, 12, and 24 months (p=0.03). Biopsies from donors with high VAT were more likely to have chronic histologic changes than donors with low VAT ($p < 0.001$). On univariate analyses both BMI and VAT were associated with chronic histologic change and decreased renal function recovery, however, on multivariate analyses VAT remained independently associated with both outcomes, while BMI did not.

CONCLUSION

Preoperative VAT appears to be a more significant indicator of renal decline in living donors than BMI. This is further evidenced by the chronic histologic changes seen in kidneys from donors with high VAT. Morphometrics, including the measurement of VAT, should be incorporated into the standard preoperative evaluation of potential kidney donors.

CLINICAL RELEVANCE/APPLICATION

Elevated preoperative VAT leads to decreased post-operative renal recovery and biopsy findings of chronic histological changes.

SSQ09-05 Preliminary Application of Incoherent Motion Diffusion Weighted Imaging (IVIM) in Renal Function Assessment of Diabetic Nephropathy

Thursday, Nov. 29 11:10AM - 11:20AM Room: S103CD

Participants
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Ming Zhang, Xian, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate renal function impairment in patients with diabetic nephropathy using IVIM technology.

METHOD AND MATERIALS

20 patients(average age 56.60±9.38)with clinically diagnosed diabetic nephropathy were enrolled as the observation group, and 20 healthy volunteers(57.60±6.08)as the control group. All diabetic nephropathy patients were enrolled according to laboratory tests of glomerular filtration rate (eGFR) before admission.The IVIM(b=0,50,100,150,200,400,600,800sec/mm²)and Diffusion weighted imaging(DWI,b=50,800 sec/mm²) sequence were obtained on a 3T scanner(Skyra, Siemens Healthineers). A total of 12 regions of interest were drawn for each subject in the cortex and medulla region of the upper pole, the renal hilum and the lower pole of the kidneys.The average value of all results is taken to ensure consistency of measurement results.ADC map was automatically generated on the Siemens MRWP workstation after DWI sequence executed. IVIM parameters(ADC,D,f and D* values) were generated by using a prototype software body diffusion toolbox(Siemens healthineers). A two-sample t-test was used to compare the difference in ADC,D, f, and D* values between the two groups of the cortex and medulla of the observation group and the control group. The Pearson correlation analysis was performed to determine the relationship between the ADC, D, f, and D* values in patients with diabetic nephropathy and eGFR.

RESULTS

In the two groups, the ADC, D, f, and D* values of the renal cortex were higher than that in medulla. Compared with the control group, the ADC, D, F, and D* values of the renal cortex and medulla in the observation group were all decreased, with statistical significance ($p<0.0001$) (Figure 1,Table 1).ADC,D,F and D* values in patients with diabetic nephropathy were positively correlated with glomerular filtration rate. ($p<0.0001$) (Figure 2).

CONCLUSION

IVIM is feasible in the examination of diabetic nephropathy. IVIM can supply useful information for kidney damage cause by diabetic nephropathy. Combined with the eGFR, the progress of diabetic nephropathy can be monitored.

CLINICAL RELEVANCE/APPLICATION

IVIM can help provide a more scientific basis for clinical changes in diabetic nephropathy, reflect the changes in microstructure, and have potential application value in the evaluation of renal function.

SSQ09-06 Magnetic Resonance Magnetization Transfer Imaging in Patients with Diabetic Nephropathy

Thursday, Nov. 29 11:20AM - 11:30AM Room: S103CD

Participants
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PURPOSE

Magnetization transfer(MT)technique used in the evaluation of renal function in patients with diabetic nephropathy.

METHOD AND MATERIALS

Two-kidney gradient echo sequence (GRE) imaging was performed on 40 subjects (including 20 patients with clinically diagnosed diabetic nephropathy and 20 healthy subjects) using Siemens Skyra 3.0 T MRI scanner. MT study was conducted using a 3D fast low angle shot(FLASH) sequence, this sequence was run two times; first one without a MT saturation pulse(MToff), second one with a MT(MTon) saturation pulse. For MT imaging postprocessing, MTR =(MToff-MTon)×100/MToff, MTR values were expressed in percentage units.The magnetization transfer rate (MTR) of the renal cortex and medulla was measured on the MT map of each subject using the region of interest method.Multiple regions of interest are drawn and averaged in the medullitary region of the upper kidney, renal hilum, and lower pole.A two-sample t-test was used for statistical analysis. The glomerular filtration rate (eGFR) for diabetic nephropathy patients was recorded and correlation between MTR and eGFR was analysed.

RESULTS

eGFR was significantly reduced in patients with diabetic nephropathy compared to healthy controls. The renal cortical MTR of the diabetic nephropathy group (824.15±77.45)%, was significantly higher than healthy control group(572.60±59.18)% ($P<0.0001$) (Figure 1,Table 1); there was no significant difference about renal medullar MTR between patient and normal groups. Pearson correlation analysis showed that there was a significant correlation between MTR and eGFR in renal cortex of diabetic nephropathy renal cortical($r=-0.880$, $P<0.0001$) (Figure 2).

CONCLUSION

Renal cortical MTR was higher in diabetic nephropathy patients than control subjects, and which has a certain correlation with eGFR.There was no significant change in the medulla MTR between patient and control groups.

CLINICAL RELEVANCE/APPLICATION

MT can provide non-invasive information about renal function, reflect the changes in microstructure.MTR may be a potential use as a observation index during clinical treatment.

SSQ09-07 DTI of the Kidney in Healthy Controls and in Patients with ARPKD

Thursday, Nov. 29 11:30AM - 11:40AM Room: S103CD

Participants

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PURPOSE

Diffusion tensor imaging (DTI) has the potential to quantitatively assess the microstructure and morphology of tissues, including kidney. Fractional anisotropy (FA) describes the degree of anisotropy reflecting the fiber density and axonal diameter. Autosomal recessive polycystic disease (ARPKD) causes displacement of coherent renal fiber orientation, which can potentially be measured using DTI. Our aim was to evaluate the feasibility of using DTI and its derived FA values to compare normal controls and patients with ARPKD.

METHOD AND MATERIALS

In this IRB-approved study, we evaluated the use of DTI to compare FA values in 'healthy' controls (patients with no history of renal disease) vs patients with ARPKD. A 20 direction DTI with b-values of b=0 and b=400 s/mm2 was used to acquire data in coronal direction using a fat-suppressed spin-echo echo-planar sequence (TR/TE 2600-3600/64-74 msec). A slice thickness of 4 mm, a matrix size of 128x96, acceleration factor of 2, and a bandwidth of 1698 Hz/pixel were used. For the DTI analysis and segmentation, Diffusion Toolkit version 0.6 and TrackVis version 0.6 were used. Tractography was reconstructed using a deterministic fiber tracking algorithm with a minimum FA threshold of 0.10 and a maximum turning angle of 55° between two adjacent voxels based on published parameters for renal tractography. TrackVis was used to draw ROI covering the entire volume of the renal parenchyma, excluding the collecting system by evaluating the anatomical images, ADC and FA maps. These images were used to avoid problems of alignment related to patient motion in-between sequences. The FA values based on the ROI data, and the mean length and volume of the tracks based on the fiber track data were exported.

RESULTS

14 healthy controls with no known history of renal disease (mean age = 9.5 years ± 3.7; 11/14 females; mean FA =0.47) and 8 patients with ARPKD (mean age = 15.5 years ± 4.7; 2/8 females; mean FA = 0.25) were included in the study. FA values were significantly lower in patients with ARPKD versus controls ($p<0.0001$) (Figure 1).

CONCLUSION

DTI was feasible and successfully performed on kidneys of patients with renal disease. Significantly lower FA values were observed in patients with ARPKD as compared to patients with normal renal function.

CLINICAL RELEVANCE/APPLICATION

DTI of the kidney offers a novel approach for detecting renal disease based on changes in diffusion anisotropy.

Honored Educators

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SSQ09-08 Magnetic Resonance T2 Mapping Derived Kidney Parenchyma T2 as a Novel Imaging Biomarker for Monitoring Disease Severity in Patients with Autosomal-Dominant Polycystic Kidney Disease (ADPKD)

Thursday, Nov. 29 11:40AM - 11:50AM Room: S103CD

Awards
Trainee Research Prize - Resident

Participants
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PURPOSE

To evaluate whether magnetic resonance T2 mapping of the kidneys can deliver novel and rapidly assessable quantitative imaging biomarkers for monitoring disease severity in patients with ADPKD.

METHOD AND MATERIALS

One-hundred forty-one ADPKD patients from the AD(H)PKD registry and 10 healthy controls underwent magnetic resonance imaging on a clinical 1.5T system. Height-adjusted total kidney volume (htTKV) was calculated on axial T2-weighted images using a standard post-processing platform. T2 mapping was acquired using a Gradient-Spin-Echo (GraSE) T2 mapping sequence covering both kidneys. Kidney cyst fraction and mean T2 relaxation times of both kidneys (kidney-T2) were calculated using a plugin for Osirix. For calculation of T2 times of the residual kidney parenchyma (parenchyma-T2), a region of interest (ROI) was manually placed at 3 distinct slices per kidney and results were averaged over all 6 ROIs. ADPKD patients were divided into 3 groups

according to kidney cyst fraction (<35%, 36-70%, >70%) as a surrogate marker for disease severity and Glomerular filtration rate (GFR) was recorded.

RESULTS

Calculation of parenchyma-T2 was 6- to 10-fold faster than calculation of htTKV and kidney-T2 (0.78 ± 0.14 vs. 4.78 ± 1.17 min., p<.001; 0.78 ± 0.14 vs. 7.59 ± 1.57 min., p<.001). Parenchyma-T2 showed a similar strong correlation to cyst fraction (r=0.77, p<.001) as kidney-T2 (r=0.76, p<.001) and allowed for the most distinct separation of patient groups divided according to cyst fraction (Fig. 1A). In contrast, htTKV showed an only moderate correlation to cyst fraction (r=0.48, p<.001) and did not allow for clear group separation (Fig. 1A). These observations were even clearer when considering only patients with preserved kidney function (GFR > 90 ml/min/m2; n=47; Fig. 1B) with similar correlations to cyst fraction (parenchyma-T2: r=0.81; kidney-T2: r=0.79; htTKV: r=0.48, p<.001 for all).

CONCLUSION

T2 mapping provides interesting novel parameters with potential to serve as quantitative imaging biomarkers in ADPKD. Especially the rapidly assessable parenchyma-T2 shows a strong association with disease severity and is far superior to the established imaging biomarker htTKV.

CLINICAL RELEVANCE/APPLICATION

Parenchyma-T2 has potential to serve as a novel imaging biomarker in ADPKD and should be examined in future studies with respect to its predictive value for disease progression.

SSQ09-09 Assessment of Renal Fibrosis in a Rat Model of Unilateral Ureteral Obstruction with Diffusion Kurtosis Imaging: Comparison with a-SMA Expression and 18F-FDG PET

Thursday, Nov. 29 11:50AM - 12:00PM Room: S103CD

Participants
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PURPOSE

To investigate the utility of diffusional kurtosis imaging (DKI) magnetic resonance imaging (MRI) in evaluation of renal fibrosis in rats with unilateral ureteral obstruction (UUO).

METHOD AND MATERIALS

Eighteen rats had UUO that was created by complete ligation of the left ureter and three normal rats without UUO were included as control. DKI was performed on a 3.0T MRI scanner before ligation and on days 1, 3, 5, and 7 after ligation. All rats then underwent 18F-fluorodeoxyglucose (FDG) dynamic positron emission tomography (PET) to evaluate metabolic activity in the kidneys, followed by histological analysis to examine a-smooth muscle actin (a-SMA) expression. DKI metrics were assessed among the time points and between both sides, and they were compared with renal function index standardized uptake value (SUV) and expression of the fibrosis marker a-SMA.

RESULTS

The axial kurtosis (Ka) on days 3 and 7, mean diffusivity (MD) on days 1 and 3, and fractional anisotropy (FA) on days 5 and 7 of cortex and medulla between the UUO sides and contralateral sides were significantly different. The medulla MD and FA of the UUO sides on days 1, 3, 5 and 7 were significantly lower than those of normal control group (all $P < .05$). FA of medulla was positively correlated with SUV ($r = 0.826$, $P < .001$), and MD of cortex was negatively correlated with a-SMA expression on the UUO sides ($r = -0.661$, $P = .002$).

CONCLUSION

DKI shows high potential in noninvasive assessment of renal fibrosis induced by UUO.

CLINICAL RELEVANCE/APPLICATION

DKI metrics may be useful noninvasive biomarkers for monitoring the severity of renal fibrosis in patients with chronic kidney disease.

SSQ10

Genitourinary (New Techniques in Prostate Imaging and Intervention)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S102CD

GU MR

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

Participants
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Aradhana M. Venkatesan, MD, Houston, TX (*Moderator*) Research Grant, Canon Medical Systems Corporation;

Sub-Events

SSQ10-01 Machine Learning and Radiomics Applied to Multiparametric MR in the Prediction of Prostate Pathology in PI-RADS 3/5 Patients

Thursday, Nov. 29 10:30AM - 10:40AM Room: S102CD

Participants
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PURPOSE

The purpose of this study is to assess the clinical relevance of focal prostate lesions complementing the PI-RADS scoring method using a Radiomic approach and machine learning systems.

METHOD AND MATERIALS

94 patients with a Contrast Enhanced (CE) multiparametric prostate MR (mpMR) and lesions covering all the PI-RADS score range were collected from the hospital archive. For all the lesions a confirmative biopsy was available. 23 out of 94 patients with PI-RADS score 3/5 (7 malignant and 16 benign) were selected form preliminary tests. PI-RADS score 3/5 represents an intermediate condition associated to diagnostic uncertainty. In this pilot study the analysis was limited to T2 weighted (T2w) and CE sequences. Parametric maps were calculated from CE sequences to spatially characterize the wash in/wash out curves. 700 imaging features were extracted using the PyRadiomics platform from T2w images and parametric maps. Shape, texture and intensity based features were calculated. Using a genetic search method the most discriminating subsets of features were identified using four ML systems: linear discriminant analysis (LDA), k-nearest neighbour (kNN), naive Bayes classifier (NB) and C4.5 decision tree. Classification accuracy was evaluated by 5 fold cross-validation.

RESULTS

LDA showed the best performances with 100% sensitivity and 94% specificity. KNN, ND and C4.5 provided 86%, 86% and 71% sensitivity and 100% specificity. Selected features derived both from T2w images and from parametric maps. In particular average and maximum enhancement maps and time-to-peak maps seems to provide the most useful information.

CONCLUSION

Preliminary analysis limited to patients with PI-RADS 3/5 score (n=23) showed promising results, encouraging further development of a Radiomic approach complementing the PI-RADS scoring method.

CLINICAL RELEVANCE/APPLICATION

The identification of malignancy within suspicious prostatic lesions classified by the proposed mpMR radiomic approach can improve the diagnostic workflow while minimizing procedure invasiveness.

SSQ10-03 Manual Versus Robotic Assisted MRI Guided Prostate Biopsies

Thursday, Nov. 29 10:50AM - 11:00AM Room: S102CD

Participants
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PURPOSE

To compare the procedure time and the percentage of positive samples per prostate cancer (PC) patient between manual and robotic in-bore MR guided prostate biopsy (MR-PB).

METHOD AND MATERIALS

All consecutive in-bore MR-PB performed in our Institution between January 2015 and March 2018 using either a manual or robotic device were retrospectively analyzed and grouped as follows: Group 1, the first 30 consecutive MR-PBs using a manual device (n=30); Group 2, the last 30 MR-PBs performed using the manual device after 2 years of experience (n=30); Group 3, the first 27 biopsies using a robotic device (n=27). The same 1.5 T MRI scanner was used for all MR-PBs. For each of the three groups, we calculated the overall procedure time, time to first biopsy and time for every additional sample, as well as the percentage of positive cores in patients who were diagnosed with PC.

RESULTS

Average overall procedure time was 57.5min (Interquartile range -IQR-: 47-63.5min; Group 1), 37.7min (IQR:31-43min; Group 2) and 31.1min (IQR:27.3-35min; Group 3); average time to first biopsy was respectively 29.4min, 22.5min and 26.5min; average time for every additional sample was 9.5min, 4.9min and 3.8min. 12 patients were positive for PC in Group 1 (average core involvement 44.6%), 19 in Group 2 (average core involvement 52.3%) and 16 in Group 3 (average core involvement 52.1%), with a percentage of positive cores per PC patient of 76.31%, 73.7% and 83.8%, respectively.

CONCLUSION

MR-PB using a robotic device decreased procedure time and increased the percentage of positive cores per PC patient. This has the potential to improve patient comfort as well as PC characterization in clinical practice.

CLINICAL RELEVANCE/APPLICATION

Robotic devices for in-bore MR guided prostate biopsy decrease the procedure time and increase accuracy of samples, thus facilitating its application in clinical routine.

SSQ10-04 Free-Hand Transperineal MRI/US Fusion-Guided Targeted Biopsy with Virtual Navigation Platform in the Diagnosis of Clinically Significant Prostate Cancer: Preliminary Experience

Thursday, Nov. 29 11:00AM - 11:10AM Room: S102CD

Participants
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PURPOSE

Free-hand transperineal MRI/US fusion-guided targeted biopsy (fhTFTB) is a promising technique that may reduce biopsy core's number, possible complications and overdiagnosis/overtreatment. The aim of this study was to evaluate the impact of fhTFTB with virtual navigation platform in the diagnosis of clinically significant prostate cancer (csPCa).

METHOD AND MATERIALS

We retrospectively selected 68 patients with a positive MRI result (PIRADS v2 score >=3) who underwent fhTFTB, from 160 prostate multiparametric MRI performed for suspicious PSA levels. fhTFTB included 3-4 targeted cores for each lesion plus at least 8 random cores and was performed under local anesthesia.

RESULTS

Overall biopsy detection rate (DR) was 63% and the Gleason Score (GS) was >=7 in 47% (32/68). In all patients with a positive histopathological report, PCa was detected in at least one of the targeted cores and in one or more random cores in 13/43 patients (30%). PCa was identified in 41/52 patients with a PIRADS score >=4, so the DR was 79% in PIRADS 4 patients, 100% (16/16) in PIRADS 5 and 12,5% (2/16) in PIRADS 3. Among the PIRADS 5 patients the 93,8% of them had a csPCa, followed by the 44% and the 6% in those with a PIRADS score of 4 and of 3, respectively. Overall, the 60% of patients with a csPCa had a PIRADS score >=4. 30/68 patients had anteriorly located lesions on MRI, the 70% (21/30) of them had a positive histopathologic report. No major complications were noted. Overall mean biopsy time was 40 minutes.

CONCLUSION

In our experience, fhTFTB with virtual navigation platform is a valid tool in the diagnosis of csPCa. Thus, biopsy technique is fast, safe and cost effective. Moreover, a transperineal approach provides an accurate sampling of anteriorly located prostate lesions. A follow-up is necessary in patients with a negative histopathological report.

CLINICAL RELEVANCE/APPLICATION

Free-hand transperineal MRI/US fusion-guided targeted biopsy with virtual navigation platform is a fast, safe and cost-effective technique for the diagnosis of clinically significant prostate cancer.

SSQ10-05 Interreader Variability of Radiologists in Segmentation of the Prostate and Its Anatomic Zones: How Good Does Artificial Intelligence Have to Become?

Thursday, Nov. 29 11:10AM - 11:20AM Room: S102CD

Participants
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PURPOSE

To investigate interreader variability of radiologists in segmenting prostatic contours and anatomical zones of the prostate on prostate MRI and compare it to published accuracy metrics of segmentation algorithms in the machine learning literature.

METHOD AND MATERIALS

In a retrospective search, we collected 67 patients who had undergone prostate MRI for workup of suspected prostate cancer at our institution. Three board certified radiologists with extensive experience in multiparametric prostate MRI segmented the prostate into two distinct zones: Peripheral (PZ) and transitional zone (TZ). The central zone and AFMS were counted as transitional zone. Furthermore, the seminal vesicles (SV) were segmented. We used the open-source software ITK-snap for segmentation. Interreader variability/congruence of segmentations was assessed with the dice coefficient. For the descriptive statistics, median and interquartile range (IQR = 1st-3rd quartile) were computed.

RESULTS

Highest agreement was found for the TZ with a median dice coefficient of 0.85 (IQR: 0.80-0.89), 0.85 (0.81-0.89) and 0.85 (0.80-0.89). The dice coefficients for the SV were 0.81 (0.75 - 0.85), 0.77 (0.72-0.82) and 0.76 (0.70-0.84). For the the PZ, the Dice coefficients were 0.77 (0.71-0.81), 0.75 (0.70-0.79) and 0.74 (0.69 - 0.79). Variability was low when considering all structures with dice coefficients of 0.89 (0.86-0.91), 0.88 (0.85-0.90) and 0.87 (0.86-0.91).

CONCLUSION

There is considerable variability in expert segmentation of the prostate into its anatomic zones. Variability between different lies within or slightly below published performance of state-of-the-art algorithms in methods using artificial intelligence.

CLINICAL RELEVANCE/APPLICATION

Physicians treating men with prostate cancer by means of focal therapy should be aware that there is a small but considerable variability in segmentation of the prostate even if performed by expert radiologists. Future machine learning research should focus on robustness rather than achieving 'perfect' accuracy for segmentation.

SSQ10-06 Magnetic Resonance Elastography of the Prostate: Feasibility of Using High-Frequency Transurethral Vibrations.

Thursday, Nov. 29 11:20AM - 11:30AM Room: S102CD

Participants
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PURPOSE

To demonstrate the feasibility and diagnostic value of magnetic resonance elastography (MRE) in evaluating prostate disease using high-frequency transurethral vibrations.

METHOD AND MATERIALS

Following ethics committee approval with a waived informed consent requirement, 23 patients were enrolled in this study. The patients had a silicone urinary catheter in place and underwent prostate MRE with 60-, 90-, 120-, 150-, and 200-Hz vibration frequencies using a transurethral driver developed at Mayo Clinic. These patients were divided into three groups: 12 patients with benign prostatic hyperplasia (BPH), 5 with clinically significant prostate cancer (PCa) and 6 with prostatitis. The success of prostate MRE was defined as having visually detectable wave propagation in the prostate. The MRE-processing confidence map was used to summarize the MRE image quality. The stiffness of the prostate was recorded. The MRE confidence and stiffness were compared across the different frequencies. Receiver operating characteristic (ROC) analysis was performed to assess the diagnostic performance for detecting clinically significant PCa.

RESULTS

From 60 to 150 Hz, all MRE acquisitions with the transurethral driver were successful, but 13 cases failed at 200 Hz (Figure 1). The confidence values were significantly lower at 60 and 90 Hz than at 120 and 150Hz (all pairs $P<0.001$). The stiffness of clinically significant PCa was significantly higher than the peripheral zone (PZ) of BPH at each frequency, and higher than prostatitis and the

central gland (CG) of BPH at 90 and 120 Hz (all $P<0.05$). The sensitivity, specificity and accuracy for differentiating PCa from other tissues are shown in Table 1.

CONCLUSION

Prostate MRE using a transurethral driver had a 100% success rate in this study using vibration frequencies of 60-150 Hz, however image quality is better at higher frequencies (120, 150Hz). Prostate MRE may have the potential to differentiate PCa from BPH and prostatitis at these higher frequencies. Additional studies are warranted to investigate its utility.

CLINICAL RELEVANCE/APPLICATION

This study presents a potentially new approach for performing prostate MRE with high resolution using a transurethral driver at high vibration frequencies.

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/ Sudhakar K. Venkatesh, MD, FRCR - 2017 Honored EducatorRichard L. Ehman, MD - 2016 Honored Educator

SSQ10-08 To Evaluate the Role of Gallium-68 PSMA PET/CT Scan For Prostate Cancer

Thursday, Nov. 29 11:40AM - 11:50AM Room: S102CD

Participants
Sikandar M. Shaikh, DMRD, Hyderabad, India (*Presenter*) Nothing to Disclose

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PURPOSE

Prostate cancer is one of the commonest biologically and clinically a heterogeneous disease in males which has varied diagnostic challenges. The biggest challenge in this is to detect recurrent disease. Biochemical response using Prostate Specific Antigen (PSA) and various imaging modalities including F FDG PET-CT has limited role as most of them have poor sensitivity and specificity. Thus we evaluated the role of Ga68-PSMA (Prostate Specific Membrane Antigen) imaging in prostate cancer, which is a new PET tracer.

METHOD AND MATERIALS

We evaluated Ga68-PSMA PET scans of 65 patients with diagnosed prostate cancer. Whole body PET-CT was done after injecting Ga68-PSMA for either staging or re staging to evaluate the response to therapy.

RESULTS

65 PSMA scans were performed initially . Ga68-PSMA scan showed more number of areas involved by extra-prostatic disease in 53.2% of cases when done at baseline before commencing any treatment. The sensitivity of Ga68-PSMA at baseline when compared with histopathological diagnosis was 95% with 95% CI ranging from 86% to 98%. The positive predictive value was high at 98% with 95% CI ranging from 91% to 99%. In 7 (12%) patients who underwent surgical management post therapy Ga68-PSMA scan was able to detect disease progression / post surgical relapse in 100% of cases. The outcome of post surgical prostate cancer was compared with other cases where surgery was not done. In those who did not surgery due to higher staging these cases showed better response by hormone therapy (p 61; 0.03) and radiotherapy (p 61; 0.01) on Ga68-PSMA. The sensitivity of Ga68-PSMA response with biochemical response was 66.7% with 95% CI ranging between 46 %- 82.7%. Ga68-PSMA response did not correlate with biochemical response.

CONCLUSION

Thus Ga68-PSMA has very good sensitivity for diagnosis, staging, restaging, evaluation of therapy response and prognostication in prostate cancer.

CLINICAL RELEVANCE/APPLICATION

Thus PET-CT PSMA has very high sensitivity as compared with F FDG PET-CT.

SSQ10-09 Technique and First Results: Targeted MRI and [68Ga]-PSMA PET/MRI Ultrasound Fusion-Guided Transperineal Prostate Biopsies

Thursday, Nov. 29 11:50AM - 12:00PM Room: S102CD

Participants
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PURPOSE

The aim of this study was to examine whether patients with elevated PSA-levels benefit from targeted MRI and [68Ga]-PSMA PET/MRI ultrasound fusion-guided biopsies, compared to systematic saturation biopsy.

METHOD AND MATERIALS

This retrospective study evaluated 219 patients with increased PSA-level (median PSA 8.3ng/ml) examined according to a multiparametric prostate protocol on a 3T MR-scanner (PI-RADSvs2). Additionally, 23 patients were examined on an integrated 3T PET/MRI-scanner. [68Ga]-PSMA-11 PET/MR-images were assessed for major functional (SUVmax) and for morphological variables (e.g.lesion delineation, diffusion restriction). All patients underwent systematic transperineal prostate biopsy and targeted MRI biopsy using rigid image-fusion (MiM software, USA) in case of PI-RADS 3-5 lesions (median 26 systematic cores and 9 targeted cores). Detection rates for prostate cancer (WHO grading system) of MRI and [68Ga]-PSMA-11 PET/MRI targeted ultrasound fusion-guided biopsies were compared to systematic transperineal saturation prostatic biopsy.

RESULTS

Altogether 5979 systematic cores, 1407 MRI-targeted cores and 217 PET/MRI-targeted cores were obtained. Per core targeted MRI ultrasound fusion-guided biopsy (35%, positive target lesions 247/716) and [68Ga]-PSMA PET/MRI ultrasound fusion-guided biopsy (48.5%, positive target lesions 49/101) showed a significantly higher detection rate of prostate cancer than non-targeted systematic biopsies (17.5%, positive systematic cores 492/2800). Altogether 2287 systematic biopsy cores revealed no atypical proliferation compared to 726 MRI- and PET/MRI-targeted cores. In the saturation prostatic biopsy histological grading was distributed as follows: grade groups (1) 15.7%; (2) 32.7%; (3) 14.3%; (4) 5.8% and (5) 2.5%. MRI- and PET/MRI-targeted biopsies identified clinically significant prostate cancer with following histological distribution: grade groups (1) 19.7%; (2) 30.1%; (3) 14.8%; (4) 6.6% and (5) 9.5%.

CONCLUSION

The [68Ga]-PSMA PET/MRI ultrasound fusion-guided biopsy is a promising technique for histological tissue verification. It contributes to accurate prostatic biopsies at a considerably lower level of biopsy tissue cores.

CLINICAL RELEVANCE/APPLICATION

Patients with elevated PSA-levels may benefit from targeted MRI- and PET/MRI ultrasound fusion-guided biopsy by a lower biopsy strain and at the same time by a higher confidence for targeting clinical significant prostate cancer.

SSQ11

Informatics (Reporting, Education Decision Support)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S103AB

ED IN

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

Participants
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Sub-Events

SSQ11-01 Development of a Structured Reporting System to Automate-RADS Schema

Thursday, Nov. 29 10:30AM - 10:40AM Room: S103AB

Participants
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CONCLUSION

Structured reporting provides a means to prompt radiologists to record essential information to describe disease processes, and when applicable, automate the determination of -RADS assessment categories.

Background

With the success of BI-RADS for improving mammography report quality, there has been a proliferation of other -RADS schema including C-RADS, CAD-RADS, HI-RADS, LI-RADS, Lung-RADS, NI-RADS, PI-RADS, and TI-RADS. Unless a radiologist is well-versed in one of these practice areas, it is often difficult to recall the details of a particular -RADS schema. We have developed a structured reporting system that prompts a radiologist to record salient disease features, and when applicable, automate the determination of the appropriate -RADS assessment category based on the recorded disease features.

Evaluation

We developed a structured reporting system that captures key images and verbal descriptions of image findings, tags the finding with metadata describing the anatomical location and radiological finding using natural language processing, and assembles a multimedia report. When a particular finding is recorded (e.g., lung nodule or colon polyp), the system prompts the radiologist with menus to record certain disease features. If the radiologist mentions the features in the dictation, the system will automatically populate the appropriate fields using natural language processing. If the radiologist fails to mention particular features, the radiologist can then select them from the menu display. Upon completion of data entry, the system automatically calculates the appropriate -RADS assessment category based on the anatomy and findings for inclusion in the Impression section of the structured report.

Discussion

The various -RADS schema are intended to improve the content and clarity of radiology reporting, especially for the communication of suspicious findings during screening examinations. However, these schema are difficult to recall for most radiologists unfamiliar with the details of how they are implemented. We demonstrate that a structured reporting system that records discrete features of disease can be used to automate the determination of the appropriate -RADS assessment category.

SSQ11-02 The MESH Incubator: Accelerating Core Competency in Technological Innovation, Artificial Intelligence, and Design Thinking in Radiology Training

Thursday, Nov. 29 10:40AM - 10:50AM Room: S103AB

Participants
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CONCLUSION

The MESH Incubator and MESH Core Innovation Design Curriculum rotation demonstrates that education in technological innovation, informatics, and artificial intelligence is in high-demand by radiology trainees.

Background

Radiology lacks core competency training in the basic tenants of innovation. This includes but is not limited to training in idea generation and validation, artificial intelligence and informatics, device and software prototyping, intellectual property, and entrepreneurship. To elevate radiology's position as a value-player in the evolving healthcare reimbursement landscape landscape, we must train our residents, fellows, and staff in these fundamental competencies.

Evaluation

The Medically Engineered Solutions in Healthcare (MESH™) Incubator was created at an academic radiology training program. MESH is a novel innovation center initially composed a physical invention workshop integrated in the clinical reading room and an innovator lecture series to foster industry alliances. At the one-year point, we conducted a Likert survey of current radiology residents, building on prior feedback. Key metrics revealed that 100% had little or no idea how to develop and idea from bedside to prototype, 95% had little or no understanding of 3-D printing and its clinical use in radiology, and 50% planned to be involved in a startup in the future. Notably, 75% agreed or strongly agreed that core competency in technological innovation should be part of the residency curriculum. Based on this feedback, a novel resident rotation in technological innovation, artificial intelligence, and informatics was designed. Qualitative and quantitative performance measures were collected.

Discussion

The MESH Core Innovation Design Curriculum is the first core curriculum in technological innovation in any residency program. MESH also includes a technological prototyping workshop and lecture series to foster product creation, intellectual property licensing, and industry collaboration. Our data demonstrates a clear desire by our trainees to institute core competency in technological innovation as part of the radiology training.

SSQ11-03 Medical Students' Attitude Towards Artificial Intelligence: A Multicenter Survey

Thursday, Nov. 29 10:50AM - 11:00AM Room: S103AB

Participants
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PURPOSE

Artificial intelligence (AI) and deep learning have recently gathered a lot of attention in radiology. Some senior radiologists describe being approached by students asking whether choosing radiology training could be a mistake considering that algorithms could potentially take over the task of interpreting images. However, apart from anecdotal episodes little is known about how students feel with respect to AI and deep learning in radiology and medicine.The aim of this study was therefore to perform a questionnaire-based survey amongst students and to assess their attitude towards these topics.

METHOD AND MATERIALS

A questionnaire was designed and implemented in SurveyMonkey (Surveymonkey, Portland, Ore). The questionnaire consisted of various parts (demographics, self-assessment, potential application of artificial intelligence in radiology, attitude towards artificial intelligence in radiology and medicine in general). A corresponding link was sent out via email to students of three major medical schools.

RESULTS

A total of 263 students responded (166 female, 94 male, median age 23 years). Around half (52.8%) were aware that AI is being discussed in radiology, but only around one third (30.8%) stated that they had a basic understanding of the technologies involved.The majority of students agreed that AI could be able to detect pathologies in imaging exams (83.7%) but only around half agreed that it would be able to automatically make a diagnosis (56.7%).While the majority was convinced that AI will revolutionize radiology and medicine in general (77.2% and 73%), they were confident that radiologists and physicians will not be replaced in the foreseeable future (82.9% and 96.6%). There was strong agreement that the use of AI will lead to improvement in care (85.5% and 83.6%).Most respondents agreed on the need of AI being included in medical training (70.1%).

CONCLUSION

Contrary to the what could have been expected, medical students are quite aware of the potential of AI in radiology and medicine but do not expect radiologists or physicians to be replaced in the foreseeable future. Basic principles of AI and computer science should be included in medical curricula.

CLINICAL RELEVANCE/APPLICATION

As one of the first subspecialties to broadly discuss the impact of artificial intelligence on medicine, radiology should take the lead in educating students on these emerging technologies.

SSQ11-04 Thyroid Nodule Biopsy: A Novel Mobile Phone App to Facilitate and Standardize the Decision Making Process

Thursday, Nov. 29 11:00AM - 11:10AM Room: S103AB

Participants
Ailbhe M. McDermott, MD,PhD, Galway, Ireland (*Presenter*) Nothing to Disclose
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CONCLUSION

This study presents a novel mobile phone App which simplifies and standardizes real-time decision making on when to proceed with thyroid nodule FNAC, providing the clinican with a user-friendly tool to assess thyroid nodules and provide guideline supported clinical practice.

Background

Thyroid nodules are prevalent and demonstrate a wide spectrum of sonographic characteristics. No single feature is pathognomonic of malignancy. The decision on when to proceed to fine needle aspiration cytology (FNAC) is not clear-cut, and is facilitated by a large number of international guidelines which mostly use a pattern-orientated approach. As such, they are difficult to apply in real-time in the clinical setting and can lead to interuser variation.We introduce a novel locally-derived mobile phone application ('App') to streamline this process.

Evaluation

We present an App which guides the user through the evaluation of a thyroid nodule using multiple parameters with pictorial examples (including consistency, heterogeneity, edge, margin, halo, echogenicity, vascularity and calcification) which feature in the risk stratification process of international guidelines (ACR-TIRADS, ATA 2016, ASRU 2005, AACE 2016, BTA 2014, Kim 2002, Korean 2016, Zayadeen 2016, Sanchez 2014, Russ 2011, EU-TIRADS 2017 and Kwak 2011). On completion of nodule assessment, a summary table provides the recommendation (in Yes/No format) of the international guidelines on whether to proceed with cytological sampling. An overall consensus recommendation is also provided. A worked through sample case would be presented to demonstrate the App in use, and highlight it's ease and swiftness of use.

Discussion

Numerous international guidelines, each with their strengths and limitations, have attempted to simply the decision making process on when to perform thyroid nodule biopsy. This novel App both simplifies and standardizes this process, providing the user with guideline supported practice that limits unnessary sampling of benign nodules without missing biologically active malignancy.

SSQ11-05 Advancing Interoperability of Image Annotations: Automated Conversion of Image Annotations in PACS to the Annotation and Image Markup Format for Longitudinal Lesion Tracking

Thursday, Nov. 29 11:10AM - 11:20AM Room: S103AB

Participants
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Daniel L. Rubin, MD, MS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

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CONCLUSION

As quantitative imaging becomes more prevalent in radiology, interoperability of image annotations gains increasing importance. Our work provides a mechanism to leverage image annotations in vendor systems and utilize it in automated lesion tracking. Our approach may facilitate large-scale analysis of image annotations and aid in the generation of high-quality labels for deep learning.

Background

Sharing radiologic image annotations among multiple institutions is important in many clinical scenarios such as tracking cancer lesions; however, interoperability is prevented because different vendors' PACS store annotations in non-standardized, proprietary formats. Interoperability of image annotations is also crucial for data sharing efforts such as the RSNA Image Share initiative and for mining training data for deep learning efforts. Our goal was to develop software to automate conversion of image annotations in a commercial PACS to the Annotation and Image Markup (AIM) standardized format and match lesion measurements across timepoints to enable lesion tracking.

Evaluation

Utilizing the Pixelmed toolkit for DICOM and AIM application programming interface (API), we created software in Java to parse the DICOM presentation state (DPS) objects for imaging studies exported from a commercial PACS (GE Centricity v3.x). Our software

identifies line annotations encoded within the DPS objects and exports the annotations in the AIM format. A separate Python script processes the AIM annotation files to match line measurements (lesions) across timepoints by tracking the 3D coordinates of annotated lesions. To validate the interoperability of our approach, we exported annotations from Centricity PACS into ePAD (http://epad.stanford.edu), a freely available AIM-compliant workstation, and the lesion measurement annotations were correctly matched across timepoints.

Discussion

Our work demonstrates that proprietary image annotations in a vendor system can be automatically converted to a standardized metadata format such as AIM, enabling interoperability and automated lesion matching across timepoints. Conversion of AIM to DICOM-SR is also possible. This effort could be extended for use with other vendors' PACS.

Honored Educators

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SSQ11-06 Determining the Need for CT Intravenous Contrast from Free-Text Clinical History Using Natural Language Processing

Thursday, Nov. 29 11:20AM - 11:30AM Room: S103AB

Participants
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Scott B. Werwath, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
Youngho Seo, PhD, San Francisco, CA (*Abstract Co-Author*) Consultant, BioLaurus, Inc
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Jae Ho Sohn, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

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CONCLUSION

We demonstrate that a linear SVM classifier with TF-IDF on bag-of-words embeddings can predict the need for intravenous contrast for CT examinations with high accuracy.

Background

Incorrect ordering of CT contrast by clinicians leads to unnecessary communication between radiologists and clinicians. An automated tool for determining contrast assignment would reduce incorrect contrast ordering and increase workflow efficiency. We developed a natural language processing (NLP) model to predict whether intravenous contrast is needed for various CT examinations, based on free-text clinical history provided by requesting physicians.

Evaluation

We extracted 15,456 reports of CT studies from a single institution. A radiologist labeled each unique study type with ground truth label of whether the study was a contrast enhanced one or not. For each report, the clinical history was extracted and preprocessed using word normalization, negation detection with NegEx, stopword removal, and replacement of synonyms using RadLex. The dataset was then split into 80% training and 20% test sets. We trained a text classification model with a linear support vector machine (SVM) classifier on term frequency - inverse document frequency (TF-IDF) vectors constructed from bag-of-words representations of the clinical history. The test set consisted of 2,767 clinical histories with corresponding ground truth label of CT contrast assignments. Various accuracy measures of the machine learning classifier were reported.

Discussion

The model achieved an AUC value of 0.89 on the ROC space, an F1 score 0.86 along with 81% recall, and 90% precision. Most important words for contrast studies were 'PE, abscess' while for no contrast studies were 'low dose, fall' (Figure 1). Data visualization with latent semantic analysis confirmed adequate separation of contrast vs no contrast categories. Error analysis by clinical radiologist revealed that the most important and inherent limitation of the prediction was due to inadequacy of provided clinical history (e.g. 'pain' as clinical history).

SSQ11-07 Biomarker Assessment Tool for Evaluation of Treatment Response

Thursday, Nov. 29 11:30AM - 11:40AM Room: S103AB

Participants
Emel Alkim, Stanford, CA (*Presenter*) Nothing to Disclose
Sheryl John, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Cavit Altindag, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Rubin, MD, MS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

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CONCLUSION

Assessing the treatment response is important for decision making in clinical trials and tools are needed to automate computation and comparison of different imaging biomarkers of response. Our plugin to ePAD permits computing and comparing imaging biomarkers for assessing treatment response.

Background

Imaging biomarkers are key indicators of the response of cancer to treatment. Although tumor size is the most commonly used biomarker that is used in criteria such as RECIST, it is recognized that simple linear measures are limited, and there is great interest in acquiring data to validate the utility of new imaging biomarkers. Our objective is to develop tools to streamline capturing these data in large scale as part of routine workflow of viewing and evaluating cancer images.

Evaluation

The electronic Physician Annotation Device (ePAD) is a web-based quantitative imaging platform that allows researchers to view and annotate radiological images, and it is extensible through a plugin mechanism. We developed an image annotation and analysis plugin for ePAD that computes image biomarker assessments in longitudinal imaging studies and analyzes and compares treatment response based on those image biomarkers by producing waterfall plots of cohort-based response. We evaluated our plugin by collecting 8199 annotations in ePAD from 419 cancer patients who had one baseline and several follow up CT scans. Our plugin generated waterfall plots using longitudinal measurement (RECIST criteria) and standard deviation of pixel intensity as an alternative biomarker. The output plots produced by our ePAD plugin permits comparing different imaging biomarkers in terms of effectiveness in showing treatment response (see Figure 1).

Discussion

Our ePAD plugin permits automated summary of the response of patient cohorts to treatment (see Figure 1) as well as comparing response based on using different imaging biomarkers of response. It may thus give valuable insight to the effectiveness of different imaging biomarkers for use in clinical trials. The charts can also be exported easily to be used in radiology reports.

Honored Educators

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SSQ11-08 Natural Language Processing for Automated Radiology Pathology Correlation of PIRADS and TIRADS Lesions

Thursday, Nov. 29 11:40AM - 11:50AM Room: S103AB

Participants
Geoffrey D. McWilliams, DO, Sacramento, CA (*Presenter*) Nothing to Disclose
Thomas W. Loehfelm, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Using NLP and structured reporting, radiology and pathology report data can be mined to automate performance outcome tracking.

Background

Structured reporting systems convey estimates of malignancy risk for thyroid nodules (TIRADS) and prostate lesions (PIRADS). There is no automated system to track biopsy yield and link those results back to the structured radiological estimate. Such a tool would be invaluable for individual and group-level performance metrics. We describe a method involving natural language processing (NLP) to extract malignancy risk estimates from radiology reports and cancer diagnoses from pathology reports.

Evaluation

Using cTAKES, an open-source NLP tool for clinical text, we analyzed more than 120,000 radiology and pathology reports, sampled from the previous 5 years at our institution. We first segmented the reports using regular expressions. Then with NLP, we identified unique anatomic concepts referring to prostate and thyroid tissue by mining them from the "specimen" section of pathology reports. Next, from the "diagnosis" section of the pathology reports, we mined unique disease/disorder concepts which referred to clinically significant malignancy. We then extracted PIRADS and TIRADS classifications from structured radiology reports using basic RegEx pattern matching.From these sets of annotations, we can correlate the radiologist's estimate of malignancy with the biopsy or resection rate, and with rate of malignancy detection. This information is provided in an easy to use dashboard that provides radiologists with automated feedback on their diagnostic accuracy, including anonymous comparisons with their peers.

Discussion

This system makes performance outcomes easily trackable by radiologists. We expect that by providing radiologists with feedback on pathology outcomes from their diagnoses, radiologists will ultimately improve their performance. We plan to expand this system to other risk stratification systems (e.g. BIRADS, LIRADS), and eventually to all diagnostic reports by linking pathology specimens to anatomic terms and organ-specific disease entities used in radiology reports.

SSQ11-09 RapRad: Validation of an E-Learning Platform with Gamification, Rapid Case Reading, and Instant Gratification

Thursday, Nov. 29 11:50AM - 12:00PM Room: S103AB

Participants
David J. Winkel, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose
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PURPOSE

The rise of social media with seemingly shorter attention span prompts e-Learning platforms to motivate and engage users during participation. The purpose of this study was to validate a new e-Learning concept featuring gamification elements, rapid case

reading, a large case number and instant feedback.

METHOD AND MATERIALS

An e-Learning concept was devised offering various game levels, blocks of questions to be read in rapid succession with instant feedback, health/experience points to be gained/lost and player level-up, if successful. The first version focusses on training pneumothorax detection in 321 cases. The user's task is to locate the pneumothorax, if present, on chest x-rays by mouse click; receives instant feedback per case. The levels were designed as follows: entry test (n=15), three training levels with increasing difficulty and a final test (n=30; 15 entry test + 15 new cases). 126 participants (medical students, 1st-year radiology residents and technicians) were invited to participate via e-Mail and asked to fill in a survey before and after playing the game.

RESULTS

59 participants responded to the first survey and finished the game (47%), while 29 of these responded to the second survey after completion the game (49%). Confidence in pneumothorax detection improved significantly from 4.3 ± 2.1 to 7.3 ± 2.1; $p < 0.01$ (mean+/-SD, 10-point scale, 10 highest score) after using RapRad. 97% of the participants would recommend the use of RapRap to others; 93% would use RapRap for learning purposes again; 86% had fun using RapRad (7% neutral, 6% negative) and 62% indicated their interest in Radiology increased (28% neutral, 7% negative). The error-rate, number of failed attempts to answer a question correctly, was 38.8% for the entry test and 21.8% for the final test following training.

CONCLUSION

The RapRad e-Learning concept is capable of improving diagnostic confidence, reducing error rates and offering fun in the interaction with the platform.

CLINICAL RELEVANCE/APPLICATION

Gamification elements and rapid case reading e-Learning can assist residency training by offering fun elements, friendly competition and promote an accelerated learning curve.

SSQ12

Molecular Imaging (Musculoskeletal, Gastrointestinal, Cardio)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S504CD

CA GI MR MI MK NM

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

Participants
Chun Yuan, PhD, Seattle, WA (*Moderator*) Research Grant, Koninklijke Philips NV; ;

Sub-Events

SSQ12-01 Histological Validation of Chemical Exchange Saturation Transfer (CEST) imaging for the Measurement of Metabolism Status in Infarcted Myocardium

Thursday, Nov. 29 10:30AM - 10:40AM Room: S504CD

Participants
Kaiyue Diao, Chengdu, China (*Presenter*) Nothing to Disclose
Zhigang Yang, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Yingkun Guo, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The purpose of this study was to test if the distribution of creatine shown on Chemical Exchange Saturation Transfer (CEST) MRI could differentiate infarct myocardium from the normal on pigs, by referring to LGE images and pathologic results.

METHOD AND MATERIALS

We prospectively enrolled 27 Bama miniature pigs. MI model was built by applying a ligation at the remote ending of the left anterior descending artery. CMR scan was arranged at 3 days and 2 months later for the AMI and CMI group on a 3 T whole-body scanner. A single SAX slice was used for CEST scanning by using Amide proton transfer (APT) sequence before the injection of contrast. 36 samples were collected from a saturation frequency offset from -5.0 ppm to + 5.0 ppm. The scanned pigs were humanely euthanized under deep anesthesia with KCl and the heart was excised. Triphenyl tetrazolium chloride was used to manifest the infarcted region. CEST values at the frequency of ~1.8ppm, ~2.5ppm, ~2ppm and ~3ppm were recorded respectively for each pig and Color code map was plotted based on the CEST values at a frequency offset of ~1.8ppm (Matlab). Statistic analysis was performed on R project.

RESULTS

A total of 5 AMI pigs (M, 7 months, 16.6 ± 1.2 kg), and 14 CMI pigs (M, 9 months, 27.8 ± 2.1 kg), were finally included. Statistic differences were observed for Cr, ATP, and Glu between the infarct myocardium and the normal myocardium for CMI pigs, while only Cr and ATP for AMI pigs. The color code CEST maps showed a prominent larger abnormal region with a lower concentration of creatine than the MI regions recognized on the LGE sequences and the pathology images.

CONCLUSION

This study demonstrated that the metabolic conditions measured on CEST imaging could be used for infarcted myocardium recognition and the region of myocardium with a lower creatine concentration was larger than the region confirmed with infarction, which again provided proof of the existence of the injured or stunned myocardial tissue surrounding the infarction region.

CLINICAL RELEVANCE/APPLICATION

CEST MRI provided a promising invasive way to observe metabolism status of infarcted myocardium and further studies on MI patients would be needed to validate its clinical application.

SSQ12-02 Molecular Lumbar Intervertebral Disc Alterations in Patients with Leg Length Discrepancy Before and After Therapy

Thursday, Nov. 29 10:40AM - 10:50AM Room: S504CD

Participants
Christoph Schleich, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Miriam Frenken, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Daniel B. Abrar, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Yan Klosterkemper, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Johannes Boos, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Joel Aissa, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Leg length discrepancy (LLD) is a frequent incidental finding during orthopedic physical examination and can be found in about two-thirds of the population without any physical complaints. According to recent studies, LLD greater than 10 mm could be a predisposing factor for early degenerations of lumbar intervertebral discs or vertebral facet joints. However, the need of its treatment is still controversial. Previous findings suggest that degeneration of the lumbar disc correlates with a decrease of glycosaminoglycan content (GAG). The purpose of this study was to elucidate the effect of LLD on GAG content in lumbar discs and to show therapy effects after the usage of shoe inserts and physical therapy.

METHOD AND MATERIALS

11 patients (25.6 ± 4.3 years) with LLD greater than 10 mm and 14 control subjects (23.9 ± 3.5 years) without LLD were examined using a 3T MR scanner. 8 patients were re-examined 6 months after physical therapy and the usage of shoe inserts. Morphological T2-weighted sequences in sagittal and transversal orientation and Glycosaminoglycan chemical exchange saturation transfer (gagCEST) sequence were performed. Subjects with bulged or herniated discs were excluded.

RESULTS

Nucleus pulposus-gagCEST values of L5/S1 disc were significantly lower in patients with LLD compared to control group ($p = 0.0008$). For all other disc levels, no significant difference was found. At follow-up, no significant difference of NP-gagCEST values at baseline and 6 months after therapy could be found ($p > 0.05$).

CONCLUSION

This study supports the hypothesis that LLD greater than 10 mm could be a predisposing factor for early molecular alterations of lumbar discs of L5/S1. Remarkably, we observed lower gagCEST values of the lumbar disc of L5/S1 caused by LLD even before any morphological pathology could be found. Biochemical disc alterations of patients with LDD could be stopped under therapy.

CLINICAL RELEVANCE/APPLICATION

This study supports the hypothesis that LLD could be a predisposing factor for early molecular alterations of the lumbar disc of L5/S1. Furthermore, lower gagCEST values of the lumbar disc of L5/S1 caused by LLD were observed before any morphological pathologies were detectable. This molecular alterations of L5/S1 of patients with LLD could be delayed under the effect of shoe inserts and physical therapy.

SSQ12-03 Blood Oxygen Level-Dependent MRI Can Evaluate the Oxygenation of Visceral Adipose Tissue in Zucker Diabetic Fatty Rats

Thursday, Nov. 29 10:50AM - 11:00AM Room: S504CD

Participants
Matteo Figini, Chicago, IL (*Presenter*) Nothing to Disclose
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Su Hu, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
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Jia Yang, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
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Yuri Velichko, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Visceral adipose tissue (VAT) hypoxia is associated with insulin resistance and obesity-related chronic low-grade inflammation (metaflammation). Its evaluation is then of great importance for prevention and therapy, but current methods are invasive and focus on subcutaneous fat rather than VAT. The purpose of this study is to investigate the feasibility of evaluating VAT hypoxia with Blood Oxygen Level-Dependent (BOLD) MRI, which is sensitive to hemoglobin oxygenation, in Zucker Diabetic Fatty (ZDF) rats.

METHOD AND MATERIALS

Seven-week old ZDF rats (n=18) were provided with water and high-fat diet ad libitum; their body weight and blood glucose were monitored. At 13 weeks of age they were divided into two subgroups, receiving a daily dose of pioglitazone (ZDF-PGZ, n=9) or saline (ZDF-VE, n=9) respectively. BOLD MRI was performed at 13 and 23 weeks of age using a multi-echo spoiled gradient-echo sequence (5 echo times from 3.75 to 29.07 ms with 6.33 ms echo spacing, TR = 408 ms, voxel size = 0.47x0.38x3 mm3). R2* values were measured in the perirenal VAT. The trygliceride, cholesterol and insulin levels were measured by blood biochemistry analysis, and insulin resistance was calculated by HOMA-IR = insulin[mU/L] x glucose[mmol/L] / 22.5. Immunofluorescence was used to evaluate hypoxia by pimonidazole adduct-positive area. The proportion of Th17 and Treg cells, CD34+ and CD34++ monocytes were evaluated by flow cytometry.

RESULTS

The ZDF-VE group had hyperlipidemia ($p < 0.01$) and hyperinsulinemia ($p < 0.001$) and higher HOMA-IR ($p < 0.001$) compared to the ZDF-PGZ group. There was a significant R2* increase between the two scans for ZDF-VE (20.14 ± 0.23 vs. 21.53 ± 0.20, $p = 0.012$) but not for ZDF-PGZ (figure 1A). VAT R2* values showed a positive correlation with pimonidazole adduct-positive area, HOMA-IR, the percentage of Th17 cells and CD43+ monocytes, and a negative correlation with the percentage of Treg cells and CD43++ monocytes (figure 1B).

CONCLUSION

This study showed the feasibility of VAT oxygenation by BOLD MRI in ZDF rats with obesity induced by high-fat diet. The R2*

values obtained by BOLD MRI are also associated with insulin resistance and metaflammation.

CLINICAL RELEVANCE/APPLICATION

BOLD-MRI can be a non-invasive tool for the evaluation of visceral adipose tissue hypoxia and obesity-related insulin resistance and systemic inflammation

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SSQ12-04 Baseline Pancreatic Beta Cell Imaging Post Pancreatic Transplantation Using Whole Body 68Ga-DOTA-Exendin-4 PET/CT: Our Initial Experience

Thursday, Nov. 29 11:00AM - 11:10AM Room: S504CD

Participants
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Kanimozhi Damu JR, MBBS,MD, Coimbatore, India (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Whole-pancreatic transplant and islet cells transplantation are currently available strategies aiming towards diabetes cure. Beta cell specific non-invasive functional imaging using novel PET radiotracers are now available.68Ga-DOTA-Exendin-4 PET/CT is used for detecting localised Insulinomas. However this tracer can also be used for beta cell imaging and quantification. We have attempted in this study to recognise the pattern of uptake by this tracer in patients with pancreatic transplants.

METHOD AND MATERIALS

8 patients who had undergone pancreatic transplant for Diabetes Mellitus were included in the study. After obtaining informed consent from the patients 4-5 mCi of 68Ga-DOTA-Exendin-4 was injected intravenously. One hour after injection whole body PET CT was performed and the images were analysed.

RESULTS

Among the 8 patients who had pancreatic transplant, 4 patients had Type I Diabetes Mellitus and 4 patients had Type II Diabetes Mellitus. The mean age of the patients were 36 yrs. All the 8 patients were male patients. One of the patient had undergone simultaneous pancreatic and renal transplant. Anterior and lateral MIP images demonstrated diffuse heterogeneous GLP-1R expression in vertically oriented transplanted pancreas in 7 out of 8 patients. Three dimensional PET CT imaging along revealed increase tracer uptake in the transplanted pancreas. There was no uptake in the native pancreas in 6 out of the 8 patients. There was atrophy and calcification of the native pancreatic tissue in these 6 patients. Mild tracer uptake was noted in 2 out of the 8 patients. In one patient there was very low tracer uptake in the transplanted pancreas. Fat stranding was noted surrounding the transplant tissue with areas of necrosis within. This patient was later confirmed to have transplant rejection.

CONCLUSION

In our initial study of 8 patients we conclude Exendin-4 PET/CT is very sensitive tracer for beta cell imaging. It can be used for baseline and flow up of graft imaging. Currently biopsy is the only method to prove graft rejection. However with the use of Exendin-4 PET/CT early graft rejection can be detected non invasively. We further hypothesize the future use of Exendin-4 PET/CT for quantification of beta cell mass using volumetric analysis.

CLINICAL RELEVANCE/APPLICATION

68Ga-DOTA-Exendin-4 PET/CT can be used as baseline and for follow up pancreatic transplant patients for analysis of beta cell mass.

SSQ12-05 In Vivo Bioluminescence Imaging of Transplanted Mesenchymal Stromal Cells and Their Rejection Mediated by Intrahepatic NK Cells

Thursday, Nov. 29 11:10AM - 11:20AM Room: S504CD

Participants
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PURPOSE

Mesenchymal stromal cells (MSCs) hold promise in the treatment of liver disease.However, short survival time of MSCs after intrahepatic transplantation limits their value; therefore,understanding the basis of MSCs survival and rejection may increase their utility. This study was aimed at determining the role of intrahepatic natural killer (NK) cells on MSCs survival and their retention in the liver shortly after transplant.

METHOD AND MATERIALS

Human MSCs were labeled with the Luc2-mKate2 dual-fusion reporter gene (MSCs-R), and the residence time and survival of MSCs-R xenografts after intrahepatic transplantation were evaluated by in vivo bioluminescence imaging (BLI). Coculture of MSCs and NK cells was performed to assess cytotoxicity. To evaluate the role of NK cells in rejection of the xenografted cells, the fates of transplanted MSCs-R were then assessed in vivo by BLI after activation of intrahepatic NK cells.

RESULTS

We observed a linear correlation between luciferase activity from live MSCs-R and cell number in vitro (R2 = 0.9956). In vivo, we observed a gradual decline in bioluminescent signals from transplanted MSCs-R over a region corresponding to the liver in both the control group and the NK-activated group.However, the survival time and retention of intrahepatic MSCs-R decreased more rapidly in the NKactivated group of mice compared to the control group. This indicated that activated NK cells accelerate the elimination of transplanted MSCs. Also, we found that the number of hepatic NK cells and the expression of NK activation markers significantly increased after intrahepatic delivery of MSCs. This suggested that resident NK cells, in a resting state, were activated by intrahepatic transplantation of human MSCs. Taken together, the data suggests that activated hepatic NK cells mediate, in part, rejection of the MSCs xenografts. Cytotoxicity assays showed that activated NK cells may inhibit the proliferation of MSCs and, to a certain extent, induce MSCs death.

CONCLUSION

Human MSCs could be followed dynamically in vivo by BLI, and the role of murine hepatic NK cells, especially activated NK cells, could be inferred from the loss of signals from MSCs.

CLINICAL RELEVANCE/APPLICATION

This finding may have practical clinical implications in MSCs transplantation in treating liver disease.

SSQ12-06 Assessment for NASH-Related Hepatocarcinogenesis Inhibition of Shikonin in a Murine Model Using DW-MRI

Thursday, Nov. 29 11:20AM - 11:30AM Room: S504CD

Participants
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Chang Won Jeong, Iksan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Nonalcoholic steatohepatitis (NASH) is a major risk factor for hepatic carcinogenesis. This study was assess the effect of shikonin using diffusion-weighted magnetic resonance imaging (DW-MRI) in an NASH-related hepatocarcinogenesis murine model.

METHOD AND MATERIALS

On the second day after birth, male pups were subjected to a single subcutaneous injection of 200 μg streptozotocin (STZ) and fed high-fat (45% kcal from fat) diet from the age of 4 weeks. The mice were randomly divided into groups when the tumor area was about > 0.5 mm² as follows: STZ + high-fat diet (SH; n=6) and STZ + high-fat diet + shikonin (SHS; n=7). For the experimental group, shikonin (2.0 mg/kg) was injected intraperitoneally daily for 14 days (with diluted PBS). DW-MRI was performed to assess effects of shikonin at pre-and post-treatment. Aspartate aminotransferase (AST) and alanine aminotransferase (ALT), glucose, cholesterol, and triglyceride were determined in plasma. The liver tissues were collected at 14 day post-treatment for hematoxylin and eosin staining.

RESULTS

The mean area of tumors were 2.56 ± 2.12 mm² at the SH and SHS groups, before treatment initiation. The tumor area changes of the SH and SHS groups were 326.28 ± 320.81% and 91.58 ± 78.22% after post-treatment. The tumor area change in the SHS group significantly lower compared to the SH group ($p < 0.05$). The mean ADC changes of the SH and SHS groups were 41.97 ± 50.48% and -9.24 ± 30.46% after post-treatment. The ADC change in the SHS group significantly decreased compared to the SH group ($p < 0.01$). AST and ALT levels were significantly lower in the SHS group than in the SH group after post-treatment. Plasma glucose, total cholesterol and triglyceride levels were not significantly different between SH and SHS groups. The SH group exhibited numerous tumors on the liver surface, whereas the SHS group exhibited fewer and smaller liver tumors. The histological findings at SH and SHS groups revealed that the tumors were hepatocellular carcinoma.

CONCLUSION

In this study, we found that the cancer inhibition effects of shikonin in a NASH-related hepatocarcinogenesis murine model by using DW-MRI.

CLINICAL RELEVANCE/APPLICATION

Shinkonin might be considered a novel preventive or therapeutic approach for NASH-related hepatocarcinogenesis.

SSQ12-07 Management of Complex Regional Pain Syndrome (CRPS) with Sigma-1 Receptor Radioligand and PET/MRI

Thursday, Nov. 29 11:30AM - 11:40AM Room: S504CD

Participants
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PURPOSE

Complex regional pain syndrome (CRPS) is a severe chronic pain condition affecting millions worldwide. Unfortunately, there is no specific diagnostic test to identify the pain generators in CRPS, leading to poor pain management of this disease. Given sigma-1 receptors (S1Rs) specific association for pro-nociceptive processes, we determine the clinical impact of a more pain-specific PET/MRI approach for CRPS, adopting a novel high affinity sigma-1 receptor (S1R) PET radioligand ([18F]FTC-146; Ki = 0.0025 nM).

METHOD AND MATERIALS

IRB and FDA approval were obtained. Fifteen patients suffering from CRPS were referred directly from specialists in pain medicine. Whole-body (head-to-toe) PET/MR (time-of-flight PET; 3.0T MR bore; GE Healthcare) imaging was perfmored following 10 mCi IV injection of [18F]FTC-146. MR sequences included 3D axial LAVA-FLEX, high-resolution 3D axial DESS and 2D axial T2-weighted FSE scans. ROI analysis was performed (OsiriX v.6.0 64-bit). Findings from the PET/MR scans were discussed with the referring pain specialists, subsequent alterations in the pain management plan were recorded and, in a subset of cases, new treatments were applied to which outcomes were measured.

RESULTS

Fourteen out of 15 patients showed unexpected findings on [18F]FTC-146 PET/MRI, which lead to a change in the patients' pain management plans. In one specific case, a CRPS patient had severe (8-10/10) unilateral knee pain despite 2 previous unsuccessful surgeries. [18F]FTC-146 PET/MRI showed a high, focal [18F]FTC-146 PET uptake of a lesion which co-localized to an abnormal mass-like lesion in the intercondylar notch on the MRI. Subsequent arthroscopic surgery removed the [18F]FTC-146-avid lesion, which completely relieved the knee pain (0/10 pain). A separate CRPS patient with severe bilateral foreleg pain showed increased uptake of [18F]FTC-146 in the anterior compartment of both forelegs. Botulinum toxin injection in the areas of high [18F]FTC-146 uptake resulted in significant improvement in pain score (9-10/10 down to 2/10). We continue to follow the other patients to further evaluate our image findings.

CONCLUSION

A whole-body PET/MRI approach with a novel S1R PET tracer, [18F]FTC-146, can potentially identify pain generators in CRPS and improves treatment outcomes.

CLINICAL RELEVANCE/APPLICATION

The proposed whole body PET/MRI approach could alter the pain management for CRPS patients to achieve better pain-relief outcome.

SSQ12-08 Inflammation Focus Search with 18F-FDG-PET/MRI: Comparative or Additive Value of PET and MRI

Thursday, Nov. 29 11:40AM - 11:50AM Room: S504CD

Participants
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PURPOSE

To evaluate the comparative or additive value of 18F-FDG PET and MRI for identifying the etiology of inflammation of unknown origin.

METHOD AND MATERIALS

A total of 24 patients (13 m, 11 w, age 42±23 [8-82] y) with suspicion of an inflammation focus due to laboratory inflammation markers (increased CRP, leukocytes) or fever and up to now non-leading conventional imaging underwent a whole-body PET/MRI. Image analyses included the detection and localization of pathologically (focal) increased tracer uptake in PET including determination of SUVmax using VOI technique and evaluation of the contrast enhancement and diffusion restriction (ADC values) of abnormal lesions in MRI. Descriptive analysis included mean values, standard deviation and range. PET/CT, clinical, and radiological follow-up as well as histopathology served as standards of reference.

RESULTS

In 17/24 patients the PET/MRI contributed to the diagnosis of a (focal) pathological etiology of the inflammatory disease (vasculitis n=5, inflammatory bowel disease n=4, pneumonia n=1, infected vascular prosthesis n=2, (active) retroperitoneal fibrosis n=1,

peritonitis and cholecystitis n=1, synovitis n=1, mycotic infection (hepatic candidosis) n=1, bone marrow activation n=1). In PET all pathological foci showed a moderately to significantly increased FDG uptake (SUVmax 5.3 ± 3.5, range 1.4-14.2). The MRI satisfactorily allows the localization of the findings, but only in 12/17 a corresponding contrast-enhancement and in 13/17 a corresponding diffusion restriction could be found. 3/17 patients showed neither a contrast-enhancement nor a diffusion restriction, but only an increased FDG uptake.

CONCLUSION

Integrated 18F-FDG-PET/MRI shows high potential in identifying the etiology of inflammation of unknown origin. The MRI satisfactorily allows the localization of the findings, but a significant higher detection rate could be found in PET compared to MRI. Considering the significantly lower dose of ionizing radiation, PET/MRI may serve as a powerful alternative to PET/CT.

CLINICAL RELEVANCE/APPLICATION

Inflammation focus search with 18F-FDG-PET/MRI

SSQ12-09 Early Detection and Measurement of Disease Activity in Experimental, Inflammatory Bowel Disease Using Target-Specific Molecular Imaging and Fluorescence Colonoscopy

Thursday, Nov. 29 11:50AM - 12:00PM Room: S504CD

Participants
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PURPOSE

Pro-inflammatory monocytes comprise the majority of the early inflammatory infiltrate in inflammatory bowel disease (IBD). In mice, these cells are characterised by high expression of Ly6C. Purpose of this study was to evaluate Ly6C-specific imaging for visualisation and measurement of IBD activity in comparison to perfusion-type contrast agents and assess the performance in fluorescence mediated tomography (FMT) and fluorescence colonoscopy (FC) for whole body and local application respectively.

METHOD AND MATERIALS

IBD was induced in 10 female Balb/c wild type mice by application of DSS with the drinking water. The weight was monitored as a marker of disease activity. FMT was performed before and 5 and 10 days after IBD induction. Mice received a Cy5.5-labelled Ly6C antibody (2nmol dye) or an equivalently labelled, unspecific IgG to reflect perfusion effects. In parallel, all mice underwent FC for detection and scoring of local disease activity. Histology served for correlation and validation of in vivo imaging.

RESULTS

On day 5 after IBD induction, weight loss did not allow for safe identification of IBD activity and was only significantly increased at day 10 (2% vs. 15%). Perfusion was elevated on day 5 as compared to baseline already but did not increase significantly towards day 10 as reflected by the IgG-driven signal (192 vs. 328 vs. 342 pmol tracer). Ly6C-specific tracer accumulation was, in contrast, significantly elevated on day 5 already; a further increase towards day 10 reflected the growing disease activity (110 vs. 700 vs. 1166 pmol; $p<0.001$). In vivo colonoscopy allowed for safe identification of inflammatory foci based on the specific probe accumulation but not the unspecific control. FC-based disease scoring was clearly reflected by Ly6C-specific imaging.

CONCLUSION

Target-specific imaging of Ly6C as a marker for early infiltrating, pro-inflammatory monocytes allows for sensitive and specific measurement of IBD activity in vivo by non-invasive and endoscopic approaches. It is superior over clinical examination and perfusion type contrast.

CLINICAL RELEVANCE/APPLICATION

In IBD, monitoring of disease activity and sub-clinical inflammation e.g. under therapy is a relevant challenge. Specific imaging can aid research and potentially improve multi-modal clinical imaging.

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SSQ13

Musculoskeletal (Arthritis and Cartilage)

Thursday, Nov. 29 10:30AM - 12:00PM Room: E451A

MR MK

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

Participants
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Sub-Events

SSQ13-01 Longitudinal MRI Findings in Accelerated Knee Osteoarthritis: Data From the Osteoarthritis Initiative

Thursday, Nov. 29 10:30AM - 10:40AM Room: E451A

Awards
Trainee Research Prize - Resident

Participants
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PURPOSE

Our aim was to systematically analyze longitudinal MRI findings during the development of accelerated knee osteoarthritis (AKOA) to identify patients that may benefit from an intervention.

METHOD AND MATERIALS

Knees progressing from no radiographic osteoarthritis (OA, KL 0/1) to advanced-stage OA (KL 3/4) within 4 years (AKOA definition) at any time point within the Osteoarthritis Initiative were selected. OA risk factors including knee injury or surgery were noted. MRIs were graded using the modified Whole-Organ Magnetic Resonance Imaging Score (WORMS) at baseline, 2 and 4 years. Additional findings such as root tears and meniscal extrusion were noted. Presence or absence of features associated with KL 3/4 onset within 2 years compared to 4 years were assessed using Pearson's chi-square test for OA risk factors and multivariable logistic regression models for baseline imaging parameters.

RESULTS

AKOA was present in 162 knees in 149 subjects (age 63.25±8.3 years; 103 females; BMI 29.4±3.9). Knee injury was documented in 22% (36/162), meniscal resection in 27% (43/162). Moderate to severe meniscal lesions WORMS >= grade 3 were present in 25% (41/162) at baseline, 65% (105/162) at 2 years and in 94% (152/162) at 4 years. Meniscal extrusion was the most prevalent finding associated with AKOA (18% bl; 45% 2y; 94% 4y). Root tears were the most common types of meniscal tears (9% bl; 22% 2y; 38% 4y). Risk factors associated with KL 3/4 onset within 2 years (n=116) compared to 4 years (n=46), included higher baseline maximum scores of the weight-bearing cartilage (adjusted odds ratio [OR], 1.22; 95% confidence interval [CI]: 1.02, 1.46; p=0.033), presence of root tears at baseline (adjusted OR, 2.82; 95% CI: 1.33, 6.00; p=0.007) and presence of knee injury during the observation period (42%, 49/116 vs. 24%, 11/46, p = 0.032).

CONCLUSION

Meniscal abnormalities were the most prevalent morphological feature associated with AKOA and are likely responsible for rapid cartilage loss. Knee injury and meniscal resection were frequently present in our cohort and probable risk factors for AKOA. Root tears were associated with substantial increased risk for progression of radiographic joint space loss.

CLINICAL RELEVANCE/APPLICATION

Meniscal pathology/damage was associated with accelerated radiographic progression with joint space loss and identifies a subgroup of patients that may benefit from an intervention.

SSQ13-02 Amount of Partial Meniscectomy Impacts Severity and Worsening of Knee Osteoarthritis: Data from the Osteoarthritis Initiative

Thursday, Nov. 29 10:40AM - 10:50AM Room: E451A

Participants
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PURPOSE

Previous studies have suggested that meniscectomy is a significant risk factor for osteoarthritis (OA), but it is not known how the amount of meniscal resection impacts disease burden and progression. The goal of this study was therefore to develop a MRI-based semi-quantitative scoring technique for postoperative assessment of the amount of meniscal resection, to test its reproducibility and to investigate how the meniscal resection scores correlate with the severity and worsening of degenerative changes.

METHOD AND MATERIALS

The right knees of 135 participants from the Osteoarthritis Initiative were selected, who underwent meniscal resection. Using a newly developed semi-quantitative meniscal resection score (MenRS) the extent of meniscal resection was assessed on baseline 3.0T MRIs. Dividing the meniscus into radial and circumferential zones amount of meniscal resection was scored from 0 (none) to 18 (complete resection). In addition knee osteoarthritic abnormalities at baseline and 48-month were graded using a modified Whole-Organ Magnetic Resonance Imaging Score (WORMS). Statistical analysis included linear and logistic regression to correlate MenRS with baseline and change in WORMS grades as well as intra-class correlation coefficient (ICC) to determine reproducibility.

RESULTS

Using the new MenRS system high ICC values for both intra- and inter-observer reproducibility of 0.980 and 0.977, respectively were found. Most importantly the amount of meniscal resection was significantly correlated with baseline WORMS grades throughout the knee: higher MenRS were associated with higher total WORMS grades ($p=0.004$) as well as cartilage ($p=0.004$), and ligament ($p<0.001$) subscores. Correlations were higher when analyzing the associations between WORMS abnormalities in the index compartment separately ($p<0.001$). There were no significant correlations of MenRS and change in WORMS grades over 4 years.

CONCLUSION

Using MenRS to assess the amount of meniscal resection showed excellent reproducibility and significant correlations with the amount of cartilage and ligamentous abnormalities, with the strongest association in the index compartment.

CLINICAL RELEVANCE/APPLICATION

The new meniscal resection score allows to analyze the amount of meniscal resection with high reproducibility and is directly correlated with the severity of degenerative knee abnormalities.

SSQ13-03 Three Tesla Multiparametric Combined Imaging Evaluation of Axial Spondyloarthritis And Pelvic Enthesopathy

Thursday, Nov. 29 10:50AM - 11:00AM Room: E451A

Participants
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PURPOSE

To evaluate patients with suspected axial spondyloarthritis (SpA) to determine technical success of multiparametric rheumatology lumbosacral MR imaging (MRLI) protocol, disease distribution, inter-reader reliability, and effect on patient management.

METHOD AND MATERIALS

41 consecutive patients with suspected axial SpA reffered by rheumaologists were included. Two rheumatologists recorded the clinical and lab findings as well as the disease activity based on a confidence scale before and after imaging results of 3T MRLI. Two radiologists interpreted the studies to record the findings of SpA and its activity. Prevalence-adjusted and bias-adjusted kappa (PABAK) was used for reader agreement. Changes in diagnostic confidence, treatment and patient response were evaluated using the sign rank test and the Fisher's exact test. P value less than 0.05 was considered statistically significant.

RESULTS

There were 41 patients; 31 females and 10 males with ages of 41+/-10 and 41+/-12 (mean+/- SD), respectively. The spine T2W

imaging received highest quality scores followed by whole abdomen-pelvis 3DT2W imaging, 3DCEMR, and DWI, respectively. On T2W, acute and chronic lesions of LS spine and SIJ were seen in 4/41, 18/41, 6/41, and 27/41 of the patients, respectively. Many enthesopathy lesions were seen in abdomen and pelvis. In the abnormal area of the bones, ADC measured 0.95+/-0.23 (mean+/-SD) versus normal bone (0.20+/-0.1). In synovial linings, there was overlap of ADC. PABAK for acute and chronic findings were 0.70-1.0 and 0.41-0.51, respectively. Clinical confidence scale after imaging changed in 20 out of 41 patients, however, with the change was not statistically significant. The changes in diagnosis occurred in 17/41 and no association existed with respect to change in treatment (p=1) or patient response (p= 0.2).

CONCLUSION

The study validates the whole abdomen and pelvis multiparametric imaging approach for axial spondyloarthritis with successful assessment of multiple regional enthesopathy sites in the same setting.

CLINICAL RELEVANCE/APPLICATION

High field multiparametric MRLI is technically successful and identifies multiple active SpA sites in the same setting. Larger scale studies can be performed using this novel protocol to evaluate the effect on patient outcomes.

SSQ13-04 Monosodium Urate Burden Assessed with Dual-Energy Computed Tomography Predicts the Risk of Flares in Gout: A 12-Month Observational Study

Thursday, Nov. 29 11:00AM - 11:10AM Room: E451A

Participants
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PURPOSE

To determine if the extent of urate burden measured with dual-energy computed tomography (DECT) and ultrasonography (US) is predictive of the risk of gout flares.

METHOD AND MATERIALS

This prospective observational study recruited gout patients to undergo monosodium urate (MSU) burden assessment with DECT (volume of deposits) and US (double contour sign) scans of knees and feet. Patients attended follow-up visits at 3, 6 and 12 months. Patients having presented with at least one flare at 6 months were compared versus those who did not flare. Odds-ratios (ORs) [95% confidence interval] were calculated on relevant data stored by the automatic selection procedure applied on the binary logistic regression model.

RESULTS

Overall, 64/78 included patients attended at least one follow-up visit. In bivariate analysis, the number of joints with the double contour sign was not associated with risk of flare (p=0.67). Multivariate analysis retained a unique variable: DECT MSU volume of the feet. For each 1cm3 increase in DECT MSU volume in feet deposits, the risk of flaring increased 2.03-fold during the first 6 months after initial assessment (OR 2.03 [1.15 - 4.38]) and 1.57-fold during the first 12 months (OR 1.57 [1.01 - 2.86]). The threshold volume best discriminating flarers from non-flarers was 0.81 cm3 (specificity 61%, sensitivity 77%).

CONCLUSION

This is the first study showing the usefulness of DECT for the management of gout patients beyond diagnosis by demonstrating that the extent of MSU burden measured with DECT but not US is predictive of the risk of flares.

CLINICAL RELEVANCE/APPLICATION

This is the first study to show the predictive value of DECT for gout flares.

SSQ13-05 Association Between Gout and Longitudinal 3T MRI-Based Knee Osteoarthritis (OA) Worsening: Initial Observation and Preliminary Analysis from the FNIH OA Biomarkers Consortium

Thursday, Nov. 29 11:10AM - 11:20AM Room: E451A

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PURPOSE

To determine whether the presence of gout is associated with increased odds of knee osteoarthritis (OA) worsening in participants

of the Foundation for the National Institute of Health (FNIH) study.

METHOD AND MATERIALS

Using 1:3 propensity score matching method, 25 subjects with positive history of physician confirmed gout (symptomatic and/or subclinical gout in any joints) and 75 controls who were matched for OA and gout confounding variables (age, sex, BMI, and race) were included in this IRB approved HIPAA compliant study. Baseline and follow-up knee radiographic measurements and MRI Osteoarthritis Knee Score (MOAKS) variables for cartilage damage, bone marrow lesions (BMLs), osteophytes, effusion-synovitis, and Hoffa-synovitis were extracted. The association between gout and 48-months radiographic OA progression (>0.7mm reduction in medial tibiofemoral joint space width) was evaluated using conditional regression model. The relationship between gout and 24-months change in MOAKS measurements was determined using conditional regression. A mediation effect analysis was utilized to explore the variable mediating the association between gout and knee OA.

RESULTS

There was no significant association between gout and 48-months radiographic OA progression (OR 95%CI: 1.21 (0.66-2.21)). However, in comparison with matched controls, subjects with gout showed higher odds of worsening tibial cartilage damage (OR 95%CI: 2.02 (1.01-4.04)) and Hoffa-synovitis (OR 95%CI: 5.20 (0.89-30.48)), but not for osteophyte or BML worsening, over 24-months. Mediation analyses suggested a non-significant trend for the mediatory role of Hoffa-synovitis for the association between gout and tibial cartilage damage worsening (Sobel's test p-value: 0.086; indirect effect 95%CI: -0.084-2.087).

CONCLUSION

Positive medical history of gout is associated with longitudinal MRI-based OA-related structural damage worsening including tibial cartilage defect and Hoffa-synovitis.

CLINICAL RELEVANCE/APPLICATION

Presence of symptomatic or subclinical gout in any joints can be considered as a potential risk factor for future tibiofemoral OA progression.

Honored Educators

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

SSQ13-06 Does Metabolic Syndrome Increase the Risk of Osteoarthritis - Analysis of Subjects with Metabolic Syndrome and Healthy Controls from the KORA Cohort

Thursday, Nov. 29 11:20AM - 11:30AM Room: E451A

Participants
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PURPOSE

The purpose of the study was to assess the effects of the metabolic syndrome on osteoarthritis of the hip joint.

METHOD AND MATERIALS

Included were 356 patients of the KORA cohort (Cooperative Health Research in the Augsburg Region) with metabolic syndrome and a healthy control group. All subjects underwent a detailed assessment for the waist circumference as well as the presence of diabetes mellitus (fasting glucose), hypertension (systolic and diastolic), elevated triglycerides as well as an MR scan. MR measurements were performed on a 3 Tesla scanner (Magnetom Skyra, Siemens Healthcare, Erlangen, Germany) using a dual-echo Dixon and a T2 Haste sequence for anatomical structures. In order to quantify osteoarthritis of the hip, assessment was performed by two experienced radiologists for joint gap narrowing, osteophytes and subchondral sclerosis according to the Kellgren-Lawrence classification. Statistical analysis was performed using odds ratios from univariate and multivariate logistic regressions.

RESULTS

Age was found the only parameter in univariate and multivariate analysis to be significantly influencing on osteoarthritis of the hip joint. There was no correlation in univariate and multivariate analysis shown for any parameter of the metabolic syndrome as the waist circumference (OR left hip: 1.00, p= 0.933 ; OR right hip: 1.00, p= 0.833), triglyceride (OR left hip: 1.00, p= 0.925; OR right hip: 1.00, p= 0.209), HDL (OR left hip: 1.01, p= 0.084; OR right hip: 1.01, p= 0.111), systolic (OR left hip: 1.01, p= 0.469; OR right hip: 1.01, p= 0.404) or diastolic (OR left hip: 1.01, p= 0.407; OR right hip: 1.00, p= 0.736) blood pressure and fasting glucose (OR left hip: 1.00, p= 0.573; OR right hip: 1.02, p= 0.102) in comparison to osteoarthritis of the hip joint. Neither did the complex of metabolic syndrome in total show any significant correlation (OR left hip: 1.69, p= 0.104; OR right hip: 1.35, p= 0.313) to osteoarthritis of the hip joint.

CONCLUSION

Despite the strong influence of the metabolic syndrome on a wide range of inter alia cardiovascular diseases, we were able to show that metabolic syndrome does not affect osteoarthritis of the hip joint.

CLINICAL RELEVANCE/APPLICATION

Since a pathological mechanism has not yet been confirmed, growing research tries to associate osteoarthritis with the metabolic syndrome. This study wants to assess which subgroup of the metabolic syndrome is associated with osteoarthritis.

SSQ13-07 Association Between Patellofemoral Cartilage Damage and Frequency of Kneeling Activity in Subjects with/without Patella Alta: An FNIH OA Biomarkers Consortium Study

Thursday, Nov. 29 11:30AM - 11:40AM Room: E451A

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PURPOSE

It has been suggested that kneeling in occupational/sport activities is associated with knee OA. Studies suggested the association between kneeling and tibiofemoral joint cartilage damage, but reports of patellofemoral joint (PFJ) involvement are controversial. We aimed to investigate whether kneeling activity is associated with the worsening of MRI measures of PFJ cartilage damage in subjects with/without patella alta (PA) using the Foundation for the National Institute of Health (FNIH) study participants.

METHOD AND MATERIALS

The study was IRB-approved and HIPAA-compliant. Baseline and 24-month follow-up semi-quantitative MRI Osteoarthritis Knee Score (MOAKS) measures of PFJ of 600 subjects from the FNIH study were extracted. At the baseline visit, subjects were asked how many days per week they participated in activities with kneeling activity >=30 minutes. Insall-Salvati ratio (ISR) (patellar tendon/patellar height) was measured by a musculoskeletal radiologist using the baseline MRIs; knees with ISR>=1.3 were considered as PA. Logistic regression adjusted for age, sex and BMI, Chi-square test and Breslow-Day Homogeneity test were used to assess the impact of kneeling on worsening of MOAKS cartilage scores over 24-months in subjects with/without PA.

RESULTS

Worsening in MOAKS cartilage scores was seen in subjects with >=6 days/week of kneeling activity compared to subjects with less kneeling activity (adjusted OR(95%CI): 2.95(1.08-8.07)). However, despite the trend, 2-5 days/week kneeling was not associated with worsening of PFJ cartilage damages compared to less kneeling activity (<2 days/week). Stratifying analysis showed that only PA+ subjects, not PA-, had significant association between the kneeling and worsening of PFJ cartilage damage, especially in surface cartilage score (OR: 45.01(1.40-1444.2)) and medial side (OR:44.0(4.55-425.7)). Homogeneity test demonstrated significant difference between PA+ and PA- groups (P-value: 0.005).

CONCLUSION

Kneeling activity in >=6 days/week is associated with the worsening of PFJ MRI cartilage scores compared to less kneeling activity, especially in subjects with underlying PA.

CLINICAL RELEVANCE/APPLICATION

Frequent daily kneeling activity is associated with the higher risk of PFJ cartilage damage resulting in PF OA, especially in subjects with associated patella alta.

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SSQ13-08 3D T1 Mapping of Hip Cartilage: Comparison of a New Inversion-Recovery Based Method with Conventional Dual-Flip Angle Acquisition

Thursday, Nov. 29 11:40AM - 11:50AM Room: E451A

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PURPOSE

Although commonly used for quantitative imaging of hip cartilage, 3D dual flip angle techniques are highly sensitive to flip angle

Although commonly used for quantitative imaging of hip cartilage, 3D dual flip angle techniques are highly sensitive to flip angle variation (B1 inhomogenities) which is even more pronounced at 3 T. To compare precontrast T1 values of (1) hip cartilage and (2) periarticular musculature using a new inversion-recovery based method with conventional dual-flip angle acquisition in asymptomatic volunteers.

METHOD AND MATERIALS

IRB-approved study of 18 asymptomatic hips (9 volunteers; mean age 27 ± 2 years, 60% female). All subjects underwent non-contrast, quantitative T1 imaging of hip cartilage at 3T with two different methods: (1) 3D dual-flip angle GRE-based technique (0.9 mm3 isotropic T1 VIBE; acquisition time 8:30 min) including a prescan for B1 correction. (2) 3D dual inversion-recovery approach that has been recently introduced in brain imaging (0.9 mm3 isotropic T1 MP2RAGE; acquisition time 7:30 min) in which T1 values are calculated based on two different inversion pulses. Radial images were reformatted for both T1 techniques. Regions of interest were placed manually, based on anatomic landmarks within the (1) cartilage at each hour position of the clockface. (2) At the 3/9 o`clock position 2 quotients (%) of the peri-articular musculature were calculated as a measure for antero-posterior (T1 psoas /gluteus maximus muscle) and medio-lateral (T1 iliacus/gluteus medius muscle) flip-angle variations over the field of view.

RESULTS

(1) MeanT1 values and standard deviations of overall (1488±174ms vs 1036±41ms), anterior (1533±219ms vs 1026±45ms) and posterior (1444±157ms vs 1047±43ms) hip cartilage were higher for the dual-flip angle compared to the inversion-recovery based method (all p<0.001). (2) T1 psoas/gluteus maximus muscle quotient (105±11% vs 97±4%, p=0.01) and T1 iliacus/gluteus medius muscle quotient (131±16% vs 98±2%, p<0.001) were higher for the dual-flip angle compared to the inversion-recovery based method.

CONCLUSION

Despite the used B1 prescan inter-individual differences (= standard deviation) in T1 values of cartilage were greater with the dual-flip angle method compared to the inversion-recovery method due to the greater flip-angle variations at 3 T.

CLINICAL RELEVANCE/APPLICATION

A more robust method for acquisition of 3D maps of hip cartilage could help in defining thresholds to differentiate intact from biochemical cartilage degeneration at 3 T.

SSQ13-09 Evaluating Variability in Knee CartiGram MRI - A Quantitative Study

Thursday, Nov. 29 11:50AM - 12:00PM Room: E451A

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PURPOSE

MRI cartilage assessment using CartiGram is a widely used T2 mapping sequence to non-invasively detect changes in cartilage. We tested the robustness of the technique by quantitatively measuring intra- and inter-scanner variability of T2 values.

METHOD AND MATERIALS

Our study had two parts. First, a phantom containing NaCl, GdCl3 and Agarose was created to mimic human meniscus, muscles, cartilage and synovium. A T2 CartiGram (test) and T1w IR-TSE (gold standard) were performed on a 3.0T (750W, GE Healthcare) and 1.5T (HDxt, GE Healthcare) MRI scanners. A phantom integrity test was performed at the end. Obtained data was evaluated by creating T2 maps and calculation of T2 mean±SD. Second, in two healthy volunteers, a T2 CartiGram was performed twice, at an interval of 10 minutes with subject lying still in the scanner, each on both the scanners on the same day. T2 maps were created and mean±SD and Relative Percentage Difference (RPD) calculated. Additional 2-D wear maps were created to check for anatomical variability.

RESULTS

Phantom: 3.0T MRI showed T2 values of 26.5±1.4 in meniscus, 61±3.5 in muscles and 56±2.9, 71.4±3.8 and 78±5.5 in three cartilage samples. The 1.5T MRI showed T2 values of 28±1.2 in meniscus, 62.3±3.4 in muscles and 52.9±2.9, 77.5±5.4 and 89±7.3 in the three cartilage samples. Healthy Volunteers: The RPDs on the same scanner for subject 1 were 3.5% (on 3.0T) and 3.8% (on 1.5T) on the medial femoral cartilage and -1.7% (on 3.0T) and -1% (on 1.5T) on the lateral, and for subject 2, they were -0.4% (on 3.0T) and 4.8% (on 1.5T) on the medial and 1.2% (on 3.0T) and 5.5% (on 1.5T) on the lateral. The 1.5T scanner reported a lower overall T2 value than the 3.0T, in contrast to the phantom results. Visual inspection of the 2D wear maps by a musculoskeletal radiologist revealed variability of T2 signal with no observable pattern.

CONCLUSION

There exists variability in T2 values of CartiGram when performed in healthy volunteers across both, different time points and different field-strengths. Further studies are needed to re-evaluate the threshold of 40ms for cartilage pathology and define MRI machine-specific guidelines.

CLINICAL RELEVANCE/APPLICATION

Significant differences in T2 values on CartiGram can lead to difficulty in diagnoses of borderline cases in clinical practice.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
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SSQ14

Nuclear Medicine (Technical Innovations and Emerging Opportunities)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S505AB

CT MR NM

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

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Participants

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Sub-Events

SSQ14-01 Initial Results From the World's First Total-Body Positron Emission Tomograph

Thursday, Nov. 29 10:30AM - 10:40AM Room: S505AB

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PURPOSE

Positron Emission Tomography (PET) offers the most sensitive method for *in vivo* imaging assays of physiologically important compounds, but it is fundamentally limited by low signal and/or high radiation dose to the subject, which negatively impacts image quality, scan times and the kinds of diseases that may be investigated. PET also has the capacity to dynamically track the fate of biomolecules *in vivo*, allowing for pharmacokinetic analysis. However, standard clinical scanners have an axial field of view (AFOV) of 15-30 cm, which limits such analysis to single organs. This research program aims to address all these limitations by building extended AFOV scanners. Here we report initial results from a 194 cm long device - the first medical tomograph capable of simultaneously imaging the entire human body.

METHOD AND MATERIALS

The scanner consists of 8 rings of 24 PET detector modules, each containing 5 x 14 detector blocks. Blocks consist of 6 x 7 LYSO crystals of size 2.76 x 2.76 x 18.1 mm3 (total ~560 kg of LYSO), read out by silicon photomultipliers. The PET component is paired with an 80-channel CT scanner. PET detector performance has been characterized and system construction and integration has been completed. Static data from a 200 cm phantom has been acquired and reconstructed to investigate detector response uniformity. A 30-second dynamic scan of activity moving through a tube has also been acquired to verify dynamic frame generation.

RESULTS

Detector time-of-flight resolution is 409±39 ps and energy resolution is 11.7%±1.5% at 511 keV. Detector dead-time of 3.5% was found at count-rates similar to those expected in clinical operation. Images of the 200 cm phantom show reasonable uniformity even though not all corrections have been implemented yet. The dynamic dataset shows that frame creation is working as expected.

CONCLUSION

The world's first total-body PET/CT scanner has been built. Detector performance is in line with expectations. The system is operational and producing images. Implementation and validation of corrections for accurate quantification is under way. Further performance characterization is planned.

CLINICAL RELEVANCE/APPLICATION

Total-body PET aims to improve all clinical PET through ultra-fast (<1min) scans; ultra-low-dose (<0.35mSv) scans; improved image quality; and total-body kinetic modeling for precision medicine.

SSQ14-02 The Effect of a Novel Bayesian Penalised Likelihood (BPL) PET Reconstruction on the Herder Risk Prediction Model of Malignancy in Solitary Pulmonary Nodules Undergoing Assessment with 18F-FDG PET-CT

Thursday, Nov. 29 10:40AM - 10:50AM Room: S505AB

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PURPOSE

The British Thoracic Society (BTS) guidelines recommend using 18F-FDG PET-CT with the Herder model to assess the risk of malignancy in solitary pulmonary nodules (SPNs). Qualitative assessment of FDG uptake in SPNs, using an ordinal scale, integral to the Herder model, is based on analysis of standard Ordered Subset Expected Maximisation (OSEM) reconstruction PET images. Novel PET reconstructions improve image quality by increasing signal-noise ratio and suppressing image noise. Our aim was to assess the impact of a novel Bayesian Penalised Likelihood (BPL) PET reconstruction on the Herder risk prediction model of malignancy in SPNs in comparison with standard OSEM images.

METHOD AND MATERIALS

Subjects with a SPN who underwent 18F-FDG PET-CT between 2014-2017, with assessable OSEM and BPL reconstructions, and either histological confirmation of malignancy or histological and/or imaging follow-up confirmation of benignity were included. Two readers independently and blindly classified FDG uptake in each SPN on both OSEM and BPL images (BTS score; 1=none; 2=MBP but <2x liver; 4=>2x liver). The BTS score in combination with other clinico-radiological features was used to calculate the Herder risk score (%) for both OSEM and BPL images.

RESULTS

97 subjects (age 69±10 years, 52% male, 84% current/former smokers, mean nodule size 16±6mm) with 75 (77%) malignant SPNs were included. There was very good inter-observer agreement for the BTS score for both OSEM (κ=0.85) and BPL images (κ=0.87). BPL images increased the BTS score in 25 (26%) SPNs (20 malignant & 5 benign); 9 SPNs (7 malignant) increased from a BTS score 2 to 3, and 16 (13 malignant) from a BTS score 3 to 4, with a mean increase of 18±22% in Herder risk score. The mean Herder score using BPL images was significantly higher than OSEM for all SPNs (73±29 vs 68±32% respectively, p=0.001), and for malignant SPNs (83±19 vs 78±25%, p=0.004), but not for benign SPNs (42±35 vs 37±34%, p=0.07).

CONCLUSION

The use of BPL PET reconstruction increases the Herder score in approximately 25% of SPNs compared to standard OSEM datasets with the potential to affect subsequent management decisions.

CLINICAL RELEVANCE/APPLICATION

Novel BPL PET reconstruction, compared to standard reconstruction, may increase the estimated risk of malignancy in a SPN, using the Herder model, thus potentially affecting management decisions.

SSQ14-03 Impact of Point Spread Function Reconstruction on 68Ga DOTATATE PET/CT Quantitative Imaging Parameters

Thursday, Nov. 29 10:50AM - 11:00AM Room: S505AB

Awards
Trainee Research Prize - Medical Student

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PURPOSE

68Ga DOTATATE PET/CT has been increasingly used for diagnosis and therapy response assessment of patients with neuroendocrine tumors (NETs). We investigated the impact of point spread function (PSF) reconstruction and lesion size on 68Ga DOTATATE PET/CT quantitative parameters.

METHOD AND MATERIALS

A total of 38 patients with 42 68Ga DOTATATE PET/CT scans and 125 lesions were included. Scans were reconstructed with and without PSF modulation. For each lesion, one reader measured the maximum and peak standardized uptake value (SUVmax and SUVpeak), metabolic tumor volume (MTV), total lesion somatostatin avidity (TLS), and tumor somatostatin receptor expression heterogeneity (TH) using area under the curve method. Intraclass correlation coefficient (ICC) and Bland-Altman analyses were used to compare PSF and non-PSF values. Subgroup analysis was performed to determine the impact of lesion size.

RESULTS

Mean age of the patients was 55 ± 15 years. 21 patients were male and 17 were female. Of the 42 scans, 11 were baseline scans and 31 were follow-up scans. Of the 125 lesions, 51 were located in the liver, 31 in lymph nodes, 17 in bone, 8 in pancreas, 4 in lung, and 14 in other sites. Correlation coefficients between PSF and non-PSF values were excellent for SUVmax (ICC=0.97), SUVpeak (ICC=0.99), MTV (ICC=0.98), and TLS (ICC=0.99), and was good for TH (ICC=0.81). Comparison of PSF with non-PSF values showed a bias (mean percent change ± SD) of +27.5 ± 14.7% for SUVmax, +15.5 ± 9.5% for SUVpeak, -18.6 ± 37.6% for MTV, +0.8 ± 28.1% for TLS, and -7.1 ± 11.0% for TH. For lesions less than 2 cm in size (n=75), comparison of PSF with non-PSF values showed a bias of +32.7 ± 15.8% for SUVmax, +19.3 ± 9.3% for SUVpeak, -27.9 ± 45.4% for MTV, -1.7 ± 35.4% for TLS, and -5.0 ± 12.2% for TH. For lesions 2 cm or more in size (n=50), comparison of PSF with non-PSF values showed a bias of +19.7 ± 8.0% for SUVmax, +9.8 ± 6.2% for SUVpeak, +0.01 ± 23.1% for MTV, +4.6 ± 8.8% for TLS, and -10.4 ± 7.9% for TH.

CONCLUSION

PSF and non-PSF values for 68Ga DOTATATE PET/CT quantitative parameters were highly correlated. PSF reconstruction increased SUVmax and SUVpeak, decreased TH, and had a variable effect on MTV and TLS depending on lesion size.

CLINICAL RELEVANCE/APPLICATION

PSF reconstruction increases SUVmax and SUVpeak and should be considered in evaluating 68Ga DOTATATE PET/CT quantitative parameters for diagnosis and therapy response assessment of NETs.

SSQ14-04 Value of CT Iterative Metal Artifact Reduction in PET/CT: Clinical Evaluation in 103 Patients

Thursday, Nov. 29 11:00AM - 11:10AM Room: S505AB

Awards
Student Travel Stipend Award

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PURPOSE

To assess the technical feasibility and diagnostic benefit of CT iterative metal artifact reduction (iMAR) in patients with metal implants undergoing PET/CT.

METHOD AND MATERIALS

PET/CT examinations of 103 consecutive patients with metal implants in different localization performed between 10/2017 and 03/2018 using a state-of-the-art clinical PET/CT scanner (Siemens Biograph mCT) were included. As PET tracers 18F-FDG (75/103), 68Ga-PSMA (25/103) and 68Ga-DOMITATE (3/103) were used. Diagnostic CT data were reconstructed with iMAR and without iMAR (noMAR) and used in comparison for PET attenuation correction, generating iMAR-corrected and noMAR-corrected PET data. The effect of iMAR on quantitative CT and PET analysis was assessed by HU and SUV measurements in predefined normal anatomical structures and pathological lesions in the vicinity of metal implants. Qualitative diagnostic confidence for lesion delineation was assessed by 2 radiologists using a 3-point Likert Scale (1=not delineated; 2= fair delineated; 3=good delineated).

RESULTS

For artifact-affected anatomical structures, mean HU of iMAR CT images were significantly different compared to noMAR CT and respective standard deviations were significantly lower (e.g., M. masseter in case of dental fillings/implants: 105.1 HU, SD 43 [noMAR] vs. 72.2 HU, SD 14 [iMAR] P<.01; M. gluteus maximus in case of hip endoprostheses: 79.4 HU, SD 23 vs. 50.0 HU, SD 15; P<.01). However, SUVs did not differ significantly in these artifact-affected anatomical structures (SUVmean 0.90 [iMAR] vs. 0.91 [noMAR]; P>.05) and pathological findings (SUVmean 10.65 [iMAR] vs. 10.67 [noMAR]; P>.05) between the iMAR and noMAR PET data. In the qualitative analysis, a significantly improved delineation of pathologic findings was observed using iMAR in CT for both the interpretation of physiological (score: 1.23 [noMAR] vs. 2.26 [iMAR]; P<.01) and pathological structures (score: 2.31 [noMAR] to 2.80 [iMAR]; P<.01).

CONCLUSION

The use of iMAR in PET/CT significantly improves delineation of both physiological and pathological structures in the vicinity of metal implants in CT. The PET quantification and image quality are not significantly affected by the use of iMAR based attenuation correction.

CLINICAL RELEVANCE/APPLICATION

Metal related artifacts impair image quality and increase the risk of missing pathological findings in PET/CT. Lesion delineation is quantitatively and qualitatively improvable by iMAR.

SSQ14-05 PET/CT versus PET/MR: Quantitative Accuracy in Y-90 Dosimetry Analysis

Thursday, Nov. 29 11:10AM - 11:20AM Room: S505AB

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PURPOSE

The purpose of this study is to compare Y-90 dosimetry estimates based on PET/MR versus PET/CT, identify errors in PET/MR dosimetry related to MR-based attenuation correction (AC) and PET detector equipment, and offer methods to avoid these errors.

METHOD AND MATERIALS

An IRB-approved prospective study was performed on eight patients receiving Y-90 radioembolization for liver malignancies. Following the intervention, patients were scanned by PET/CT (Siemens Biograph mCT) and PET/MR (Siemens Biograph mMR). PET/CT scans were performed arms-up, while the PET/MR scans were performed either arms-up, arms-down, or both. AC for PET/CT was derived from a low-dose CT scan. AC for PET/MR was performed with three class segmentation using the Dixon technique. Dosimetry calculations were performed using MIMs 6.5 software (MIM Software Inc.). PET/CT dosimetry was used as the standard to compare PET/MR dosimetry analysis. Accuracy of PET/MR dosimetry was analyzed in relation to injected activity, background liver and tumor dose, and PET/MR arm location.

RESULTS

PET/MR dosimetry provided accurate dosimetry estimates (within 20% of PET/CT) in the majority of cases. Inaccuracies in PET/MR dosimetry estimates were most pronounced in studies having segmentation errors or truncation errors in the PET/MR AC map, causing inappropriate attenuation correction. Inaccurate PET/MR dosimetry also occurred in cases with high Y-90 injected activity (>3 GBq). Such errors were attributed to the slow characteristics of the Biograph mMR's PET detectors given the high singles rate arising from bremsstrahlung x-rays, leading to inaccurate dead-time correction and increased noise and inaccurate corrections for random coincidences. These causes for error can be avoided by ensuring the AC map is accurate, checking for truncation errors, and using Y-90 doses less than 3 GBq.

CONCLUSION

PET/MR can provide accurate Y-90 dosimetry estimates as compared to PET/CT, provided that the injected activity is not excessive and the MR-based AC map has no major errors. Newer technologies, namely high-speed PET detectors using silicon photomultipliers and new atlas-based methods for PET/MR AC, are expected to improve accuracy of PET/MR Y-90 dosimetry.

CLINICAL RELEVANCE/APPLICATION

PET/MR can provide accurate Y-90 dosimetry estimates as compared to PET/CT, provided that the injected activity is not excessive and the MR-based AC map has no major errors.

SSQ14-06 Evolution of PET/MR Protocols Since 2011: A Single-Center Observational Study Including 1797 Examinations

Thursday, Nov. 29 11:20AM - 11:30AM Room: S505AB

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PURPOSE

PET/MR is a versatile hybrid imaging modality especially used for oncologic imaging. Since the introduction of combined PET/MR systems in 2011 this relatively new technology has undergone significant developmental stages and has evolved into a robust clinical modality. The purpose of this study was to record and evaluate the development of clinical PET/MR examinations in our institution with respect to acquisition times, protocol complexity and tracer dosage.

METHOD AND MATERIALS

Essential parameters of 1797 clinical PET/MR examinations were recorded in an institutional database between 01/2013 and 12/2017 including total examination time, PET acquisition time, number of PET bed positions, number of generated images, injected tracer dose and administration of MR contrast agent. All examinations were conducted on a clinical PET/MR system (Siemens Biograph

mMR, 3 T). PET/MR protocols were iteratively adjusted according to available optimal settings over the observation period. We evaluated the recorded PET/MR parameters with respect to their development over time and with respect to their variation among different examination groups (adult patients, pediatric patients and brain studies).

RESULTS

The 1797 examinations included in the final database consisted of 1004 adult patient studies, 278 pediatric patient studies, and 515 brain studies. Average examination time decreased significantly between 01/2013 and 12/2017 from 75.7±26.7 to 66.6±23.4 min ($P < 0.5$). Compared to adult patients, the average pediatric examination time was longer but also significantly shortened between 01/2013 and 12/2017 (from 96.8±21.2 min to 84±23.0 min ($P < 0.5$)). In the same period however, overall examination complexity measued by the number of acquired images significantly increased from 2697 to 3696 acquired images per examination ($P < 0.01$).

CONCLUSION

PET/MR is a complex and time-consuming imaging modality producing a large number of complex image data. Despite increasing protocol complexity however, examination times were significantly reduced by the introduction of accelerated MR imaging techniques and protocol optimization.

CLINICAL RELEVANCE/APPLICATION

By optimizing examination protocols PET/MR scan times can be reduced, potentially increasing patient comfort and patient compliance, which is particularly important when examining children.

SSQ14-07 Feasibility of "Low Dose MR" Dixon Technique for Imaging FDG PET-MR Lymphoma

Thursday, Nov. 29 11:30AM - 11:40AM Room: S505AB

Participants
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PURPOSE

Clinical whole body PET-MR imaging has wrestled with the problem of acquiring high quality multiplanar MR sequences compared to lower resolution fast MR sequences. "Low dose MRI" is a term used in the nuclear medicine community to describe fast acquired PET-MR scan protocols that relied heavily on PET images for diagnosis. In this study, we sought to determine if the Dixon sequences obtained for attenuation correction could be used as a diagnostic sequence for interpreting PET-MRI lymphoma cases.

METHOD AND MATERIALS

We retrospectively identified 40 patients who underwent 88 FDG PET-MR body imaging studies for staging or restaging lymphoma. Brain images were not reviewed. A radiologist and nuclear medicine physician blindly reviewed PET images, attenuation correction coronal Dixon MRI, PET-MR fusion with Dixon, and multisequence (ms) MR, and ms PET-MR images. Lesions were characterized based on location, imaging characteristics, size, max SUV, and malignant potency.

RESULTS

All patients were adults with average study age 43.8 y. Studies consisted of 40 females and 48 males with 7 for staging and 81 for restaging. All patients had systemic lymphoma with 29 being diffuse large B-cell lymphoma. 37 studies had active lymph nodes (LN) on Dixon PET-MR that agreed with ms PET-MR in 33 positive cases (89.1%) having avg SUV 10.2 +/-7.74 SD. 4 Dixon PET-MR cases did not detect lesions, avg SUV 2.3 +/-0.55 SD, read as minimal residual activity. ms MR identified 11 patients with enlarged LN without FDG uptake, not seen on Dixon. All 5 studies with bones lesions were detected by Dixon PET-MR as well as 2 soft tissue organ lesions. ms MR identified 1 patient with nonactive healed bone lesions. 55 true negative. Compared to ms PET-MR, Dixon had 89.2% sensitivity, 100% specificity with no false positive studies.

CONCLUSION

In this retrospective study, Dixon PET-MR was shown to be sensitive and specific compared to ms PET-MR in the detection of lymphoma. Low number of cases not detected had minimally active LN that resolved on subsequent imaging and probably were not clinically important.

CLINICAL RELEVANCE/APPLICATION

Low dose MRI sequences using the Dixon technique for interpretation may a play role in PET-MR imaging when scan time becomes important. This may be necessary in patients with comorbidity, claustrophobia, or when multiplanar MR of particular areas be necessary.

SSQ14-08 An Unsupervised Dixon-Based Five-Tissue 18F-Sodium Fluoride Synthetic CT Generation for PET/MR Attenuation Correction

Thursday, Nov. 29 11:40AM - 11:50AM Room: S505AB

Participants
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PURPOSE

To create accurate voxel-wise attenuation correction (AC) maps for PET/MR using Na18F images and obviate the need for both specialized MR pulse sequences and conventional methods that typically lack bone information.

METHOD AND MATERIALS

Sixteen breast cancer patients received research PET/MRI exams (Philips Ingenuity TF) following clinical Na18F PET/CT exams. Free-breathing 3D T1-weighted (T1W), breath-holding mDixon, and (clinical) low-dose CT images were acquired. Rigid-body registration and local-phase deformable registration were used to transform CT, Dixon-water (Water), and Dixon-fat (Fat) to match free-breathing T1W images. A bone feature image was segmented from the non-AC Na18F image. Water, Fat, and bone features were classified into five tissue types using fuzzy c-means clustering. CT numbers of -1000, -741, -98, 40, 380 HU were assigned to estimated air, lung, fat, soft tissue, and bone classes, respectively. Synthetic CT (sCT) was generated as a linear combination of these. Mean error (ME) and mean absolute error (MAE) were estimated to evaluate the accuracy of the sCT generated by water-filled (WF), three-class T1W-based (3C-T1W), four-class Dixon-based (4C-Dx), four-class deformed Dixon-based (4C-defDx) and five-class deformed Dixon-Na18F (5C-DxBone) methods. A threshold-based CT bone mask was used to assess the accuracy of the sCT in bone regions.

RESULTS

The MAE of the sCT from WF, 3C-T1W, 4C-Dx, 4C-defDx, 5C-DxBone were 135±8, 133±19, 111±14, 105±11, 103±10 HU, respectively. The 4C-defDx group showed better agreement to measured CT than the conventional 4C-Dx. The ME in the bone mask (MEbone) of the 4C-defDx and 5C-DxBone were -351±27 and -225±29 UH. The 5C-DxBone group presented robust Na18F-derived bone information especially in spine and pelvis; it reduced by 33-37% the MEbone when compared with the other AC methods and resulted in the lowest ME and MAE.

CONCLUSION

The deformable registration mitigated the mismatch between Na18F and Dixon due to different breathing conditions. The results suggest that the Dixon-based sCT can be improved by having a Na18F-derived bone feature to increase the accuracy of PET/MR Na18F quantification.

CLINICAL RELEVANCE/APPLICATION

PET/MR Na18F for bone metastasis detection is not well-established as the lack of bone information for attenuation correction (AC). We propose a feasible five-tissue method for PET/MR Na18F AC.

SSQ14-09 Investigation on PET/MR Image Fusion Mismatch Due to Expanding Bladder: A Pilot Study

Thursday, Nov. 29 11:50AM - 12:00PM Room: S505AB

Participants
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PURPOSE

A considerable change of the urinary bladder shape between consecutive bed positions poses a unique challenge on a multi-bed simultaneous PET/MR scan. Our aim is to report our initial experience on the fusion error caused by expanding bladder.

METHOD AND MATERIALS

120 patients (63 males and 57 females, average age = 51.3 years, range 22-70 years) who had been diagnosed with cancer or had previous history of cancer were recruited. Each patients were scanned on a simultaneous whole-body PET/MR system with 5 bed positions (feet in first, 4 bed positions for body and 1 for head). All PET/MR images were visually examined by two independent experts to evaluate the pelvis fusion accuracy with a Likert scale scoring system (1-5, 5 as the best quality).

RESULTS

The mean and standard deviation of the score is 4.57 and 0.75 correspondingly. 14 patients(11.7%) were rated less or equal to 3 by both readers all because of mismatch in the bladder area. This is due to the fact that the bladder area is in the overlap region of PET images from two consecutive bed positions, so the image of the bladder area is a weighted sum of these two PET images based on the sensitivity curve. Because the bladder expanded significantly between these two bed positions, the average of the two very different bladder images cannot match the MRI image from either bed position. This effect is magnified with PET/MR scanning because the scan duration for each bed position is usually significantly longer than that of a PET/CT system due to the limitation of MRI.

CONCLUSION

Our initial clinical results shows that, in most scenarios PET/MRI can achieve very good image fusion accuracy in the pelvis area. However, it is important to know that expanding bladder might cause mismatch between PET and MRI images when the bladder area is in the PET overlap region of two bed positions. Special care might be needed if there is diagnostic interests of the area near bladder. This effect can be avoided by arranging bed position accordingly so that bladder is close to the center of one bed position.

CLINICAL RELEVANCE/APPLICATION

This study provides a guideline for simultaneous PET/MR scan protocol to avoid the fusion error in pelvis area due to expanding bladder.

SSQ15

Neuroradiology (Dots and Dashes: Image Analysis in Neuroradiology)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S503AB

MR NR

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

FDA Discussions may include off-label uses.

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Sub-Events

SSQ15-01 Gray Matter Network Organization in Psychotic Disorders

Thursday, Nov. 29 10:30AM - 10:40AM Room: S503AB

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PURPOSE

Abnormal structural brain networks are believed to be an important cause of serious mental illness. Detailed studies of brain networks using advances neuroimaging approaches continues to advance understanding of these network disturbances. In the present study, we used a relatively novel approach for identifying atypical gray matter network organization in a large cohort of patients with serious mental illness and their first degree relatives, and examine their genetic associations.

METHOD AND MATERIALS

N=854 subjects (330 probands with psychotic disorders, 320 of their nonpsychotic relatives and 204 healthy controls) were recruited. Single-subject gray matter networks were extracted from structural MRI scans using a recently developed automated and data-driven method. In gray matter graphs, nodes represent small cortical areas whereas edges represent statistical similarities in regional gray matter morphology between nodes. Small-world properties and nodal centrality metrics were calculated and compared among participant groups. Genetic associations of abnormal network metrics were examined using GWAS.

RESULTS

Psychotic probands showed decreased nodal degree and nodal efficiency mainly in right superior frontal gyrus and bilateral superior temporal regions relative to healthy controls. The connectivity matrix analysis showed that the impaired connections between frontal and temporal regions were found highly replicated for each abnormal node. Genome-wide significant association with nodal degree of right frontal cortex was observed with SNPs in the cell proliferation regulating inhibitor of protein phosphatase 2A gene (CIP2A) at chromosome 3q13.13, while temporal nodal metric changes were associated with psychotic symptomatology. The network metrics of nonpsychotic relatives did not differ from healthy controls.

CONCLUSION

By investigating single-subject gray matter graphs to define neuroanatomic networks in a large group of individuals with psychotic disorders, our findings provide novel evidence indicating disorganizations of anatomical gray matter network mainly involving the fronto-temporal circuit that were related to genetic and clinical factors, which may underpine the neuropathology of psychotic disorders.

CLINICAL RELEVANCE/APPLICATION

Our study provide novel evidence indicating gray matter disorganizations in fronto-temporal circuit that are related to the genetic origin and severity of psychotic symptomology.

SSQ15-02 Synthetic MRI in 3D

Thursday, Nov. 29 10:40AM - 10:50AM Room: S503AB

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PURPOSE

Synthetic MRI is based on absolute quantification of R1 and R2 relaxation rates and proton density PD, where image contrast is synthesized as a post-processing step. A limitation thus far has been the lack of a 3D sequence with a clinically relevant image quality and scan time. The aim of this work was to assess a new 3D quantification method, QALAS, for high-resolution brain imaging in 6 minutes scan time.

METHOD AND MATERIALS

The 3D QALAS sequence is a segmented spoiled gradient echo sequence with 5 parallel acquisitions, interleaved with a T2 preparation and inversion pulse. The 2D QRAPMASTER sequence (MDME or MAGiC) is a saturation recovery multi-slice TSE sequence with multi-echo read-out. Twenty-four phantoms with various combinations of R1 and R2 relaxation rates were scanned with an inversion recovery (IR) sequence with 6 inversion delay times at 100, 200, 500, 1000, 2000 and 5000 and a multi-echo (ME) TSE sequence with 20 echoes. Additionally, a group of 10 volunteers was acquired with the two quantification methods to correlate automatically segmented brain volumes of white matter, grey matter, cerebrospinal fluid and myelin. Post-processing was performed by a prototype SyMRI 12 (SyntheticMR, Sweden). The scanner was a patched Philips Ingenia 3T.

RESULTS

Linear regression showed a slope of 0.97 and an intercept of 0.01 of QALAS R1 and IR. A slope of 1.02 and an intercept of 0.01 was observed for QALAS R2 and ME. The Pearson correlation coefficient was >0.99 for R1, R2, PD and for the synthetic T1W, T2W and FLAIR. The observed mean brain volume for QALAS was 1337 ml, the mean intracranial volume was 1493 ml, a difference of -36 ml and -34 ml, respectively, compared to QRAPMASTER. WM volume was 552 ml, GM 744 ml, CSF 157 ml and myelin 176 ml, a difference -9, -45, -1, -11 ml, respectively. Normalized for ICV, no significant differences were observed, the brain fraction BPF was 89.5%, WM fraction 36.9%, GM fraction 49.8%, CSF fraction 10.5% and myelin fraction 11.8%.

CONCLUSION

Absolute quantification in 3D isotropic resolution using QALAS provides very similar values for R1, R2 and PD, synthetic T1W, T2W, FLAIR and automatic brain segmentation in comparison to a known 2D quantification method in the brain.

CLINICAL RELEVANCE/APPLICATION

Synthetic MRI provides many image contrast in a short scanning time. Being based on quantitative maps it also provides robust input to automatic brain segmentation.

SSQ15-03 Abnormal Cerebellar-Default Mode Network Connectivity in Unmedicated Bipolar II Depression

Thursday, Nov. 29 10:50AM - 11:00AM Room: S503AB

Participants
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PURPOSE

Objective: Bipolar disorder (BD) is a common psychiatric disease. Previous studies have found abnormalities in structural and functional brain connectivity in BD patients. However, few studies have focused on the functional connectivity (FC) of the cerebellum and its sub-region in patients with BD. The present study aimed to examine the FC of cerebellar subregion-default mode network (DMN) in patients with BD II.

METHOD AND MATERIALS

Materials and Methods: All patients met Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (known as DSM-V) criteria for BD II according to the diagnostic assessment by the Structured Clinical Interview for DSM-V Patient Edition (SCID-P). And they were diagnosed with total YMRS score<7 and HDRS-24 score>21. In total, 92 patients with unmedicated BD II depression and 100 healthy controls (HCs) were recruited, and they underwent the resting-state functional magnetic resonance imaging. Three pair subregions of the cerebellum the DMN-related had been selected as seed regions (bilateral Crus I, Crus II, and lobule IX) and calculate the whole brain FC for each subregion. The two-sample t test was performed to assess the significant differences of the FC for each subregion between BD II and HCs. Age, gender and the mean framewise displacement were included as nuisance covariates. Statistical maps were thresholded using permutation tests (1000 trials). The threshold-free cluster enhancement and voxel-wise correction with permutation tests were tested at two-tailed $p<0.05$ for multiple comparisons.

RESULTS

Results: Compared with HCs, the patients with BD II depression showed increased FC in the right Crus I-bilateral precuneus, decreased FC in the left Crus II-right medial prefrontal cortex (mPFC), -bilateral medial frontal gyrus (MFG) and the right Crus II-left MFG. There were no significant difference in the whole FC of the left Crus I and bilateral lobule IX between the BD II depression group and the HCs group.

CONCLUSION

Conclusions: The findings showed impaired FC between the cerebellum and the DMN in BD, partially FC of the Crus I-precuneus, the Crus II-prefrontal cortex, suggest the importance of abnormal cerebellum-DMN FC in the pathophysiology of BD.

CLINICAL RELEVANCE/APPLICATION

The work described has not been submitted elsewhere for publication, and all the authors have approved the manuscript that is

enclosed. The authors do not have any possible conflicts of interest.

SSQ15-04 Denoising fMRI Data Using Random Matrix Theory Improves Language Mapping Sensitivity in Brain Tumor Patients

Thursday, Nov. 29 11:00AM - 11:10AM Room: S503AB

Participants
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PURPOSE

Functional MRI improves preoperative planning in brain tumor patients, however BOLD signal changes for task-based 3T fMRI are only 2-3% and the tumor often compromises patient performance. This study tested the hypothesis that Marchenko-Pastur Principle Component Analysis (MP-PCA) denoising significantly improves statistical power for pre-operative fMRI language mapping.

METHOD AND MATERIALS

This IRB-approved, HIPAA-compliant study retrospectively identified 22 brain tumor patients (13 female; 42.5±18.1yrs, all left language dominant) that successfully performed verb generation, sentence completion and listening comprehension language fMRI paradigms. Original and MP-PCA denoised volumes for the 3 language tasks were processed using FSL-FEAT. For each task, we created histograms of z scores for original and MP-PCA denoised data within the left frontal operculum (LFO) and left parieto-temporal junction of the contralateral homologous region. Mean Z-scores were compared using paired 2-sided t-tests and their distributions compared with Kolmogorov-Smirnov tests.

RESULTS

MP-PCA denoising resulted in increased volume and magnitude of fMRI activation for all 3 language tasks. In the LFO during sentence completion, MP-PCA denoised statistic maps showed 12% average greater volume of voxels with $Z>3$ ($p=0.0002$) and mean z-score increased from 4.9±1.1 to 5.7±1.5 ($p<0.0001$) (almost an order of magnitude increase in statistical power). Mean z-scores did not increase after MP-PCA denoising in contralateral regions not involved in language. Histogram of z-scores in cortical language regions shifted to stronger statistical correlations to the task (KS test; $p<0.0001$) and appeared less Gaussian than typically observed with fMRI, which may better reflect known widespread cortical recruitment during language performance.

CONCLUSION

MP-PCA denoising demonstrated increased sensitivity for cortical regions recruited during language task-based fMRI paradigms in brain tumor patients. This could improve the clinical value and practical utility of performing preoperative fMRI in more brain tumor patients.

CLINICAL RELEVANCE/APPLICATION

A recently described denoising approach can significantly increase the statistical power of task-based fMRI to improve language mapping sensitivity in patients with brain tumors.

SSQ15-05 Assessment of Zygomatic Bones Symmetry through 3D Segmentation and Mirroring Procedure on CT Scans (MFCT) for Reconstructive Maxillofacial Surgery Work-Up

Thursday, Nov. 29 11:10AM - 11:20AM Room: S503AB

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PURPOSE

Zygomatic bones contribute to overall facial morphology: their integrity and symmetry is of pivotal interest in reconstructive maxillofacial surgery. Our aim was to prove the feasibility of a new technique for zygomatic bones symmetry assessment through registration and calculation of point-to-point distances between the mirrored 3D models.

METHOD AND MATERIALS

100 patients (50 male, 50 females), divided in 2 groups (18-49 years ; 50-95 years) were randomly selected from our CT-scans

database. CT acquisition parameters were: 150 mAs, 120 kV, collimation: 128 x 0.6 mm, pitch: 0.55, recon. thickness: 1 x 0.8 mm, recon.algorithm: H60 sharp. 1 operator performed a 2 -step semi-automatic segmentation of bone volumes through ITK-SNAP software; first the bone surface from zygomatic, maxillary, frontal and temporal areas was acquired; then the obtained 3D model was elaborated with a 3D-elaboration software (VAM© software) to manually select the zygomatic bone according to sutures. Once the 2 zygomatic bones are acquired, the left bone is automatically mirrored and registered on the right one according to the least point-to-point distance between the 2 models by the VAM© software, which provides point-to-point mean and root mean square (RMS) distance and a graphical representation of constant and variable areas between the 2 surfaces.

RESULTS

According to Bland-Altman test, repeatability of RMS measurements performed by the same operator and by a different observer was 79% for both. TEM for intra- and inter-observer error was respectively 4.3% and 3.5%. No statistically significant differences were found according to sex, neither for mean point-to-point distance ($F = 0.15$, $p = 0.670$) nor for RMS value ($F = 0.4$, $p = 0.529$). No statistically significant difference was found according to age groups, neither for mean point-to-point distance ($F = 0.58$, $p = 0.448$) or RMS value ($F = 0.05$, $p = 824$). Interaction between sex and age was negligible for both the parameters ($F = 0.38$, $p = 0.539$; $F = 0.82$, $p = 0.367$, respectively). Effect size for sex and age groups was respectively 0.15 and 0.00: in the former case the value corresponds to a small effect, whereas in the latter one to no effect.

CONCLUSION

We confirmed the feasability of this new 3D method for assessing zygomatic symmetry.

CLINICAL RELEVANCE/APPLICATION

The use of this technique can help a precise planning for surgical reconstruction of zygomatic bones fractures.

SSQ15-06 Which Standardized T1-Weighted Brain MRI Template to Use in Studies on Older Adults?

Thursday, Nov. 29 11:20AM - 11:30AM Room: S503AB

Participants
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PURPOSE

Atlas-based MRI investigations on older adults typically utilize young adult standardized structural templates, such as those of the ICBM. In addition, a quantitative assessment of how different available standardized structural templates perform in an aging population has not yet been performed. Here, a new standardized T1-weighted template designed specifically for studies on older adults was developed and compared to 15 other standardized templates in terms of image quality and inter-subject spatial normalization accuracy.

METHOD AND MATERIALS

T1-weighted brain MRI data from 222 non-demented older adults (65-95 age-range, male: female=1:1) participating in the Memory and Aging Project were included in this work. A template was constructed from these data based on ANTs registration and is referred to in the following as the IIT-Aging template. The IIT-Aging template and 15 other standardized templates were compared in terms of image sharpness by means of the normalized power-spectral density. All templates were also compared in terms of the inter-subject spatial normalization accuracy achieved when used as references for normalization of T1-weighted data from 222 non-demented ADNI participants. Normalization accuracy was assessed for each template by means of the average pair-wise normalized cross-correlation, standard deviation, and average absolute log-Jacobian determinant in gray matter of ADNI participants.

RESULTS

The IIT-Aging template has higher image sharpness compared to other templates, also demonstrated as higher energy at high spatial frequencies in the normalized power spectra Fig (A, B). Inter-subject spatial normalization accuracy was higher when using the IIT-Aging compared to all other templates Fig (C, D). The IIT-Aging and MCALT templates required lower spatial deformation for spatially normalizing ADNI datasets Fig (E).

CONCLUSION

The new IIT-Aging T1-weighted template is characterized by superior image quality and allows higher inter-subject spatial normalization accuracy for studies on older adults, compared to other available standardized templates.

CLINICAL RELEVANCE/APPLICATION

Evaluate older adult templates for use in aging population

SSQ15-07 Three Dimensional Deep Neural Network Based Multi-Modality and Multi-Organ Automatic Segmentation for Brain Radiosurgery

Thursday, Nov. 29 11:30AM - 11:40AM Room: S503AB

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PURPOSE

Tumor and critical organ delineation is the most critical step in automatic stereotactic radiosurgery (SRS) treatment planning workflow for brain metastases. Recent progress in 3D convolutional neural networks has made it feasible to produce voxel-wise predictions of volumetric images and provide a powerful tool for automatic segmentation. The present study aims to develop a 3D convolutional networks algorithm for tumor and multi-organ segmentation on multi-modality imaging including contrast-enhanced computed tomography (CTc) and contrast-enhanced T1-weighted magnetic resonance imaging (MRI-T1c).

METHOD AND MATERIALS

Our training and testing dataset are acquired from one brain metastases cohort (n=95) treated with SRS using CyberKnife system. Each data included volume mask for brain tumors, brain stem, optic chiasm, bilateral eyes and optic nerves with associated CTc and MRI-T1c. We develop a workflow to organize the raw data, perform image preprocessing including data augmentation and registration, construct 3D U-Net models containing 19 million parameters, train and test the models then visualize the results. The workflow was developed by using Python 3.5 programming language and Google TensorFlow framework. All models were trained on NVIDIA Tesla P100 or V100 GPUs.

RESULTS

Our preliminary results of DICE scores for tumors and multi-organs ranged around 0.72-0.76 and 0.58-0.64 in the training set for CTc and MRI-T1c images, respectively. The DICE scores for the testing set for multi-organs ranged from 0.53-0.61 for CTc and 0.46-0.51 for MRI-T1c images.

CONCLUSION

The present work demonstrated the feasibility of simultaneous tumor and multi-organ segmentation using 3D neural network based on multi-modality imaging. Further work to elaborate the algorithm and incorporate it into SRS planning process is warranted and will shed light on future automated radiation therapy workflow.

CLINICAL RELEVANCE/APPLICATION

Simultaneous tumor and multi-organ segmentation is the very first step in automatic radiotherapy treatment planning, and multi-modality imaging schemes will help the precise delineation of the target region. The combined approaches will possess the key position in comprehensive automatic radiotherapy workflow.

SSQ15-08 Deep Learning Segmentation for Detection of Brain Metastases in the Small Data Regime

Thursday, Nov. 29 11:40AM - 11:50AM Room: S503AB

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PURPOSE

Detecting brain metastases can be a tedious and time-consuming task for many radiologists, particularly with the routine use of 3D imaging. By leveraging a fully CNN's ability to learn from the detailed pixel-wise labels of segmentation data, we have trained a network that can scalably detect brain metastases on MRI.

METHOD AND MATERIALS

In this retrospective cohort study at a single academic institution, we included 48 pre-surgical patients who had brain metastases from several primary malignancies. MRIs, all of which included a contrast-enhanced axial IR-prepped FSPGR T1-weighted images, were performed on a combination of 1.5T (n=8) and 3T (n=40) scanners. 42 patients were used for training, and 6 patients were used for testing. The input to our segmentation network is a 2D image slice from the aforementioned sequence. Manual segmentation was performed by an experienced neuroradiologist using OsiriX software by drawing region of interests around each enhancing metastatic lesion. We used a GoogLe net architecture modified for segmentation.

RESULTS

The mean age of patients was 63.7 yrs (range: 29-90 yrs). Primary malignancies included 29 lung, 13 breast, 3 melanoma, 1 esophageal, 1 renal, and 1 multiple cancers in the setting of Li Fraumeni syndrome. The test set of 6 patients had a total of 38 lesions. Our segmentation IoU (averaged per scan) was 0.46. We detected brain metastases at a sensitivity of 0.89 with a false positive rate of 5 lesions per scan. Similar experiments were done with a variety of different network architectures with very similar results. Adding additional slices as input channels (i.e., 2.5D) yielded similar results.

CONCLUSION

Even training with as few as 48 patients, our network could learn and provide usable results and ultimately yielded high sensitivity for the detection of brain metastases. By leveraging pixel-data, our network could learn from richer pixel-wise target labels rather

than construct robust features from scan-wise class labels.

CLINICAL RELEVANCE/APPLICATION

Our study provides proof of concept for the application of a widely available deep learning network to detect brain metastases on contrast-enhanced MRI with high sensitivity and illustrates the potential use of this technique in a clinically relevant setting.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Daniel L. Rubin, MD, MS - 2012 Honored EducatorDaniel L. Rubin, MD, MS - 2013 Honored Educator

SSQ15-09 Dictionary Based T1 Mapping Algorithm for the Tri-TSE Pulse Sequence

Thursday, Nov. 29 11:50AM - 12:00PM Room: S503AB

Participants
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PURPOSE

Quantitative T1 mapping provides absolute measures of tissue hydration and integrity. In addition it facilitate cross-platform comparison. Traditional T1 mapping can be slow, thus it has not been adopted in clinical settings by radiological community. Most qT1 methods require solving steady-state Bloch equations for each voxel, which is time consuming and generates numeric solution. Here, we propose using two standard clinical sequences, T1-weighted single echo (SE) and dual echo (DE), as well as an adaptive T1 dictionary, to efficiently and accurately access T1 relaxation in addition to T2 map generated from DE.

METHOD AND MATERIALS

Theory and data analysis scheme is illustrated. Briefly, instead of solving the non-linear equation, we establish a dictionary for each T1 values in the 0 to 5000ms (interval=0.01ms) range, by calculating the corresponding PVRdictionary (the signal ratio of SSE and SDE1)using the Bloch equation. To generate T1 map, the minimal absolute difference between obtained PVRvoxel and PVRdictionary was used to quickly identify the matching T1. The algorithm was tested on 20 clinical subjects without radiological findings or exposure to Gd, using a 3T system (Ingenia, Philips, Best, The Netherlands). The key parameters were: TRSE/DE=500/2129ms, FA= 90, ES=10ms, ETLSE/DE=7/14. The study was approved by our IRB. Data was analyzed in Matlab (Mathworks, MA). Histogram of T1/T2 values for each subject was also generated.

RESULTS

Representative T1/T2 maps from a subject were shown. The corresponding T1/T2 histograms of the whole brain were shown. The average of all patients, the peak value of gray matter was 1267.036.4ms, white matter 771.438.8ms. The averaging processing time for T1 map is 78.8±4.4s.

CONCLUSION

The combination of clinical available SE/DE sequence and dictionary searching method provides an accurate and efficient T1 mapping in addition to T2 maps provided by DE, hence, have the potential for facilitating the adaption of quantitative MRI in the clinical setting.

CLINICAL RELEVANCE/APPLICATION

The triFSE sequence are commonly available and could provide T1/T2-weighted images that match diagnostic standards. Our method creates additional relaxometry measures without extra time burden in clinics, which would have an impact on cross-platform researches, and also provide a better quantitative tool to understand diseases.

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/ Hernan Jara, PhD - 2014 Honored Educator

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

SSQ16

Neuroradiology (Cervicocranial Vascular Imaging)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S504AB

MR NR VA

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

FDA Discussions may include off-label uses.

Participants
Seung-Koo Lee, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose
Jayapalli R. Bapuraj, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SSQ16-01 Individually Targeted CO2 CVR with BOLD MR Imaging is Safe and Well-Tolerated in a Large and Diverse Clinical Cohort

Thursday, Nov. 29 10:30AM - 10:40AM Room: S504AB

Awards
Student Travel Stipend Award

Participants
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PURPOSE

To retrospectively assess, in a large and diverse clinical population, the feasibility, safety and tolerance of cerebrovasuclar reactivity (CVR) mapping with a well-controlled CO2 stimulus protocol. Images were obtained using blood oxygen level-dependent (BOLD) magnetic resonance (MR) imaging during the CO2 protocol.

METHOD AND MATERIALS

We performed a retrospective chart review of all CVR studies at a tertiary care hospital between Jan 1, 2006 and March 19, 2018. The CO2 protocol included elevations in CO2 over resting baselines between 10 and 15 mmHg. Demographic data, past medical history, incidence of adverse events and reasons for failed examinations were collected in addition to study parameters. The diagnostic quality of CVR mapping was conducted by two independent and blinded observers. Studies were graded as good, diagnostic but suboptimal, non-diagnostic, requiring reassessment or failed/missing. Data are presented as raw values using descriptive statistics (means +/- standard deviations), and inter-observer variability was evaluated using the intra-class correlation coefficient.

RESULTS

One thousand fifty consecutive CVR examinations from 597 patients (47.5% male patients) were studied. Patient age ranged from 9 to 88 years (mean age, 55.0; median 46.8). There were no cerebrovascular accidents, myocardial infarctions, or other major complications. The success rate of generating diagnostic scans was 70.0% (735 of 1050) and those requiring reassessment was 17.4% (183 of 1050). Among the 735 diagnostic examinations, good quality CVR maps were obtained in 672 (64.0%) and diagnostic but suboptimal in 63 (6.0%). Of the 315 non-diagnostic and failed scans, 67 (24.0%) were due to discomfort, 27 (8.6%) due to head motion, 8 (2.9%) due to inability to cooperate, 19 (6.8%) due to technical difficulties, and 158 (55.6%) due to unknown or unspecified conditions. Factors that influenced the successful completion of these scans included patient characteristics such as anxiety, claustrophobia or a pre-existing medical condition.

CONCLUSION

Prospectively targeted CO2 stimulus for CVR mapping with BOLD MR imaging is technically feasible and well tolerated. Importantly, in this large and diverse clinical cohort, patient safety was maintained.

CLINICAL RELEVANCE/APPLICATION

Prospectively targeted CO2 stimulus with BOLD MR imaging is a safe and effective technique for imaging cerebral vascular activity in a diverse clinical population.

SSQ16-02 Visualizing Wall Enhancement Over Time in Unruptured Intracranial Aneurysms Using 3D Vessel Wall Imaging

Thursday, Nov. 29 10:40AM - 10:50AM Room: S504AB

Participants
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PURPOSE

High resolution MRI vessel wall imaging provides important capabilities in assessment of intracranial vascular disease including intracranial aneurysms. This study aims to compare the aneurysm wall visualization on pre- and post- 3D isotropic T1-weighted SPACE images and to explore whether there is a change in wall enhancement at follow up.

METHOD AND MATERIALS

Twenty-nine patients with thirty-five unruptured intracranial aneurysms were scanned on a 3T Siemens Skyra scanner with pre- and post-contrast 3D T1-weighted SPACE (0.5mm isotropic). Follow up studies were performed on all patients. Aneurysm wall visibility and enhancement scores were assigned by three neuroradiologists on pre- and post-contrast SPACE respectively. The aneurysm wall visibility between pre- and post-contrast images as well as the wall enhancement between follow up and baseline studies were compared. Differences in wall visibility and enhancement were also investigated as a function of aneurysm diameter and location.

RESULTS

Agreement among three reviewers in grading wall visibility and enhancement was excellent. Post-contrast images had significantly higher wall visibility. A wall enhancement score >=2 was found on 71% (25/35) of the aneurysms. Changes in levels of wall enhancement were found on 17% (6/35) of the aneurysms at follow up studies, but those changes were small. Wall visibility and enhancement scores of large aneurysms were significantly higher than that of small aneurysms.

CONCLUSION

3D T1-weighted high resolution SPACE can be used to assess changes in enhancement at follow up studies. Contrast SPACE image provides better aneurysm wall visibility and improves diagnostic confidence.

CLINICAL RELEVANCE/APPLICATION

Advances in vessel wall imaging techniques using high-resolution MR sequences now allow for improved visualization of the walls of intracranial vessels. In this study, we present results obtained with a 3D variable flip angle fast spin echo sequence (SPACE) to visualize the walls of intracranial aneurysms and to grade the extent of aneurysm wall enhancement in subjects whose aneurysms were monitored over time. Our studies showed that visualization of the aneurysm wall is significantly better on post-contrast images than on pre-contrast images, and the majority of unruptured aneurysms show wall enhancement. Furthermore, we found the wall enhancement scores to remain essentially unchanged on follow up studies.

SSQ16-03 Branching Pattern of Lenticulostriate Arteries in Moyamoya Disease and Atherosclerotic Moyamoya Syndrome by Whole-Brain Vessel Wall Imaging

Thursday, Nov. 29 10:50AM - 11:00AM Room: S504AB

Participants
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PURPOSE

Moyamoya disease (MMD) and atherosclerotic moyamoya syndrome (A-MMS) have a great overlap in luminal imaging, which brings difficulties to differential diagnosis. Whole-brain (WB) magnetic resonance vessel wall imaging (VWI) enables visualization of vessel wall structure and lenticulostriate arteries (LSAs) in one image setting, allowing distinguishing different vasculopathies. We hypothesized that the pattern of branching of the LSAs and vessel wall characteristics is different between the two diseases. For the purpose of the study, we made a comparative analysis of the pattern of branching of the LSAs and vessel wall characteristics using WB-VWI between MMD and A-MMS.

METHOD AND MATERIALS

WB-VWI was performed on 19 adult patients with clinically defined MMD and 21 adult patients with A-MMS. The pattern of branching of the LSAs (pattern 1=no dilation or proliferation, pattern 2=mild dilation and proliferation, pattern 3=dense dilation and proliferation), wall thickening pattern (eccentric and concentric), morphology of occluded middle cerebral artery (MCA) (plugged and vanishing), and intraluminal thrombosis (absent and present) were evaluated.

RESULTS

A total of 80 involved hemispheres were analyzed (38 in MMD and 42 in A-MMS). The pattern of branching of the LSAs was

different (P=0.004) between MMD (pattern 1=55.3%; pattern 2=31.6%; pattern 3=13.2%) and A-MMS (pattern 1=88.1%; pattern 2=7.1%; pattern 3=4.8%). Concentric wall thickening was more frequently observed in MMD than A-MMS (78.9% versus 21.4%, P < 0.001). Morphology of occluded MCA and intraluminal thrombosis were not statistically different between the two groups (P < 0.05 for both).

CONCLUSION

MMD has a distinct vascular pathophysiology in terms of the pattern of branching of the LSAs and wall thickening characteristics compared with A-MMS. WB-VWI enables the combination of vessel wall and LSA imaging, which together may improve the differentiation of MMD and A-MMS.

CLINICAL RELEVANCE/APPLICATION

(dealing with whole-brain MR vessel wall imaging) whole-brain MR vessel wall imaging detects distinct pattern of branching of the LSAs and wall thickening characteristics in patients with MMD and is recommended in the differential diagnosis of moyamoya disease and atherosclerotic moyamoya syndrome.

SSQ16-04 Strain Discontinuities in Carotid Atherosclerotic Plaques - A Novel Marker for Plaque Vulnerability?

Thursday, Nov. 29 11:00AM - 11:10AM Room: S504AB

Participants
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PURPOSE

We aim to develop and validate a novel method using ultrasound radiofrequency (RF) measurements to determine intraplaque inhomogeneities in the strain distribution with a high axial resolution.

METHOD AND MATERIALS

Ultrasound examinations were performed on common (CCA) and internal carotid arteries (ICA) of 22 patients, 17 with recent ischemic stroke / transient ischemic attack and 5 asymptomatic patients (39 CCAs and ICAs). The strain distribution was computed from RF data with a depth resolution <0.5mm using a custom MATLAB algorithm. In the plaque-free CCA, the radial wall strain was compared with the relative diameter change to validate the strain computation. Two observers analyzed the data for intra-observer variation analysis. In the ICAs, strain inhomogeneities in symptomatic and asymptomatic plaque were studied.

RESULTS

Within the CCA wall, the strain (observer 1: -7.4±2.7%, observer 2: -6.4±2.6%) had reasonably good intra-subject precision (1.6%) and accuracy (correlation with relative distension, observer 1: r=0.69; p<0.0001, observer 2: r=0.68; p<0.0001). Intra-observer variability had an ICC of 0.681 (two-way mixed, single measure). In the ICA, strain inhomogeneities had an elongated shape (mean: 0.7x11mm) and demarcated in 58% of the cases the plaque-adventitia boundary. The percentage of ICAs with 1 or more strain inhomogeneities was increasing with the degree of stenosis (p=0.03, 95%-CI). Strain inhomogeneities were more frequent in ICAs at the symptomatic side of stroke/TIA patients as compared to the contralateral arteries and both carotid arteries of the asymptomatic subjects combined (odd's-ratio=4.7; p=0.07). In contrast to the average strain, strain in the deviating strain regions was higher at the symptomatic compared to the asymptomatic side (p=0.02).

CONCLUSION

The proposed method to assess local radial strain distribution proved to be accurate and precise in the CCA. In the ICA, areas with high strain inhomogeneities were more frequent in symptomatic plaques as compared to asymptomatic plaques. These strain inhomogeneities could be a promising novel marker for plaque vulnerability.

CLINICAL RELEVANCE/APPLICATION

Rupture of atherosclerotic plaques is an important underlying cause of stroke and is ultimately a biomechanical event. Local ultrasound strain measurements may identify vulnerable plaques.

SSQ16-05 Quantitative Susceptibility Mapping Analysis of Carotid Intraplaque Hemorrhage

Thursday, Nov. 29 11:10AM - 11:20AM Room: S504AB

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PURPOSE

Intraplaque hemorrhage is considered an important factor in carotid plaque vulnerability. We investigated whether quantitative susceptibility mapping (QSM) can be used to characterize the composition of carotid plaques and to detect intraplaque hemorrhage.

METHOD AND MATERIALS

We obtained 3T MR data on 9 carotid plaque specimens from 9 patients who had undergone carotid endarterectomy. QSM images were generated using the morphology-enabled dipole inversion method. One radiologist measured the susceptibility values (SVs) on QSM images by using a region-of-interest (ROI) method. Pathologists performed histo- and immunopathologic analyses for tissue characterization and the identification of intraplaque hemorrhage. Areas immunopositive for glycophorin A, a sialoglycoprotein of the red blood cell membrane, were semi-quantified using color image analysis software. These areas were expressed as the ratio of positively-stained areas per ROI area (PSA/RA). The relationship between the mean SVs and the PSA/RAs was assessed using the Spearman rank correlation coefficient.

RESULTS

We examined 24 areas (intraplaque hemorrhage, n=7; lipid-rich necrotic core, n=7; calcification, n=10). The average SV for intraplaque hemorrhage, lipid-rich necrotic core, and calcification was 201 ± 115 parts per billion (ppb), -10.8 ± 17.3 ppb, and -157.7 ± 78.1 ppb, respectively. The difference in the mean SV among the three tissue components was statistically significant ($p < 0.05$). The PSA/RA was positively correlated with the mean SV ($r=0.65$, $p<0.0001$).

CONCLUSION

Our preliminary study suggests that QSM can be used to characterize the carotid plaque composition and to detect intraplaque hemorrhage.

CLINICAL RELEVANCE/APPLICATION

QSM is useful for evaluating the presence of carotid intraplaque hemorrhage.

SSQ16-07 Deep Learning based Computer-Aided Detection of Unruptured Cerebral Aneurysms

Thursday, Nov. 29 11:30AM - 11:40AM Room: S504AB

Awards
Student Travel Stipend Award

Participants
Saori Koshino, MD , Tokyo, Japan (*Presenter*) Nothing to Disclose
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PURPOSE

To demonstrate the usefulness of deep learning based Computer-Aided Detection (CAD) for reader performance in detecting unruptured cerebral aneurysms from the data of MR Angiography (MRA).

METHOD AND MATERIALS

100 head MRA datasets (39 men and 61 women; mean age, 63.8 years ± 12.3; mean aneurysm size, 3.5 mm ± 1.3), 40 with one or more unruptured cerebral aneurysms and 60 without, were retrospectively evaluated. Twenty doctors (10 expert radiologists, and 10 non-specialists) were asked to detect cerebral aneurysms on MRA scans with associated projection images. The readers indicated their confidence level rating on a visual analog scale for each detected lesion, first without and then with CAD output. Our CAD algorithm consisted in the following steps: (1) volume reconstruction from MRA images; (2) vessel segmentation using a threshold-based method; (3) key point extraction based on principal curvature method; (4) ranking of key points using a deep learning method (convolutional neural network composed of 39 convolutional, one average pooling, and one fully connected layers); (5) clustering of the key points with score higher than 0.5. The observers' performance was evaluated using receiver operating characteristic (ROC) and jackknife free-response ROC curves.

RESULTS

For the cases used in this study, the sensitivity of the CAD software was 90.5% (57/63) with an average of 1.6 false-positive detections per case. Using the software, the area under the inferred ROC curve (AUC) improved on average from 0.850 to 0.888 across all readers ($P = 0.0002$). The AUC for non-specialists improved from 0.794 to 0.855 ($P = 0.0006$) and from 0.910 to 0.926 for expert radiologists ($P = 0.0236$). The figure-of-merit values computed using the jackknife free-response ROC program improved from 0.735 to 0.810 for non-specialists ($P = 0.0001$) and from 0.884 to 0.908 for expert radiologists ($P = 0.0064$). Whereas the average sensitivity increase from 90.3% to 93.1% for expert radiologists was not statistically significant, average sensitivity significantly improved from 67.9% to 80.1% for non-specialists.

CONCLUSION

The diagnostic accuracy of cerebral aneurysms improved among all readers with the use of CAD.

CLINICAL RELEVANCE/APPLICATION

In the detection of unruptured cerebral aneurysms, the use of CAD can reduce the oversight of radiologists, and enable non-

in the detection of unruptured cerebral aneurysms, the use of CAD can reduce the oversight of radiologists, and enable non-specialists to improve their reading performance as an educational tool.

SSQ16-08 4D Flow MRI Analysis of Cerebral Blood Flow before and After Extracranial-Intracranial Bypass Surgery for Atherosclerotic Disease

Thursday, Nov. 29 11:40AM - 11:50AM Room: S504AB

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PURPOSE

The purpose of this study was to clarify the change in the hemodynamics after superficial temporal artery to middle cerebral artery (STA-MCA) bypass surgery for atherosclerotic steno-occlusive disease by using time-resolved 3D-phase contrast (4D Flow) MRI.

METHOD AND MATERIALS

We retrospectively enrolled 20 patients (14 men; mean age 63.9) undergoing STA-MCA bypass surgery for internal carotid artery (ICA) stenosis (10 pt.) and MCA stenosis (10 pt.). We excluded moyamoya disease. All patients underwent 4D Flow MRI preoperatively and 3 weeks after surgery. The imaging parameters; 3.0-T MRI (Achieva, Philips), TR/TE = 8.4/5.4, VENC = 100cm/sec, voxel size = 0.82X0.82X1.4mm, heart phase = 15, scan time = approx. 6 min. We measured blood flow volume (BFV) of bilateral ICAs, basilar artery (BA), and bilateral STAs using GT Flow (Gyro Tools). The BFV of each vessel and total brain BFV (total-BFV = bilateral ICAs + BA + ipsilateral STA (after surgery)) was compared between before and after surgery with the paired t-test. We evaluated postoperative hyperperfusion syndrome based on the clinical chart.

RESULTS

4D Flow MRI data were successfully generated in all patients. Hyperperfusion syndrome occurred in 1 case. BFV of ipsilateral STA significantly increased after surgery (0.53 ± 0.22 vs. 1.78 ± 0.54 ml/sec ($p < 0.001$)). BFV of ipsilateral ICA significantly decreased after surgery (2.37 ± 5.09 vs. 1.82 ± 3.42 ml/sec ($p = 0.03$)). While, no significant difference was observed in total-BFV (12.40 ± 5.55 vs. 12.94 ± 6.71 ml/sec ($p = 0.24$)) or BFV of contralateral ICA (5.14 ±5.87 vs. 4.72 ± 4.60 ml/sec ($p = 0.06$)), BA (4.89 ± 2.89 vs. 4.61 ±2.48 ml/sec ($p = 0.11$)), and contralateral STA (0.33 ± 0.06 vs. 0.40 ±0.06 ml/sec ($p = 0.07$)) between before and after surgery.

CONCLUSION

BFV of ipsilateral STA significantly increased after surgery. While, there was no significant difference in total-BFV between before and after surgery. It may indicate that ipsilateral STA and native intracranial arteries (i.e., bilateral ICAs and BA) supply blood flow complementarily after surgery.

CLINICAL RELEVANCE/APPLICATION

4D Flow MRI can quantify the change of hemodynamics after EC-IC bypass surgery for intracranial atherosclerotic steno-occlusive disease.

SSQ16-09 Imaging Characterization and Differentiation of Intracranial Vasculopathies Using 3T MR Vessel-Wall Imaging

Thursday, Nov. 29 11:50AM - 12:00PM Room: S504AB

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PURPOSE

The purpose of this study is to evaluate the ability of MR VWI to differentiate between various types of intracranial vasculopathies.

METHOD AND MATERIALS

Patients who presented with new non-traumatic intracranial hemorrhage and/or MRI-confirmed ischemic stroke and who also demonstrated vascular abnormalities suggestive of underlying intracranial vasculopathy on initial CT, MR or catheter angiography were identified between January 1, 2013 and July 1, 2017. All patients received our institution's MR VWI protocol (high-resolution multiplanar T1W pre- and post-contrast and 3D SPACE T2W sequences) and underwent CSF collection with or without image-guided brain biopsy. An expert clinical neurologist panel retrospectively evaluated each patient's history, imaging, labs, and

pathology in order to produce a consensus diagnosis of the underlying vasculopathy. A radiologist, blinded to patient identity and diagnosis, evaluated each MR VWI study. The distribution and severity of intracranial vascular stenoses, vessel wall thickening, and vessel wall enhancement were assessed. Statistical analysis was performed in order to identify the correlation between these imaging features and the specific underlying vasculopathy.

RESULTS

Thirty-eight patients (22F, 16M) were included in the final analysis. Reversible cerebral vasoconstriction syndrome (RCVS) presented with an average of 5 stenoses per patient which was the largest number of stenoses per patient amongst all of the vasculopathy types evaluated. RCVS was 4.6 times more likely to demonstrate moderate-to-severe stenoses than infectious vasculopathies (p=9.73E-05). Infectious vasculopathies presented with the greatest number of enhancing lesions per patient, with varicella zoster virus (VZV) vasculitis and miscellaneous infectious vasculopathies presenting with on average 4.7 and 4.3 enhancing lesions per patient, respectively. Overall, these infectious vasculopathies were 2.3 and 2.7 times more likely to show enhancing lesions relative to RCVS (p=0.045).

CONCLUSION

MR VWI can aid in differentiating intracranial vasculopathies based on imaging features. Infectious vasculopathies are more likely to demonstrate abnormal vessel-wall enhancement whereas RCVS is more likely to demonstrate high grade multifocal stenoses.

CLINICAL RELEVANCE/APPLICATION

Pertinent MR VWI findings may be used to both guide therapy decisions and monitor patient response as well as to direct surgical biopsy.

SSQ17

Physics (CT: Imaging Performance)

Thursday, Nov. 29 10:30AM - 12:00PM Room: N229

CT PH

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

Participants
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Sub-Events

SSQ17-01 Radiopaque 3D Printing of Patient Phantoms for Computed Tomography and Radiation Therapy

Thursday, Nov. 29 10:30AM - 10:40AM Room: N229

Participants
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PURPOSE

To develop methods for 3D printing realistic anthropomorphic phantoms of individual patients for simulation of patient exposure in computed tomography and radiation therapy.

METHOD AND MATERIALS

In a first step, patient CT images are printed with inkjet technology and radiopaque ink on paper. In a second step, the printed paper sheets are processed with paper based 3D printing methods to mechanically stable phantoms with the attenuation properties and the external contour of the patient. The resulting patient phantoms are examined in the CT scanner (Canon Aquilion One and Aquilion Prime). Acquisition parameters (tube voltage, tube current, acquisition mode, pitch, reconstruction technique) are systematically combined and dose and image quality are analyzed.

RESULTS

Radiopaque 3D printing achieves detailed patient phantoms with individual anatomy and pathology. Phantom Hounsfield units correlate linearly with patient Hounsfield units ($r = 0.9925$) and phantom attenuation values correspond to patient values for different radiation energy levels. Systematic analysis of 72 combinations of acquisition and reconstruction parameters on patient phantoms yields a dose optimum with automated tube potential selection in combination with automated tube current modulation, volume acquisition and iterative reconstruction. Dose reduction potential of iterative reconstruction is >60% in comparison with filtered back projection.

CONCLUSION

Radiopaque 3D printed patient phantoms provide a detailed simulation of patient exposure and allow systematic investigation of dose and image quality.

CLINICAL RELEVANCE/APPLICATION

Realistic patient phantoms allow systematic development and analysis of dose reduction, optimization and imaging techniques.

SSQ17-02 Rapid Measurement of Low Contrast Detectability

Thursday, Nov. 29 10:40AM - 10:50AM Room: N229

Participants
Scott S. Hsieh, MS, Los Angeles, CA (*Presenter*) Nothing to Disclose
Akinyinka O. Omigbodun, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
John M. Hoffman, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Low contrast detectability (LCD) is a metric of fundamental importance in CT imaging, but cannot easily be measured with nonlinear reconstruction methods because concepts such as contrast-noise ratio (CNR), modulation transfer function (MTF) and noise power spectrum (NPS) do not directly apply. We introduce a new framework for rapidly measuring LCD using model observers with a single scan.

METHOD AND MATERIALS

We place a large number of low-contrast markers into the field of view and assess their detectability using a model observer. In this work, we used a non-prewhitening (NPW) observer that searches the image for candidate marker locations by subtracting an estimate of the local background signal, convolving with a template disk image, and then identifying local maxima above a response threshold. More sophisticated alternatives to NPW could also be used. By varying the threshold, we can produce free-response ROC curves. We used this framework to compare iterative reconstruction (IR) with filtered backprojection (FBP) in simulations. We also tested the framework on experimental data, fabricating a phantom consisting of small polycarbonate spheres interspersed in acrylic spheres and placed in 13.5% sugar solution. The sugar solution was iso-attenuating with acrylic, leading to a dispersion of low-contrast polycarbonate bead markers of about 20 HU.

RESULTS

In simulations with anisotropic noise, IR+NPW showed consistently better performance than FBP+NPW, with sensitivity at one false positive (FP) of 80% compared to 57%. With uniform noise, the difference disappeared and the sensitivities at 1 FP were 70% and 67% for IR+NPW and FBP+NPW, respectively. Experimental scans demonstrated the feasibility of low-contrast automated detection (of polycarbonate spheres) with an easily constructed phantom.

CONCLUSION

An objective metric for LCD can be produced by scanning a specialized, target-rich phantom and using model observer software. This framework holds equally well for iterative or analytic reconstruction algorithms, and could be used for comparison of scanners, assessment of new reconstruction algorithms, or routine quality assurance.

CLINICAL RELEVANCE/APPLICATION

Automatic detection of LCD could be used in routine quality assurance and could also be used to elucidate conditions (for example, non-uniform statistics) that affect detectability.

SSQ17-03 Diagnostic Accuracy of Sub-Millisievert Coronary CT Angiography on 16cm Wide-Detector CT Using 70kVp for Patients with High Heart Rate: Comparison with Digital Subtracted Angiography

Thursday, Nov. 29 10:50AM - 11:00AM Room: N229

Awards
Student Travel Stipend Award

Participants
Yuhuan Chen, MD, Xianyang, China (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate the image quality and diagnostic accuracy of coronary CT angiography (CCTA) on a 16cm wide-detector CT using 70kVp for patients with high heart rate using Digital Subtracted Angiography (DSA) as reference standard.

METHOD AND MATERIALS

Forty-three patients with heart rates higher than 80 bpm underwent both CCTA on a 256-row, 16cm wide-detector CT (Revolution CT) and DSA. All CCTA scans were acquired in one heart beat with bolus-tracking technique using 70 kVp and automatic tube current modulation for noise index of 36HU at 0.625mm image thickness, and at weight-dependent contrast dose rate of 16mgI/kg/s for 8s injection. Images were reconstructed at the best cardiac phase with the least motion with 80%ASIR-V and with Snapshot Freeze Motion Correction in all patients. Two experienced cardiovascular radiologists and two cardiovascular specialists evaluated the subjective and objective image quality of CCTA study and the DSA results, separately and independently . CCTA performance for diagnosing >=50% stenosis was analyzed against the DSA results. The sensitivity and accuracy of CCTA were calculated. The volumetric CT dose index (CTDIvol), dose length product (DLP) were recorded to calculate the effective dose.

RESULTS

The mean heart rate was 96.2±17.1bpm (range: 81-156bpm). The mean effective radiation dose was 0.46?±?0.21 mSv. All CCTA images were deemed to have diagnostic quality, and 94.2% (650/690) of the coronary segments were analyzed for stenosis. Using DSA as the reference standard, sensitivity and accuracy for diagnosing >=50% stenosis with CCTA were 100% and 90.7% on a per-patient basis. These values were 92.3% and 89.0% on the per-vessel basis and 77.6% and 87.2% on the per-segment basis.

CONCLUSION

CCTA on a 16cm wide-detector CT using low tube voltage of 70kVp provides high quality images and high accuracy for diagnosing stenosis at sub-millisievert radiation dose even for patients with high heart rates.

CLINICAL RELEVANCE/APPLICATION

CCTA with 70kVp on 16cm wide-detector CT that enables 1-beat imaging at sub-mSv radiation may be used to provide high image quality and diagnostic accuracy for cardiac patients with heart rates.

SSQ17-04 Low Contrast Detectability Observer Study For Four Different Reconstruction Algorithms in CT

Thursday, Nov. 29 11:00AM - 11:10AM Room: N229

Participants
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PURPOSE

This report performs a comparative human and model observer study for low contrast detectability, following the MITA recommendations. Standard filtered backprojection (FBP) is compared to model based iterative reconstruction (MBIR) and two different methods for noise reduction in image space: edge preserving denoising and deep learning algorithm.

METHOD AND MATERIALS

Data was scanned 50 times at 3 different dose levels each using MITA low contrast module phantom and subsequently reconstructed with the aforementioned four reconstruction methods. We used 120kV scans with 50, 40 and 30 mAs. Dose levels were chosen to be low enough to make the signals seemingly saturated with noise, making the detectability task difficult in standard FBP for a human observer. Eight human observers were asked to review obtained images using 4-alternative-forced-choice method with 3 signal-absent images and 1 signal-present image. The objective was to understand the capability of advanced image reconstruction methods to improve the low contrast detection over the standard FBP reconstruction. The same images were also fed into a publically available model observer tool to understand whether a model observer can be used in place of human observers in the future examinations.

RESULTS

Human observers consistently performed with approximately two times higher detectability indices in images reconstructed using MBIR when compared to the standard FBP. A similar result was also repeated in detectability indices for images denoised by the deep learning method. An edge preserving denoising used in this study had relatively same detectability index as the standard FBP (between 0.8 and 1.2). Model observer technique for low contrast detectability task performed with similar trends as the human observers, but absolute values for the detectability indices were higher by a factor of 1.5.

CONCLUSION

Advanced reconstruction and noise reduction methods can improve the low contrast detectability indices in CT imaging, but not all methods perform the same way. One has to perform tuning when attempting to replace human observers with the model observers.

CLINICAL RELEVANCE/APPLICATION

Low contrast detectability tests with MITA phantom and diagnostic tasks in liver and brain studies are closely related. Clinical users should expect an improved performance in imaging with MBIR and deep learning algorithms, when compared to the standard reconstruction methods.

SSQ17-05 The Weight of ASiR-V in Low Radiation Dose Craniocerebral CT Scan

Thursday, Nov. 29 11:10AM - 11:20AM Room: N229

Participants
Dong Han, MD, Xianyang, China (*Presenter*) Nothing to Disclose
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PURPOSE

To explore the weight of ASiR-V under low radiation dose craniocerebral CT scan that was comparable that obtained in conventional scanning

METHOD AND MATERIALS

60 Patients who underwent craniocerebral CT scan were prospectively and randomly divided into two groups. Group A (n=30) use conventional 120kVp scanning protocol while group B (n=30) use 100kVp scanning protocol.The data in Group A were reconstructed with ASiR-V 50% images while the data in Group B were reconstructed with ASiR-V weights of 60%, 80% and 100% images. Three slices were selected in each group of patients. The CT values of bilateral frontal gray matter, parietal gray matter and centrum ovale white matter were measured at the centrum ovale slice. The CT values of bilateral frontal gray matter, temporal lobe gray matter, occipital lobe gray matter, lenticular and white matter were measured at the basilar nucleus slice. The CT values of bilateral cerebellum gray matter, temporal lobe gray matter, and white matter were measured at the cerebellum slice. The ROI were drawn in the front of the forehead to measure the air standard deviations (SD). SD of air is used as the background noise. Three slices of gray/white matter SNR were calculated and the CNR of gray-white matter were calculated. The subjective noise, contrast of gray-white matter and posterior fossa artifacts score was evaluated blindly by two radiologists independently using a 5-point scoring system.

RESULTS

The effective dose in group B (1.02mSv) decreased by 34.3% compared to group A (0.67mSv). Group B with ASiR-V 60% was only higher than group A ($p<0.01$), and the other was similar to group A (all $p>0.05$). Gray/white matter SNR with ASiR-V 100% was

higher than group A in the three slices (all p<0.05), and the other was similar to group A (all p>0.05). the gray-white matter-CNR with ASiR-V 80% and 100% was higher than group A in the basilar nucleus slice (all p<0.05), and the other was similar to group A (all p>0.05). There were no significant difference in noise, contrast of gray-white matter and posterior fossa between the Group B with ASiR-V 60% and Group A (all Adjust-p>0.05).

CONCLUSION

The image quality of ASiR-V 60% in group B was similar to group A in objective parameters and subjective evaluation in craniocerebral CT scan.

CLINICAL RELEVANCE/APPLICATION

In craniocerebral CT scan, low radiation dose scan combined with the increased ASiR-V weight could ensure adequate image quality.

SSQ17-06 Low-Contrast Detectability of Clinical CT Images in 3D Reformatted Planes

Thursday, Nov. 29 11:20AM - 11:30AM Room: N229

Participants
Jayse Weaver, Rochester, MN (*Presenter*) Nothing to Disclose
Lifeng Yu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

3D reformatted images are frequently generated in clinical CT for diagnostic purposes. Due to the difference between axial and 3D-reformatted images in terms of spatial resolution and noise correlation, it is unknown if the low-contrast detectability of 3D-reformatted images is comparable to that of axial images from the same data. The purpose of this work was to use a Channelized Hotelling Observer (CHO) to evaluate the index of detectability for low-contrast objects of various sizes in the coronal plane compared to in the axial plane.

METHOD AND MATERIALS

A 3D-printed phantom with embedded spheres of various sizes and contrast levels was scanned 50 times on a 192-slice scanner (Force, Siemens) to provide an ensemble dataset for CHO calculation. Images were reconstructed in the axial and coronal planes using filtered backprojection (FBP) with a Br40 kernel and an iterative reconstruction (IR) method (ADMIRE, Siemens) with the same Br40 kernel but two strength settings, Br40-3 and Br40-5. The reconstruction planes were across the center of the spheres. Pixel size was kept the same between reconstructions. A CHO with 12 Gabor channels (previously validated against human observer performance) was used to calculate the index of detectability, d', for two low contrast spheres (3 and 9 mm in diameter, both with a contrast of -36 HU from background) in the axial and coronal planes.

RESULTS

For FBP, d' in the coronal plane was similar to that in the axial plane for both size spheres (9 mm: 5.78±0.58 in coronal vs. 5.87±0.61 in axial; 3 mm: 2.15±0.24 in coronal vs. 1.96±0.25 in axial). When IR was applied, d' improved over FBP for the large sphere in both planes, but the improvement in the coronal plane was less than that in the axial plane. For the smaller sphere, applying IR appeared to have no effect on d'.

CONCLUSION

Given the same slice thickness and reconstruction kernel, the low-contrast detectability was similar in the axial and coronal planes using the FBP reconstruction. When IR was used, the low-contrast detectability in coronal planes appeared to improve less than that in axial planes, especially for large objects.

CLINICAL RELEVANCE/APPLICATION

Low-contrast detectability in 3D-reformatted planes appears to be similar to that in routine axial planes using FBP reconstruction method. The performance may differ when IR is used.

SSQ17-07 Assessment of Beam-Hardening Artifact Reduction Effect on CT

Thursday, Nov. 29 11:30AM - 11:40AM Room: N229

Participants
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PURPOSE

To evaluate the effect of beam-hardening artifacts reduction technologies on 256 Multi-Detector wide-coverage CT and high-definition gemstone spectral CT(HDCT) by comparing the two CT models.

METHOD AND MATERIALS

A cylindrical plastic phantom with 9 hard plastic tubes which were filled with different concentrations(20, 10, 0 mgI/ml) of iodine

solution was used in phantom(The diameter is 18mm), the highest concentration (20mg/ml) is the center of the plastic phantoms , and the other 8 tubes were located clockwise in outer circle. The phantom was scanned using three different modes respectively: 1) a 256 Multi-Detector CT (Revolution CT) scanner equipped with Multi-Material Artifact Reduction (MMAR) technology and Volume High Definition (VHD) image reconstruction technology, which scans by axial mode(Group A),2) HDCT(Discovery CT)scans with conventional 120kvp mode(Group B) and GSI mode (Group C) were respectively performed. In each of the three groups, ROIs with the same area were placed on regions that were most significantly affected by beam-hardening artifact (between tubes with 20 and 10 mgI, 20 and 10 mgI, 20 and 0 mgI iodine solution). Image noise (SD) in these ROIs were measured and artifact index (AI) was calculated as AI2=SD2-SDb2 (SDb was the background noise).

RESULTS

The average image noise in the three groups (Group A, Group B and Group C) were 6.4±0.6,8.7±2.1 and 2.7±0.2, and the AI were 8.3±0.5,10.3±1.8 and 6.8±0.1 respectively. Compared with conventional 120kvp mode of HDCT, Revolution CT with VHD technology and MMAR technology, and GSI mode of HDCT can reduce image noise and AI, the effect of GSI mode is better than Revolution CT.

CONCLUSION

Revolution CT scan with VHD technology and MMAR technology, and HDCT-GSI mode can reduce hard-artifact index (AI), and improve image quality, but the effect of HDCT-GSI mode is best.

CLINICAL RELEVANCE/APPLICATION

256 Multi-Detector CT (Revolution CT) with 16 cm wide body detector, by one rotation can complete a single organ (such as the heart, brain, substantial / hollow organs) imaging .It return to the origin of CT scan- axial scan equipped with Multi-Material Artifact Reduction (MMAR) technology and Volume High Definition (VHD) image reconstruction technology for better image quality.

SSQ17-08 Evaluation of CT Image Quality and Liver Lesion Detectability with Different Dose Levels and Different Levels of the Iterative Reconstruction Algorithm ASiR-V

Thursday, Nov. 29 11:40AM - 11:50AM Room: N229

Participants
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PURPOSE

The aim of this study was to optimize image quality and dose levels with different levels of ASiR-V.

METHOD AND MATERIALS

A novel anthropomorphic liver phantom customized for quantitative and qualitative image analysis (Phantom Laboratory, NY US) was scanned at three different dose levels (CTDIvol 15, 10, and 5 mGy) and 120 kVp on a GE Revolution 16 CT scanner (GE Healthcare, Milwaukee, WI US). Images were reconstructed using a standard abdominal kernel and different levels of the iterative reconstruction (IR) algorithm ASiR-V (0-100%). Mean CT values, noise, signal to noise ratio (SNR), contrast to noise ratio (CNR), low contrast detectability and noise power spectrum (NPS) was analyzed. Noise texture deviation (NTD) was evaluated to look at IR specific artifacts. Lesion detectability was assessed on a 5-point scale by 5 readers. The areas under the receiver operating characteristic (ROC) curve were calculated.

RESULTS

Mean CT-values and low contrast detectability did not change with increasing level of ASiR-V. Compared to filtered back projection the noise was reduced while SNR and CNR increased for ASiR-V levels 10-100%. The NTD analysis showed that the mean NTD was not different from NTD calculated for FBP for ASiR-V 10-40 % for CTDI 15 mGy and ASiR-V 10-50 % for CTDI 10 and 5 mGy ($p>0.05$). Mean NTD increased to be different from FBP for ASiR-V 50-100% for CTDI 15 mGy and ASiR-V 60-100 % for CTDI 10 and 5 mGy ($p<0.05$). The area under the ROC curve increased with increasing level of ASiR-V. For the CTDIvol 15, 10 and 5 mGy reconstructing with 90%, 80 % and 100% ASiR-V gave the highest area under the ROC curve respectively. Lower dose levels reduced the lesion detectability, low contrast detectability, SNR and CNR. Preliminary analysis of the NPS showed that the peak frequency decreased slightly as the level of ASiR-V increased.

CONCLUSION

This study showed that increasing the level of ASiR-V improved liver lesion detectability when using a standard abdominal kernel. SNR and CNR increased at increasing level of ASiR-V while low contrast detectability remained constant. Noise texture deviation analysis showed that IR artifacts increased for higher levels of ASiR-V (above level 40%).

CLINICAL RELEVANCE/APPLICATION

Iterative reconstruction aims to reduce patient dose in CT. Lesion detectability and image quality need to be assessed to ensure satisfactory examination quality, which was the purpose in this study.

SSQ17-09 Technical Assessment of a Mobile CT Scanner for Image-Guided Brachytherapy: Image Quality, Dose, and Technique Protocols

Thursday, Nov. 29 11:50AM - 12:00PM Room: N229

Participants
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Marc Morcos, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

A technical assessment of imaging performance and radiation dose is reported for a recently introduced mobile CT scanner (Airo, Brainlab, Munich, Germany), with application to image-guided brachytherapy. Such quantitative assessment guides selection of technique protocols for pertinent imaging tasks and facilitates translation to new applications.

METHOD AND MATERIALS

Four studies were performed to assess 3D image quality and dose of the system: (1) Objective measures of uniformity and noise (20 cm diameter water phantom), HU accuracy and contrast (tissue-simulating materials (Gammex RMI)), and spatial resolution (modulation transfer function, MTF); (2) Visual image quality using anthropomorphic phantoms with realistic bone and soft-tissue anatomy of the head, chest, abdomen, and pelvis; (3) Image quality and artifacts measured using custom phantoms emulating transvaginal brachytherapy via cylindrical or tandem-and-ring applicators adjacent to soft-tissue; and (4) Radiation dose (CTDI) measured in 16 cm (head) and 32 cm (body) cylinders. Image quality and dose were assessed for manufacturer-specified techniques as well as custom protocols spanning a wide range of kV, mA, scan mode (axial or helical), smoothing kernel, and (optional) metal artifact reduction (MAR).

RESULTS

The technical assessment provided quantitative insight on system performance and limitations. Image uniformity and HU accuracy were within 5%, supporting dose calculation in brachytherapy. Helical scans (1.4 pitch) reduced dose and scan time compared to axial scans, but also reduced z-direction MTF and introduced windmill artifacts about high-contrast structures and instrumentation, diminishing soft-tissue visibility. Contrast and noise performance were sufficient for soft-tissue visualization in brachytherapy of the cervix and uterus. The MAR algorithm greatly improved soft-tissue visualization in the presence of needles and applicators.

CONCLUSION

The imaging system provided excellent accuracy and uniformity with sufficient contrast and spatial resolution for application in transvaginal brachytherapy. The technical assessment identified opportunities for dose reduction (lower kV protocols) and artifact reduction in helical scan mode.

CLINICAL RELEVANCE/APPLICATION

New mobile CT systems can improve precision and safety of image-guided interventions. Rigorous assessment of image quality and dose helps guide adoption and future application of such technology.

SSQ18

Physics (CT: Organ Dose)

Thursday, Nov. 29 10:30AM - 12:00PM Room: N228

CT PH

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

Participants
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Sub-Events

SSQ18-01 Estimating Embryo and Fetal Dose from Abdomen/Pelvis CT Scans That Use Tube Current Modulation

Thursday, Nov. 29 10:30AM - 10:40AM Room: N228

Participants
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PURPOSE

Estimates of embryo and fetal dose have previously been limited to fixed tube current exams. However, tube current modulation (TCM) is used routinely in clinical practice. Therefore, the purpose of this work is to develop patient size-specific CTDIvol-to-fetal-dose conversion coefficients from TCM abdomen/pelvis (A/P) CT exams of pregnant patients of various gestational ages.

METHOD AND MATERIALS

Twenty-four publicly available voxelized pregnant patient models were used in Monte Carlo (MC) simulations of A/P CT scans using TCM. The models represent a range of gestational ages from less than 5 to 36 weeks and have maternal and fetal anatomy identified from image data. Attenuation characteristics were estimated from simulated topograms of each voxelized patient model. Predicted TCM schemes were then generated for each patient model using a validated method that accounts for both patient attenuation and scanner model characteristics. Embryo and fetal doses were obtained by incorporating each TCM scheme into an MC source model of a 64-slice MDCT scanner, simulating the A/P exam and tallying dose to the fetus. If the fetus was not visible (i.e. early gestational age) then dose to the gestational sac or uterus was used to estimate embryo dose. Water equivalent diameter (Dw) was used as the size metric and was calculated at the image containing the three-dimensional geometric centroid of either the fetus or the gestational sac. All embryo and fetal doses were normalized by scan-specific 32 cm CTDIvol values based upon the average tube current across the entire simulated scan. Normalized embryo and fetal doses were then parameterized as a function of Dw using an exponential function similar to SSDE.

RESULTS

Embryo and fetal doses from the 24 simulated CT A/P exams using TCM demonstrate an exponential relationship between normalized dose and Dw which has a coefficient of determination of 0.79. This relationship is slightly different from that of SSDE, which is not an explicit representation of organ or fetal dose.

CONCLUSION

A method to estimate embryo and fetal dose that account for patient size (through Dw) and TCM has been developed which uses an exponential function similar to SSDE.

CLINICAL RELEVANCE/APPLICATION

Using this methodology, embryo and fetal dose at various gestational ages can be reasonably estimated with the scanner-reported CTDIvol and a metric of patient size such as Dw.

SSQ18-02 Web-Platform for Fast and Accurate Assessment of Radiation Dose Received by Conceptus in Clinical CT

Thursday, Nov. 29 10:40AM - 10:50AM Room: N228

Participants
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PURPOSE

Computed tomography (CT) is sometimes required during pregnancy. In this case the radiation dose received by conceptus should be evaluated. Existing methods are either limited in their accuracy or require complicated measurements and calculations. The aim of this study is to develop a web-based tool for radiation dose assessment received by conceptus in CT; validate this tool and implement it in clinical routine.

METHOD AND MATERIALS

The tool is based on the doses derived from Monte Carlo (MC) simulations performed for generic CT system on virtual phantoms, representing a range of various patient sizes and gestational ages. For validation, the values calculated by the online tool were compared against dose values calculated by detailed MC simulations performed on real patients' data. The data for 30 pregnant patients, underwent clinically indicated examinations on CT scanner of two different vendors (Siemens, GE) were collected. Detailed MC simulations took individual patient geometry and scan parameters into account. After the validation the software framework was designed in order to provide the free of charge access to the tool for multiple clients, without installing the software locally. The feedbacks from the users have been collected.

RESULTS

The validation of the tool has shown that the average error of the dose values calculated by the online tool was 23%, with the overestimation of about 41% in case of obese patients. The biggest error of 56% was found in patient when additional hardware (i.e. fixation device) was applied and visible in the reconstructed image, resulting in the higher current values applied by the CT system, and thus higher fetal dose values estimated by the program. The users have found the program convenient and intuitive for use in clinical routine. The average time required for calculating single patient case is less than 2 minutes.

CONCLUSION

The online platform provides fast and reliable evaluation of the radiation dose, received by conceptus from CT examination.

CLINICAL RELEVANCE/APPLICATION

This tool can be used by physicians for fetal dose assessment and performing risk-benefit analysis. It can be also used for training purposes.

SSQ18-03 The Impact of Scanning Heads Within a Dedicated Head Holder Versus the Table Top on Effective Mas, Image Quality, and CTDI

Thursday, Nov. 29 10:50AM - 11:00AM Room: N228

Participants
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PURPOSE

Often, especially in the CT trauma setting, heads must be placed on the table top instead of in a head holder. A head holder attenuates the beam less than the table top requiring less effective mAs to obtain the same image quality. The purpose of this study is to quantify this difference.

METHOD AND MATERIALS

264 adult head (193 head holder, 71 table top) head data was collected under IRB approval. The effective mAs and CTDIvol were recorded for each case. Phantom scans were performed with a 16 cm CTDI phantom placed on the table top and in the head holder. Regional (center, top, bottom of the phantom) noise values and regional (center, top hole, bottom hole) CTDI100 values were measured. The use of AEC, which allowed the scanner to account for the extra attenuation of the table versus the head holder, and manual mA were used to scan the phantom. For the human scans, we also documented the presence or absence of patient transport "slider boards" and dental amalgam to evaluate their impact on scanner output.

RESULTS

The mean effective mAs for the clinical scans increased by a factor of 1.7 times for heads imaged on the table top relative to the head holder. Statistically significant differences in image noise were observed from the phantom scans for table top versus head holder positioning in manual mA mode. A statistically significant difference in image noise between the top and bottom of the CTDI phantom was observed for table top imaging, but not for head holder imaging indicating noise is more uniform for head holder scans. The presence of dental amalgam and "slider boards" did not cause a statistically significant difference in CTDIvol. Head holder and table top positioning produced statistically significant differences (6% versus 23% respectively) between top and bottom hole CTDI100 measurements.

CONCLUSION

This study demonstrates the superiority of using AEC versus a manual technique for head. Using a manual technique inhibits one's scanner from being able to compensate for the attenuation differences between the table and head holder.

CLINICAL RELEVANCE/APPLICATION

Using manual mA for head imaging does not account for attenuation differences between table top and head holder patient positioning leading to poorer image quality for the latter.

SSQ18-04 Clinical Study of Measurement of Mammary Gland Dose Using Organ-Based AEC

Thursday, Nov. 29 11:00AM - 11:10AM Room: N228

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CONCLUSION

For plain chest CT of Japanese women, Organ-Based AEC reduces the exposure dose to mammary glands by 14.6%. Earlier studies, conducted using phantoms, overestimated the reduction effect of Organ-Based AEC.

Background

Chest CT requires suppression of exposure to mammary glands. Many reports of earlier studies have described that Organ-Based AEC can reduce the exposure dose by 25-60%. In a report that analyzed CT images retrospectively, it is considered that most of the mammary glands are not included in the dose reduction area. However, these phantom data and simulation studies did not actually measure patients. Therefore, the effect of Organ-Based AEC exposure dose reduction in clinical research has not been clarified. This clinical study measured mammary gland doses using Organ-Based AEC in chest CT. Furthermore, the properties of Organ-Based AEC were examined by phantom study.

Evaluation

This observational study study examined plain chest CT scans of female patients: 30 using Organ-Based AEC, and 30 not using Organ-Based AEC. Subjects were randomly extracted. Their mammary gland doses were measured. An OSL dosimeter was affixed to 12 patients' breasts. The equipment used was Aquilion ONE® (Toshiba Medical systems). Organ-Based AEC used OEM (Organ Effective Modulation). In the Organ-Based AEC, as the size of the subject became smaller, the reduction effect was also lower. The Organ-Based AEC had the greatest reduction effect in the anterior side of the subject, the reduction effect got lower as approaching the lateral side. In clinical study, results show that 9.18 ± 1.96 mGy doses were received when Organ-Based AEC was used, but 10.76 ± 2.58 mGy doses were received when Organ-Based AEC was not used. The radiation dose reduction ratio of mammary glands was therefore 14.6%.

Discussion

The results of phantom studies of earlier studies have a greater dose reduction effect than our clinical studies. The reason is that in the earlier study, part of the mammary gland is out of the dose reduction zone, and it is not considered that the physique affects the reduction ratio of Organ-Based AEC.

SSQ18-05 How Much Does Low kV Imaging Increase Skin Radiation Dose in Contrast-Enhanced CT? - A Simulation Study on a Virtual Population of Patient Models

Thursday, Nov. 29 11:10AM - 11:20AM Room: N228

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PURPOSE

To compare the effect of utilizing a lower kV setting over a standard high kV setting (70 vs 120 kV) on skin dose in contrast enhanced CT.

METHOD AND MATERIALS

The scanner-specific geometry was modeled for a state of the art CT scanner (Revolution CT, GE Healthcare) on a GPU-based Monte Carlo tool based on the MC-GPU framework. This tool was utilized in association with a virtual population of 58 anthropomorphic XCAT patient models (age, 18-78 y.o.; BMI, 18.21-38.81 kg/m2; sex #(M/F), (34/24)) to estimate organ doses for the abdominopelvic protocol (1.375 pitch, 80 mm collimation) at tube voltages of 70 and 120 kV. The organ dose values for both tube voltages were then normalized to a volumetric CTDI value of 12, to make them representative of a typical abdominopelvic scan. In addition to tabulating an average skin dose value for each tube voltage, the ratio of the skin dose to the effective dose (reff) and cumulative dose (rcum) was also computed as additional metrics of dose comparison. The standard deviation for each metric was calculated to represent the dose variability over the virtual patient population.

RESULTS

The absorbed dose values for skin were estimated to be 1.49±0.16 and 1.36±0.14 mGy for 70 and 120 kV tube voltages,

respectively. The corresponding values for reff were 0.80±0.12 and 0.59±0.06 respectively. For the same pair of tube voltages, the rcum value were 0.030±0.004 and 0.023±0.002. Lowering tube voltage from 120 to 70 kV didn't translate to a statistically significant increase in the absorbed skin dose as observed over a virtual population of 58 XCAT patients.

CONCLUSION

The lowering of kV setting from 120 to 70 kV did not lead to a significant increase in skin dose for the virtual patient population, thereby mitigating potential concerns related to the detrimental effects of low kV on skin dose.

CLINICAL RELEVANCE/APPLICATION

CT imaging at lower kV potentially leads to greater dose efficiency and increased image quality, especially for contrast enhanced CT. Concerns about drastic increases in skin radiation dose seem to be overstated with only marginal increases in skin dose.

SSQ18-06 Retrospective Assessment of Radiation Dose in Abdominopelvic CT: Inter- and Intra-Scanner Variability

Thursday, Nov. 29 11:20AM - 11:30AM Room: N228

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PURPOSE

To develop a practical data-crunching solution for retrospectively assessing inter- and intra-scanner variabilities and inconsistencies in abdominopelvic CT dose using clinical patient data.

METHOD AND MATERIALS

This IRB-exempt study evaluated CT abdominopelvic (AP)-related examinations performed in 2016 and 2017 from 12 scanners (4 GE 750 HD,2 GE VCT, 4 Siemens Flash, and 2 Siemens Definition AS) in 3 site hospitals in an enterprise. An in-house developed informatics system automatically extracted protocol information, patient size (cross-sectional diameter), radiation dose, and *in vivo* noise magnitude within images. Protocol nomenclature categorization was performed using a decision-tree machine learning algorithm. Dose reference and fit lines were defined for each scanner by using machine learning logistic regression algorithms between dose and patient size. For a predefined reference patient size, Reference dose (RfD: intersect point of dose fit line and reference patient size) and dose deviation index (DDI: a ratio of received dose and ideal dose minus one) were then calculated.

RESULTS

17,000 (Data2016) and 17,000 (Data2017) AP studies for patients ages 0-70 and sizes 13-48 cm were identified. 12 dose reference lines with slopes 0.03-0.1 from Data2016 and 24 dose fitting lines (1th and 99th) from Data2017 were constructed. RfDs were calculated using a reference size of 31 cm and ranged from 466-568 mGy-cm for GE 750 HD, 630-674 mGy-cm for GE VCT, 401-428 mGy-cm for Siemens Flash, and 220-306 mGy-cm for Siemens Definition AS. DDIs ranged from 0.15-0.55. A multi-dimensional metrics compositing the above results was then established and visualized for system performance evaluation across systems.

CONCLUSION

This study offers the first even data-crunching solution for assessing inter- and intra-scanner variabilities in CT dose with clinical patient data. High dimensional metrics built upon patient data are essential for quantitatively assess protocol- and system-inconsistencies as well as optimize the quality, patient safety, and clinical operation.

CLINICAL RELEVANCE/APPLICATION

This study fulfilled an unmet need for quantitative assessment of system-inconsistencies, along with device performance assessment and optimization, to ensure rigorous patient safety and consistent image quality.

SSQ18-07 Explore the Feasibility of 'Four-Low' Scanning Protocol in Coronary Imaging Using Wide-Detector Revolution CT

Thursday, Nov. 29 11:30AM - 11:40AM Room: N228

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PURPOSE

To investigate the feasibility of low-kvp, low-contrast medium, low-flow rate, low-dose 'four-low'scans for coronary artery imaging using wide-detector Revolution CT.

METHOD AND MATERIALS

60 patients underwent coronary artery CT imaging with coronary heart disease diagnosed in our hospital were divided into two groups. Group A use 100 kVp and group B use 80 kVp with 30 cases in each group. Contrast agent iopamidol (370 mgI/mL), both use standard (25 mgI/kg/s) iodine flow rate, dose and flow rate calculation formula. Scanning parameters: cardiac axial scan, Smart mA (200-650 mA), NI=26, fixed collimator width 140mm, Auto gating ECG, Pre-Asir-V=70%, Post-Asir-V=80. The CT values and SD standard deviations of aortic root, coronary artery RCA, LAD, LCX proximal lumen and surrounding adipose tissue were measured, SNR, CNR were calculated, CTDI, DLP were recorded, and the effective radiation dose ED was calculated. Subjective evaluations were conducted using a 4-point grading system by two senior-level physicians by double-blind method according to the American Heart Association (AHA) coronary 13 segments. The radiation dose, image quality, contrast agent dosage, and flow rate were statistically analyzed.

RESULTS

Age and heart rate in the two groups have no statistical significance (P> 0.05). The two groups of contrast agents were: (41.52±5.14) ml, (22.64±2.70) ml, and group B contrast was 45.5% less than that of group A. The flow rates in the two groups were: (3.45±0.43)ml/s, (1.90±0.21)ml/s, and group B was 44.9% lower than that of group A. ED was: (41.52±5.14) mSv in group A and (22.64±2.70) mSv in group B, group B dose was 41.0% lower than that of group A with statistical significant difference (P<0.05). There was no statistically significant difference in image quality subjective scores at the distal end (P>0.05).

CONCLUSION

Low-kVp, low-contrast, low-flow rate, low-dose, CT coronary artery imaging in wide-detectors is feasible. Image quality was not affected and the contrast agent dosage was reduced by 45.5%, the effective radiation dose was reduced by 41.0%, and the flow rate was reduced by 44.9%.

CLINICAL RELEVANCE/APPLICATION

The"four-low"scan scheme is feasible in coronary imaging without affecting the image quality. At the same time, the radiation dose, the contrast agent dose, and the injection rate of the contrast agent are greatly optimized and is recommended for clinical promotion.

SSQ18-08 A Comparison of Lung and Breast Doses from CT Scans Using Organ-Based Tube Current Modulation (TCM) vs. Conventional Attenuation-Based TCM Using Monte Carlo Simulations

Thursday, Nov. 29 11:40AM - 11:50AM Room: N228

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PURPOSE

Organ-based Tube Current Modulation (TCM) was designed to reduce organ dose to anteriorly-located, radiosensitive organs such as the breast in CT exams. The purpose of this work was use Monte Carlo simulation techniques to compare lung and breast doses from chest CT exams using organ-based (TCM) to those using conventional TCM.

METHOD AND MATERIALS

Under IRB approval, raw projection and image data were collected from thirty-four patients (17 females, 17 males) who underwent CT chest/abdomen/pelvis (CAP) examinations employing organ-based TCM (XCARE + CAREDose4D, Siemens Healthineers). The actual organ based TCM schemes for the chest portion were extracted from the raw projection data for each patient. Lung and glandular breast tissue were semi-automatically segmented from patient image data for each case to create voxelized models of patient anatomy for use in a validated Monte Carlo (MC) transport code. Additionally, for these patients, TCM schemes from conventional, attenuation-based modulation only (CAREDose4D) were also estimated using a recently developed method that accounts for patient attenuation characteristics and scanner design. Absolute lung and breast doses for each TCM scenario were estimated for each patient model using MDCT source models in Monte Carlo simulations. The resulting lung and breast doses from each scheme were compared using within-patient percent difference using the from conventional TCM as the reference.

RESULTS

The differences of lung and breast dose from organ-based TCM across patients ranged from -35% to 73% and -53% to 45%, respectively. The mean female lung and breast dose differences were -11% and -21%, respectively. The average male lung dose difference was -21%. When pooled, on average, organ-based TCM reduces breast dose by 21% while dose lung dose remained nearly constant with a 5% increase.

CONCLUSION

Organ-based TCM may reduce breast dose while not incurring a substantial lung dose penalty when compared to conventional TCM. However, there can be some patients in which this may not be the case and may increase lung dose for men.

CLINICAL RELEVANCE/APPLICATION

On average, organ-based TCM may reduce breast dose relative to conventional TCM without increasing lung dose, but some patients may receive higher lung or breast from organ-based TCM.

SSQ18-09 Coronary CT Angiography Using a 70 kVp Protocol on 16cm Wide-Detector CT: Improved Vascular Enhancement with Reduction of Both Radiation and Contrast Agent Doses

Thursday, Nov. 29 11:50AM - 12:00PM Room: N228

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PURPOSE

To investigate image quality, radiation dose, and diagnostic efficiency of prospectively ECG-triggered coronary CT angiography (CCTA) on 16cm wide-detector scanner using 70 kVp with low contrast dose compared with routine 100 kVp CCTA protocol.

METHOD AND MATERIALS

Forty patients (29 men and11 women; mean age, 55±14 years) received CCTA using either 70 kVp, noise index (NI) of 36HU, and at weight-dependent contrast dose of 16mgI/kg/s rate for 9s injection (Group A, n=20) or the conventional 100kVp, NI of 28HU, and at 25mgI/kg/s rate for 10s injection (Group B, n=20). Adaptive statistical iterative reconstruction (ASIR-V) was used with 80% strength for the 70 kV group and 60% strength for the 100 kV group. All CCTA image quality was evaluated by two experienced cardiovascular radiologists using a 5-point scale (5: best, 1: worst, >=3 scores diagnosable) and signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated and compared. The volumetric CT dose index (CTDIvol) in mGy, dose-length-product (DLP) in mGy-cm of CT scan were recorded. The Mann-Whitney U-test was used to compare the subject image quality scores and the unpaired t-test was used to compare the continuous variables including CT value, SNR, CNR and radiation dose and contrast dose.

RESULTS

There was no significant difference in age, heart rate and body mass index (21.18±2.08kg/m2 vs. 22.00±2.33kg/m2) between the two groups (all P>0.05); Mean CT values, SNR and CNR of the two groups were statistically the same(all P > 0.05). Subjective image quality showed no difference between the two groups (P=0.458) with good interobserver agreement (k=0.820). However, there was a significant difference in CTDIvol between Group A (2.20±1.0mGy) and Group B (9.03±5.50mGy) (P<0.05), resulting in 76.1% effective dose reduction for the 70kVp group (Group A) (0.43±0.20mSv vs. 1.80±1.28mSv, p<0.001). Moreover, the contrast dose for Group A was significantly lower than for Group B (22.01±3.11ml vs. 38.21±5.40ml) (P<0.001), a reduction of 42.4%.

CONCLUSION

Our proposed 70kVp CCTA protocol provides diagnostic information with substantial reduction in both radiation and contrast agent doses compared to the routine CCTA at 100 kVp.

CLINICAL RELEVANCE/APPLICATION

CCTA with 70kVp on a 16cm wide-detector CT that reduces both radiation and contrast agent doses while maintaining image quality compared with the routine 100 kVp CCTA protocol.

SSQ19

Pediatrics (Neuroradiology)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S402AB

NR PD

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

FDA Discussions may include off-label uses.

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Sub-Events

SSQ19-01 Development and State-Related Gradients in Infant Brain Functional Connectome

Thursday, Nov. 29 10:30AM - 10:40AM Room: S402AB

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PURPOSE

Early brain functional development studies using resting-state functional MRI (rs-fMRI) has been recently emerging. However, little is known whether the development of brain functional connectome can be embedded in the high dimensional connectome space and, if so, how such embedding looks like in the context of developmental neuroscience. This study is to explore the large-scale neuromechanism that encode the developmental functional connectome.

METHOD AND MATERIALS

Whole-brain region-wise functional connectome was built for each infant from a longitudinal rs-fMRI dataset with a large sample size (# subjects = 87, # scans = 302, natural sleeping from neonate to 2 years old, while passive movie watching for older subjects up to 6 years old). Principal component analysis (PCA) was conducted on the multi-subject, multi-scan functional connectome and each component was examined with age information. Based on a pure data-driven method, a 2-D embedding of the functional connectomes was adopted to unravel any development-related gradient(s).

RESULTS

Different age groups show clear clustered patterns with the first two principal components used even they accounted ~10% variance across subjects/scans. Two intriguing gradients were identified, one encoding development (span from younger to older ages), the other encoding brain states during the rs-fMRI scan ('natural sleeping' or 'awakening while movie watching'). The developmental gradient shows dominant inter-modular connections, with several hubs in auditory and spatial attention-related regions, and the thalamus. The state-related gradient shows prominent connections within visual, default mode, and executive control networks, with hubs in high-order cognitive function-related regions.

CONCLUSION

This is the first developmental study on 0-to-6-year-old functional connectome. The pure data-driven method could reveal changes in functional connectome due to early development and different brain states. The functional connectome gradients could be informative for better understanding brain functional development in the first years of life, a previously less investigated period.

CLINICAL RELEVANCE/APPLICATION

Reveal brain functional changes in the first years of life by detecting two 'gradients' and highlight regions and links that are most important to the rapid, dynamic development in this pivotal stage.

SSQ19-02 Longitudinal Strain Measures of White Matter Tracts in Youth Football Players

Thursday, Nov. 29 10:40AM - 10:50AM Room: S402AB

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PURPOSE

We characterized longitudinal strain of the white matter in youth football players compared to non-contact sport control athletes and tested the hypothesis that axial and radial shape changes of fiber bundles would be associated with participation in contact sports and serve as a new neuroimaging biomarker of subconcussive head impact exposure.

METHOD AND MATERIALS

Twenty-three male youth football players (Age=12.1±1.2 yrs) and 13 male non-contact sports control participants (Age=10.6±1.7 yrs) were recruited for this IRB approved study. Longitudinal brain MRI data, including diffusion tensor imaging (DTI) were acquired before and after a single sports season (approximately 3-months) . Longitudinal registration was performed between pre-season and post-season T1-weighted images. DTI processing included geometric distortion correction, eddy-current correction, fitting of diffusion parameters, and co-registration to T1-weighted images. The voxel-wise fiber-specific deformations (axial and radial strains) were estimated by aligning 3D deformation tensor derived from longitudinal T1-weighted images to the co-registered eigenvectors from DWI. Parameter maps for axial and radial strains were registered to the study-specific template. We compared total and voxel-wise white matter volume change rates between football players and control participants using a linear regression and multiple comparison correction.

RESULTS

There was greater axial strain (contraction) among football players compared to controls in the body and right splenium of the corpus callosum ($p < 0.01$, 340 vox) (upper panel of figure). There was greater radial strain (expansion) in the splenium of the corpus callosum among controls compared to football players ($p < 0.01$, 219 vox) (lower panel of figure).

CONCLUSION

Axial and radial strain data demonstrated more directional contraction and less expansion, respectively, in the football group compared to non-contact sports controls. These tract-specific strains in white matter tracts may reflect changes associated with repetitive sub-concussive head impact exposure.

CLINICAL RELEVANCE/APPLICATION

There is growing concern regarding the long-term consequences of repetitive sports-related subconcussive head impact exposure on the developing brain. We propose a novel white matter tract-specific morphometry method to analyze the effects of repetitive subconcussive impacts on brain developmental trajectory.

SSQ19-03 White Matter Microstructural Correlates of Sensory Processing Disorder (SPD) on Connectome Edge Density Imaging and Probabilistic Tractography: Potentials of Machine Learning Models for Devising New Imaging Biomarkers

Thursday, Nov. 29 10:50AM - 11:00AM Room: S402AB

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PURPOSE

SPD - affecting up to 16% of children - is associated with Autism Spectrum Disorders, and ADHD. We aimed to evaluate white matter microstructure of children with SPD, and apply machine-learning models for devising image-based diagnostic biomarkers.

METHOD AND MATERIALS

Children (aged 8 to 12 years) were prospectively recruited via our 'Sensory Neurodevelopment and Autism Program'. The connectome Edge Density (ED) and probabilistic Tract Density (TD) maps were developed using DTI and high-resolution T1 scans. Tract-Based Spatial Statistics (TBSS) was used for voxel-wise analysis. Stepwise penalized logistic regression was used to identify independent tract-based ED/TD variable(s) distinguishing children with SPD. Five different machine-learning models were used for identification of SPD: random forest, neural network, naïve bayes, and support vector machines with 'linear' and 'polynomial' kernels. Cross-validation of models was performed applying stratified random sampling of cohort into training and validation datasets (x500), preserving SPD-to-TDC ratio.

RESULTS

44 children with SPD and 41 typically developing children (TDC) were included. There was no significant difference in average age ($p=0.191$) and gender ratio ($p=0.338$) between SPD and TDC groups. On voxel-wise analysis, children with SPD had lower ED and TD in body and splenium of corpus callosum, posterior corona radiata, posterior thalamic radiation, and tapetum. On stepwise penalized logistic regression analysis, the average TD of splenium was the only independent variable differentiating SPD from TDC ($p<0.001$). Among different machine learning models, the random forest algorithm using ED had the best test characteristics NPV for identification of SPD with 75.6% accuracy, 79.4% sensitivity, 71.3% specificity, 77.5% PPV, and 75.1% among validation datasets.

CONCLUSION

Children with SPD have lower density of connectome edges and probabilistic tracts in body/splenium of corpus callosum and posterior white matter pathways, with 'lower splenium TD' as the most distinctive pattern. Machine learning models - particularly random forest algorithm using tract-based ED - can help identify children with SPD.

CLINICAL RELEVANCE/APPLICATION

Edge density imaging and probabilistic tractography can be used to identify white matter microstructural abnormalities in children with SPD, and to devise imaging biomarkers for SPD based on machine-learning models.

SSQ19-04 The Brain Network Architecture Classification of Pediatric Patients with Autism

Thursday, Nov. 29 11:00AM - 11:10AM Room: S402AB

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PURPOSE

Although many cases are genetic in etiology, no clinical method exists to diagnose autism before its syndrome appears. Earlier diagnosis could allow intervention before the brain network fully developed. Brain imaging is a promising method to probe brain network organization without requirement for patient cooperation. In this study, we measured morphologic and diffusion-based brain network metrics in terms of their capacity to differentiate autism patients from controls. Those metrics can be measured individually and have the potential to be used as one of biomarkers for autistic diagnosis and prediction.

METHOD AND MATERIALS

17 age-matched pairs of autistic-control sibling were selected in this HIPAA-compliant study. The T1-weighted structural data was processed using FreeSurfer 5.3 resulting in 148 cortical parcels. Further division results in around 600 fine parcels with roughly equal size. We transformed parcels from anatomical space to diffusion space. First, cortical thickness was measured over the whole brain. Next, probabilistic tracking (FSL) on 32 directional diffusion data generated a connectivity matrix where the connection between each pair of network nodes was defined as the probability that a white matter connection exists between nodes. Based on the connection matrix, we computed five topologic properties of network organization (table 1) using the Brain Connectivity Toolbox. Univariate comparison between groups were performed for age and all measured metrics. A machine learning algorithm was used to measure the importance of each metric to autism classification after adjusting for the contribution of all other metrics.

RESULTS

The cortical thickness and brain network modularity are metrics showing significant group differences (Table 1). Further, the machine learning analysis demonstrated that the cortical thickness and modularity stand out as most important metrics in autism classification (figure 1).

CONCLUSION

In this cohort of pediatric autistic patients cortical thickness and brain network modularity were important discriminators between autistic patients and normal subjects.

CLINICAL RELEVANCE/APPLICATION

MR imaging provides a potential tool to predict/diagnose brain network disorder in early age. We investigates the importance of imaging-based brain network architecture in autism classification.

SSQ19-05 Integrating U-Net and Dilated Dense Network for Infant Hippocampus Subfield Segmentation

Thursday, Nov. 29 11:10AM - 11:20AM Room: S402AB

Participants
Hancan Zhu, Chapel Hill, NC (*Presenter*) Nothing to Disclose
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PURPOSE

Accurate and automatic segmentation of hippocampus (HC) subfields from magnetic resonance (MR) brain images is important for studying both normal and abnormal early brain development. The goal of this study is to develop an automatic HC subfield segmentation method for infant MR brain images.

METHOD AND MATERIALS

Image Dataset: We used infant MR brain images of ten subjects, each with T1w and T2w images acquired at age of 12 months. Five HC subfields were manually labeled for each subject by the consensus of two neuroradiologists, including cornu ammonis sector

1 (CA1), CA2/3, subiculum (SUB), CA4/dentate gyrus (DG), Uncus. Methods: We propose a novel deep neural network for HC subfield segmentation. It is based on U-net, consisting of a contracting path to extract abstract features and an expansive path to recover spatial resolution. However, the contracting-expansive process in U-net can often miss detailed image information, thus affecting the accurate segmentation of small structures, such as HC subfields. To overcome this limitation, we embed the dilated dense network in the U-net to obtain a new network (DUnet). In the DUnet, the embedded dilated dense network can provide multi-scale features with relatively high spatial resolution. To further improve the performance, we group every two convolutional layers with one residual connection in the DUnet, and obtain the Residual DUnet (ResDUnet).

RESULTS

Our proposed methods were compared with U-net, using Dice ratio. The results show that our proposed DUnet outperforms the U-net in all subfields. Our proposed ResDUnet can further improve the segmentation performance by introducing residual connections. In particular, ResDUnet increases Dice ratios: 0.024 for CA1, 0.031 for CA2/3, 0.026 for SUB, 0.020 for CA4/DG and 0.024 for Uncus, compared with U-net.

CONCLUSION

We propose a new network for infant hippocampal subfield segmentation by integrating U-net and dilated dense network. Our proposed network can avoid losing detailed image information in the successive down-sampling steps, and effectively extract multi-scale features, which are important for image voxel localization and classification.

CLINICAL RELEVANCE/APPLICATION

Our proposed method for automatic segmentation of infant hippocampal subfields from MR brain images can be used for studying neurodegenerative diseases.

SSQ19-06 Alterations of Structural and Functional Connectivity in Bilateral Severe-to-Profound Sensorineural Hearing Loss Infants within an Early Sensitive Period: A Combined fMRI and DTI Study

Thursday, Nov. 29 11:20AM - 11:30AM Room: S402AB

Participants
Shanshan Wang, Shenyang, China (*Presenter*) Nothing to Disclose
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PURPOSE

The development of central auditory system has a sensitive period during the first few years of life. This study was aimed to characterize the patterns of whole-brain structural and functional connectivity change in infants with bilateral severe-to-profound sensorineural hearing loss (SNHL) within an early sensitive period.

METHOD AND MATERIALS

36 infants with bilateral severe-to-profound SNHL (mean age = 16 months, range 6-35 months) and 33 age and sex matched healthy controls were recruited for the present study based on referral for clinical MRI and other inclusion criteria. All subjects underwent 3.0T anatomical and functional MRI included DTI and resting-state fMRI. DTI data were processed using Tract-Based Spatial Statistics (TBSS) to describe white matter (WM) impairment across the whole brain. fMRI data were analyzed to map functional connectivity (FC) feature related to left/right primary auditory cortex (A1) using a seed-based correlation method with the voxels in the whole-brain.

RESULTS

In comparison to controls, SNHL infants showed pronounced and wide-spread WM abnormalities, including the cortico-cortical WM tracts (SLF, ILF, UF and inferior fronto-occipital fasciculus), the cortico-fugal WM tracts (CST, external capsule, corona radiata, as well as thalamic radiation) and the interhemispheric connections of corpus callosum. In addition, SNHL infants exhibited enhanced functional connectivity between left A1 with right insula and right superior temporal gyrus, right A1 with right superior temporal gyrus.

CONCLUSION

Using DTI-TBSS in conjunction with rs-fcMRI analysis, the present study provides new evidences in support of the disconnection hypothesis caused by hearing loss, revealing the characteristics of early brain reorganization and compensatory activation changes in congenital severe-to-profound SNHL infants within early sensitive period.

CLINICAL RELEVANCE/APPLICATION

Improvements in our understanding of early brain development after auditory deprivation can promote individually customized rehabilitation programs targeted at improving clinical outcomes for cochlear implanted children.

SSQ19-07 Brain Language Network Architecture and Verbal Intelligence in Children with Focal Epilepsy

Thursday, Nov. 29 11:30AM - 11:40AM Room: S402AB

Awards
Student Travel Stipend Award

Participants
Farahnaz Golriz, MD, Houston, TX (*Presenter*) Nothing to Disclose
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Zili David Chu, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Higher order functions of the human brain depend on the efficient integration of information across a functionally specialized brain network. The aim of this study is to examine the relationship between verbal intelligence and language network architecture in the pediatric, epileptic brain.

METHOD AND MATERIALS

Patients were retrospectively identified with the following criteria: 1) localization-related epilepsy; 2) brain MRI imaging at 3T, including resting-state fMRI sequence; and 3) Full-scale IQ subscales, including verbal comprehension index (VCI) measured by a pediatric neuropsychologist. The cerebral cortex was subdivided into approximately 1500 gray matter network nodes. Language network map was generated based on the automated Neurosynth meta-analysis. The strength of a connection between each pair of nodes within the language network was defined as the correlation between their resting BOLD time-series. The following network architecture metrics were calculated: clustering coefficient, global efficiency, modularity, transitivity, and path length. A machine-learning algorithm was used to measure the independent contribution of each metric to the verbal comprehension index while adjusting for age, gender and seizure duration.

RESULTS

Forty-six patients met the criteria with mean age 12.9 years (age range: 3 - 18). The male: female ratio was 28/18. After accounting for age, sex, and seizure duration, all five metrics including clustering coefficient, global efficiency, transitivity, modularity and path length were shown to be independently associated with verbal comprehension index. Clustering coefficient was the strongest predictor of verbal comprehension index.

CONCLUSION

These findings show that the topology of the constructed language network in children with focal epilepsy is associated with a core aspect of the brain function.

CLINICAL RELEVANCE/APPLICATION

Quantification of specific functional networks is an important step toward the clinical utility of network-based biomarkers.

SSQ19-08 Brain Structural Damage and Atrophy Correlates of Impaired Processing Speed in Pediatric Onset Multiple Sclerosis

Thursday, Nov. 29 11:40AM - 11:50AM Room: S402AB

Participants
Sindhuja Tirumalai Govindarajan, MS, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
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M. Andrea Parra, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
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Leigh Charvet, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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David Ouellette, MS, Stony Brook, NY (*Presenter*) Nothing to Disclose

PURPOSE

Brain atrophy (anatomical imaging), and structural damage (diffusion imaging), are commonly used to quantify neurodegeneration in multiple sclerosis (MS) and its impact on neurocognitive impairment. However, very few studies have investigated such relationships in pediatric onset MS (POMS) patients. The goal of this study was to investigate atrophy and diffusivity changes in pediatric onset MS patients and to correlate them with cognitive impairment.

METHOD AND MATERIALS

T1-weighted and diffusion tensor imaging (DTI) at 3T, and neuropsychological tests - symbol digits modality test (SDMT), brief visuospatial memory test (BVMT), Rey's audio verbal memory test (RAVLT), wide range achievement test (WRAT) and CogState brief battery - were performed on N=25 POMS patients (14F, 20.8 ± 4.5 years, age at onset = 15 ± 3.7 years, EDSS= 1.1 ± 1.26, mild disability) and N=24 age/sex-matched healthy controls (HC) (14F, 20.3 ± 3.7 years). Normalized total gray (GM), white matter (WM) and deep gray matter structures (DGM) volumes were quantified from T1-w images. Mean diffusivity (MD) was mapped across WM from DTI images, and normalized to standard space for voxelwise analyses. Volumetric and diffusivity metrics were analyzed for group differences, and correlated with age-adjusted neuropsychological test scores.

RESULTS

POMS showed decreased total WM, Thalamus (Thal), Putamen (Put) and Pallidum (Pall) volumes when compared to HC. In POMS group only, significant association was found between Put and Thal volumes and SDMT ($p<0.01$), Hippocampus volume and RAVLT ($p<0.05$), and total GM and Put volumes and WRAT ($p<0.05$). Voxelwise analyses showed widespread increases in MD in POMS when compared to controls. SDMT (processing speed) correlated negatively and CogState (processing time) scores correlated positively with increased MD in the corpus callosum, L/R superior and posterior corona radiata, and L/R superior longitudinal fasciculus ($p<0.05$, corrected). There were no significant correlations of MD with other neuropsychological scores.

CONCLUSION

In our mildly disabled POMS cohort, processing speed impairment was significantly associated with reduced DGM volumes and increased MD indicative of tissue loss and structural damage, respectively.

CLINICAL RELEVANCE/APPLICATION

Improved understanding of MS pathophysiology and progression in patients with pediatric disease onset could help develop strategies for early detection and treatment.

SSQ19-09 Effects of Repetitive Non-Concussive Head Impact Exposure on Default Mode Network Connectivity among Youth Football Players

Thursday, Nov. 29 11:50AM - 12:00PM Room: S402AB

Participants
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Caitlin M. Carroll, BA, Winston Salem, NC (*Abstract Co-Author*) Nothing to Disclose
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Joseph A. Maldjian, MD, Dallas, TX (*Abstract Co-Author*) Consultant, BioClinica, Inc; Consultant, Koninklijke Philips NV
Christopher T. Whitlow, MD, PhD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this investigation was to determine if repetitive sports-related head impact exposure alters default mode network (DMN) connectivity in a cohort of youth football players compared to a non-contact sport control group.

METHOD AND MATERIALS

Twenty-nine male football players (mean±SD; 11.62±0.78 yrs; age range 10-13 yrs) and 19 age-matched male non-contact sports controls (mean±SD; 11.64±0.8 yrs; age range 10-13 yrs) were recruited for this IRB approved study. None of the participants had a history of concussion before or during the sports season. Participants received pre- and post-season MRI, including resting-state BOLD imaging. Pre-processed BOLD data were coregistered to structural T1-weighted images. A DMN seed was created from the orthogonal slices of spatial cross-correlation of the ICA spatial maps and used to extract individual DMNs for pre- and post-season data. A delta metric was computed by subtracting pre- and post-season DMN data for each individual to estimate changes in DMN connectivity strength. Voxel-wise linear regression with covariate (age) was conducted to examine between-group differences in longitudinal DMN connectivity strength. Lastly, we estimated the size of false positive clusters and applied this threshold to remove noise-only clusters.

RESULTS

Four clusters demonstrated between-group differences in DMN connectivity strength: 1. right middle/superior temporal cortex and right angular gyrus, 2. left middle temporal and left angular gyrus, 3. right superior/middle frontal gyrus, and 4. left middle/superior gyrus and left anterior cingulate cortex. Regression analyses demonstrated statistical significant differences in DMN connectivity strength between these regions ($P<0.05$). Overall, DMN connectivity strength increased among non-contact-sport controls, but decreased for footballers.

CONCLUSION

A single season of youth football was associated with decreases in DMN connectivity strength among football players compared to controls. These changes were not associated with clinically diagnosed concussion, and more work is necessary to determine potential functional significance among youth athletes with repetitive non-concussive sports-related head impact exposure.

CLINICAL RELEVANCE/APPLICATION

Decreased resting-state DMN connectivity strength could reflect disruption of related functions in youth athletes with repetitive sports related non-concussive head impact exposure.

SSQ20

Vascular Interventional (Non-Vascular Interventions)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S403A

GI GU IR

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

Participants
Ronald S. Arellano, MD, Boston, MA (*Moderator*) Nothing to Disclose
Alexios Kelekis, MD, PhD, Athens, Greece (*Moderator*) Medical Advisory Board, BTG International Ltd; Medical Advisory Board, Merit Medical Systems, Inc; Research Grant, Mindray Medical

Sub-Events

SSQ20-01 Utility of Microcatheter for Adrenal Venous Sampling in Primary Aldosteronism

Thursday, Nov. 29 10:30AM - 10:40AM Room: S403A

Participants
Yoshifumi Noda, MD,PhD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Goshima, MD, PhD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuro Kaga, MD, Gifu, Japan (*Presenter*) Nothing to Disclose
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Masayuki Matsuo, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the utility of using microcatheter for the assessment of aldosterone hypersecretion and the laterality in adrenal venous sampling (AVS) for patients with primary aldosteronism.

METHOD AND MATERIALS

This prospective study was approved by our institutional review board and written informed consent was obtained. Thirty-seven consecutive patients with primary aldosteronism underwent AVS. A microcatheter was inserted in right adrenal central vein (RCV), left adrenal central vein (LCV), and left adrenal common trunk (CT). Aldosterone hypersecretion was diagnosed if the plasma aldosterone level after cosyntropin injection was >= 14,000 pg/mL. Laterality of aldosterone hypersecretion was determined based on the lateralized ratio and contralateral ratio. The diagnosis of aldosterone hypersecretion and laterality were compared between the results with 5-French (5-Fr) catheter and microcatheter.

RESULTS

The plasma aldosterone levels were significantly higher in RCV, LCV, and CT selected with microcatheter than in the right and left adrenal vein selected with 5-Fr catheter (*P < 0.0001-0.029). Five and twenty-two patients for right and left AVS were diagnosed aldosterone hypersecretion only with microcatheter. The diagnosis of aldosterone hypersecretion from left adrenal gland was statistically more accurate with microcatheter than with 5-Fr catheter (P < 0.0001). Diagnostic change of the laterality from unilateral to bilateral was found in 3 patients (8%) with microcatheter.*

CONCLUSION

The microcatheter was useful for the assessment of aldosterone hypersecretion and the laterality, especially in the left adrenal vein.

CLINICAL RELEVANCE/APPLICATION

The clinical diagnosis and treatment options potentially are changed on the basis of the results in AVS with microcatheter.

SSQ20-02 Fluoroscopic Gastrojejunostomy with Lumen-Apposing Metal Stent: Feasibility and Safety in Swine

Thursday, Nov. 29 10:40AM - 10:50AM Room: S403A

Participants
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Xiaowu Zhang, Beijing, China (Abstract Co-Author) Nothing to Disclose
He Zhao, Beijing, China (Abstract Co-Author) Nothing to Disclose
Tao Gong, Beijing, China (Abstract Co-Author) Nothing to Disclose
Xiao Li, PhD, Chengdu, China (Abstract Co-Author) Nothing to Disclose

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PURPOSE

To evaluate the feasibility and safety of fluoroscopic gastrojejunostomy (GJ) with lumen-apposing metal stent (LAMS) in a miniature swine model.

METHOD AND MATERIALS

The animal experiments were approved by the institutional animal care and use committee. Six female miniature swine (range, 2.5-3.0 kg) were included in this study. With the animals under general anesthesia, a pigtail catheter was inserted through the mouth and negotiated into the proximal jejunum with a hydrophilic guidewire under fluoroscopic guidance as the puncture target. A Rösch-Uchida liver access set was introduced into the stomach over a separate hydrophilic guidewire, and the proximal jejunum was punctured under continuous fluoroscopic monitoring. A 16-mm-diameter and 20-mm-length LAMS was placed between the stomach and the proximal jejunum, and contrast medium was injected to confirm the stent position.

RESULTS

Technical success was achieved in all animals. The number of needle puncture ranged from 1 to 2. All procedures were completed within 45 minutes. One animal had vomiting for 3 days after the procedure. No other procedure-related complications were observed. All animals were alive and well at 1 month after the procedure, with no signs of stent malfunction.

CONCLUSION

Fluoroscopic GJ with LAMS is feasible and safe in a miniature swine model.

CLINICAL RELEVANCE/APPLICATION

(dealing with gastric outlet obstruction(GOO)) 'Fluoroscopic GJ is an alternative to surgical bypass for the palliation of GOO with simple operation and minimal invasion.'

SSQ20-03 Biodegradable Magnesium Stent Insertion for the Treatment of Benign Esophageal Stricture in a Rabbit Model

Thursday, Nov. 29 10:50AM - 11:00AM Room: S403A

Participants
Yingsheng Cheng, MD, Shanghai, China (Presenter) Nothing to Disclose
Yueqi Zhu, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine the technique feasibility, therapeutic effect and tissue response to silicone-covered biodegradable magnesium stent insertion into the benign esophageal stricture in rabbits.

METHOD AND MATERIALS

Benign esophageal stricture was surgically created in 12 rabbits. Twelve silicone-covered biodegradable magnesium stents were inserted to treat benign esophageal stricture in rabbit models under fluoroscopic guidance. Esophagography was performed at 1, 2 and 3 weeks. Four rabbits in each group were euthanized at each time point for histological examination

RESULTS

All stent insertions were well tolerated. The esophageal diameters at immediate,1, 2 and 3 weeks were 9.8 ± 0.3mm, 9.7 ± 0.7mm, 9.4 ± 0.8mm and 9.2 ± 0.5 mm, respectively (vs. 4.9 ± 0.3 mm before stent insertion; $P < 0.05$). Magnesium stents migrated rate was 9.3% (1/12) at 1 week, 25% (2/8) at 2 weeks and 100% (4/4) at three weeks respectively. Esophageal wall remodeling (thinner epithelial and smooth muscle layers) was found more significant in the stent groups than in the normal esophageal wall ($P < 0.05$). Esophageal injury and collagen deposition following stent insertion were similar and did not differ to the normal esophageal wall ($P > 0.05$).

CONCLUSION

Esophageal silicone-covered biodegradable magnesium stent insertion was feasible for the treatment of benign esophageal stricture, without causing severe injury or tissue reaction.

CLINICAL RELEVANCE/APPLICATION

Biodegradable magnesium stent can further be applied for the treatment of benign esophageal stricture in clinical.

SSQ20-04 Adhesive Embolization of Truncal Varicosities: Can It Be an Alternative to Thermal Ablation of Varicose Veins?

Thursday, Nov. 29 11:00AM - 11:10AM Room: S403A

Participants
Venkatesh Kasi Arunachalam, MBBS, DMRD, Coimbatore, India (Presenter) Nothing to Disclose

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PURPOSE

1. To evaluate the success rate of Glue embolisation using N Butyl 2 Cyanoacrylate. 2. To compare the occlusion rate with thermal ablation (we are comparing with Radiofrequency ablation as it is performed in our hopital) for varicose veins(Truncal veins) 3. To compare the cost of adhesive embolisation and RFA.

METHOD AND MATERIALS

Study period: October 2017 to August 2018. Inclusion criteria: Patients with symptomatic SFJ incompetence Exclusion criteria:

Deep vein thrombosis Glue embolisation of great saphenous vein(GSV) is planned atleast for thirty patients with N Butyl 2 cyanoacrylate. The great saphenous vein in thigh was punctered directly with 21 G needle atleast at 7 - 10 sites with a gap of 5cms and 0.1-0.2ml of glue is injected at each sites. After injection, compression is done with ultrasound probe for 45 seconds at that site. The injection is started from the caudal to cranial direction. The cranial most site of injection is 3cm distal to SFJ. The procedure is performed without perivenous tumescence. The patients are followed with ultrasound at one week, one month and six months intervals. The Patients will be evaluted for occlusion of GSV as well as complications associated with it. The results are compared with the results of RFA of varicose veins in literature. The cost of the procedure is also calculated and compared with the cost of the RFA in our hospital.

RESULTS

Till now 15 cases were performed with glue embolisation. We are planning to perform atleast 30 cases with glue and follow them atleast for 6 months. The cost of glue embolisation in our institution is about 15000 INR and RFA is about 60000 INR. If we are able to acheive the results of RFA with glue embolisation , the expenditure for the patient will be 1/4th of RFA.. The complications associted with glue embolisation including Inflammation , soft tissue necrosis and ulcer will be assesed and has to be compared with complictions assocaited with RFA.

CONCLUSION

The hypothesis of this exhibit is that efficacy of glue embolisation of varicose veins done with direct puncture is similar to RFA and it can be done with decreased cost (<1/4th of RFA).

CLINICAL RELEVANCE/APPLICATION

In a developing country like India, if we have a procedure which can give an acceptable rate of occlusion of varicose veins with decreased cost , it will be the procedure of choice and many patients will be benefitted.

SSQ20-05 Neutropenia in Adults at the Time of Subcutaneous Chest Port Insertion is a Risk Factor for Early Infection-Related Port Removal

Thursday, Nov. 29 11:10AM - 11:20AM Room: S403A

Participants
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Filip Banovac, MD, Navshville, TN (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine if neutropenia at the time of subcutaneous, implantable chest port placement in adults confers an increased risk for early, infection-related removal.

METHOD AND MATERIALS

This retrospective cohort study was approved by the institutional review board and compliant with the Health Insurance Portability and Accountability Act. It included 2580 ports placed at a single tertiary medical center between June of 2007 and July of 2017. A total of 159 of these ports were placed in neutropenic patients. Neutropenia was defined as an absolute neutrophil count (ANC) <1500 cells/mm3. Electronic medical record follow-up was conducted for 30 days following port placement. Absolute percentages were calculated for port removal within 30 days in neutropenic and non-neutropenic groups. A chi-squared test was used to compare categorical data between the groups, and a t-test was used to compare continuous variables. Infection-related port removal was defined as a port removed due to a confirmed port infection. Port infection included central line-associated bloodstream infections (CLABSI) or local infections evidenced by either deep erythema, induration and/or tenderness overlying the catheter tunnel and port, or superficial erythema and induration overlying the port.

RESULTS

Within 30 days of port placement, ports placed in neutropenic patients had a significantly greater incidence (P = 0.01) of infection-related removal (3.8%, 6/159) compared to ports placed in nonneutropenic patients (1.1%, 27/2421). There was no significant difference between the neutropenic and nonneutropenic groups in gender or age (P = 0.31 and P = 0.77, respectively). Neutropenic patients had a greater, but not statistically significant, incidence of death related to port infection within the first 30 days (0.63%, 1/159) compared to the nonneutropenic group (0.12%, 3/2421; P = 0.22).

CONCLUSION

Neutropenia at the time of implantable, subcutaneous port placement is associated with an increased risk for early infection-related port removal. Incidence of death related to port infection, while increased in the neutropenic population, is not significantly higher than in the nonneutropenic population.

CLINICAL RELEVANCE/APPLICATION

Neutropenia in adults at the time of subcutaneous, implantable chest port placement confers an increased, although still low, risk for early infection-related port removal and should be taken into account when considering port placement.

SSQ20-06 Point of Care Ultrasound by Nonradiologist Physicians: Do the Trends Indicate a Shift Away from Radiologists?

Thursday, Nov. 29 11:20AM - 11:30AM Room: S403A

Participants
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David C. Levin, MD, Philadelphia, PA (Abstract Co-Author) Consultant, HealthHelp, LLC; Board Member, Outpatient Imaging Affiliates, LLC
Laurence Parker, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Ethan J. Halpern, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
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PURPOSE

"Point of care" ultrasound (POC US) is defined as US performed at the patient's bedside in real-time by a nonradiologist provider (NRP) versus formal ultrasound interpreted by a radiologist. Given the continued encouragement and development of POC US specialty based guidelines, our purpose was to assess the trends in use of POC US to determine if there has been a shift from radiologists to NRPs.

METHOD AND MATERIALS

The nationwide Medicare Part B fee-for-service databases for 2004-2016 were searched. All noninvasive noncardiac US CPT codes were selected. The databases indicate procedure volume which were used to calculate utilization rates per 1000 Medicare beneficiaries. Medicare place-of-service codes showed where the exams were interpreted and specialty codes indicated the specialty of the interpreting physicians. Sample statistics are not required in full populations like this.

RESULTS

POC US performed by NRPs peaked in 2010 at 211 studies per 1000 Medicare beneficiaries and has since declined to 192 studies in 2016 (-9%). POC US by NRPs is predominantly performed in private offices where peak utilization was seen in 2010 at 159 studies per 1000, declining to 140 in 2016 (-12%). The 2004-2016 interval changes in the remaining places-of service where NRP POC US is performed are as follows: (1) EDs: 1 to 3 (+136%); (2) hospital inpatients: 21 to 14 (-31%); hospital outpatient departments (HOPDs): 21 to 26 (+23%). The top NRP specialties in noncardiac POC US in 2016 and their rates were: vascular surgeons 38, cardiologists 37, other surgeons 31, primary care physicians 20. US use by radiologists peaked in 2011 at 238 studies and has since fluctuated between 234-238 without a significant trend. Over the period of the study, US use by radiologists has grown in the following places-of-service: (1) ED: 10 to 23 (+133%); (2) HOPD: 83 to 101 (+21%); (3) private offices: 39 to 56 (+44%). Inpatient US by radiologists has declined recently.

CONCLUSION

Despite the increased advocacy of POC US in recent years, NRPs have demonstrated a 9% decline in its utilization since 2010, particularly with decreasing use in private offices. There is no evidence of a recent shift away from radiologists. Radiologists demonstrated growth in use of POC US in EDs, HOPDs and private offices.

CLINICAL RELEVANCE/APPLICATION

There is no significant growth in use of point of care ultrasound by nonradiologist physicians.

SSQ20-07 *Primary Percutaneous Placement of Low-Profile versus Traditional Pigtail and Standard Balloon-Retention Gastrostomy Catheters in Adults: A Retrospective Review*

Thursday, Nov. 29 11:30AM - 11:40AM Room: S403A

Awards
Student Travel Stipend Award

Participants
Iftikhar Burney, MD, Houston, TX (Presenter) Nothing to Disclose
Zeyad A. Metwalli, MD, Bellaire, TX (Abstract Co-Author) Nothing to Disclose
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PURPOSE

De novo percutaneous placement of low-profile or button-type gastrostomy catheters (LP) is infrequently reported in adults. This study compares the safety and clinical outcomes of primary percutaneous placement of LP catheters and traditional (pigtail and balloon-retention) gastrostomy catheters (TG) at a single institution.

METHOD AND MATERIALS

This was an institutional review board-approved retrospective, single-institution review comparing initial LP and TG catheter placements in a 24-month time period. The age, gender, indication, catheter type, catheter French size, and method of anesthesia of 139 consecutive initial gastrostomy placement procedures were recorded. Total catheter days without intervention, major and minor complications, reasons for re-intervention, and procedure fluoroscopy times were compared.

RESULTS

During the 24 month study period, 61 LP and 78 TG catheters were placed. Technical success for both methods was 100%. Mean total catheter days prior to intervention was 137 days in the LP group and 128 days in the TG group ($p = 0.70$). Minor complications including cellulitis, peri-catheter leakage and early catheter occlusion occurred in 4.9% (3/61) in the LP group and 9% (7/78) in the TG group ($p = 0.51$). Major complications including early catheter dislodgement and bleeding requiring transfusion (in one patient) occurred in 4.9% (3/61) in the LP group and 7.7% (6/78) in the TG group ($p = 0.73$). Procedure fluoroscopy time was lower in the LP group (2.56 minutes) compared to the TG group (4.21 minutes) ($p < 0.005$).

CONCLUSION

Primary placement of low-profile or button-type gastrostomy catheters is technically feasible with a low complication rate similar to that of traditional gastrostomy catheters.

CLINICAL RELEVANCE/APPLICATION

De novo placement of low-profile gastrostomy catheters is technically feasible with a comparable safety profile to traditional

pigtail and balloon-retention gastrostomy catheters.

SSQ20-08 Comparison of Treatment Outcomes in Thermal Ablation for T1a Renal Cell Carcinoma: Does Treatment Modality Matter?

Thursday, Nov. 29 11:40AM - 11:50AM Room: S403A

Awards
Student Travel Stipend Award

Participants
Wenhui Zhou, BS , Boston, MA (Presenter) Nothing to Disclose
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PURPOSE

To compare the clinical outcomes of radiofrequency ablation (RFA), cryoablation (CA) and microwave ablation (MWA) for treatment o fT1a renal cell carcinoma (RCC).

METHOD AND MATERIALS

A retrospective analyis was performed of 320 patients (mean age = 71 ys., range = 22-90 yrs.) between October 2006 and December 2017. Mena R.E.N.A.L., P.A.D.U.A. and centrality index scores were 6., 8.1, and 2.9, respectively. Treatment response, residual disease and survival outcome were compared among the three groups. Local recurrence-free, metastatic-free,and overall surival rates were tabulated using Kaplan-Meier methods and compared with log-rank tests.

RESULTS

365 T1a biopsy-proven RCC measuring 1.2 to 4. cm were treated with CT-guided MWA (n= 40, 11%), RFA (n=291, 80%), or CA (n=34, 9%). There were no significant differences in patient demographics or tumor characteristics betwen the three cohorts. Technical success rate, complication rate and rsidual disease rate were similar among the three groups (p=0.91, p=0.14, p=0.46, respectively). At two-years follow-up, analysis of the local disease free-, metastatic free-, andoverall survial rate showed that MWA is non-inferior to RFA and CA (p=0,60, p=0.93, p=0.75, respectively).

CONCLUSION

CT-guided percutaneous MWA is an effective thermal ablation option for treatmen of T1a renal cell carcinoma.

CLINICAL RELEVANCE/APPLICATION

Microwave ablation has comparable therapeutic efficacay and oncologic outcomes when compared to RFA and CA.

SSQ20-09 Role of Dynamic Contrast-Enhanced MRI (DCE-MRI) in Treatment Response Evaluation of Metastatic Bone Disease

Thursday, Nov. 29 11:50AM - 12:00PM Room: S403A

Participants
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PURPOSE

To correlate perfusional features in skeletal metastases treated with MR-guided Focused Ultrasound (MRgFUS) with clinical outcomes assessed by visual analogue scale (VAS).

METHOD AND MATERIALS

53 patients with symptomatic skeletal metastases, suitable for MRgFUS, were enrolled. Dynamic Contrast-Enhanced MR exam (3T Discovery 750 scanner, GE; Gd-BOPTA, Bracco) was performed before and 3 months after the ablative procedure. As perfusional parameters, DCE transfer rate (Ktrans) and extravascular volume fraction (ve) were calculated by dedicated analysis software. Clinical outcomes were evaluated over the following three months using VAS scale.

RESULTS

42 of 53 treated subjects (79.2%) demonstrated a clinical complete response (CR), with a VAS score mean reduction of 4,5 (48,2%. p<0,001), whereas five patients showed a partial clinical response (PR) with residual pain, according to VAS scale. Perfusional analysis demonstrated in CR population significant decrease of Gadolinium extraction (mean Ktrans reduction 2,18/min, ΔKt=52,72%. p<0,01) and ve increase (5,6%. p<0,01). Partial Responders showed no substantial modification in Ktrans value (ΔKt=+0,044/min, +11,39%. p>0,05) or increase in extravascular volume (1.3%. p<0,01). Spearman test revealed a significant relationship between Ktrans quantitative parameters and pain relief evaluated by VAS scale (p<0,001) in both CR and PR patients.

CONCLUSION

K trans value reduction positively correlates to clinical outcomes, probably for a decreased neoplastic cells' metabolism after ultrasound ablation procedure.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI has an important role in treatment response evaluation. Perfusional parameters may be routinely included in the imaging evaluation of patients affected by metastatic bone disease.

SSQ21

Vascular Interventional (Liver Cancer Interventionist)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S403B

GI IR VA

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

FDA Discussions may include off-label uses.

Participants
Xiaoming Yang, MD, PhD, Mercer Island, WA (*Moderator*) Nothing to Disclose

Sub-Events

SSQ21-01 Tunable Ultrasound Vascular Therapy for Hepatocellular Carcinoma

Thursday, Nov. 29 10:30AM - 10:40AM Room: S403B

Participants
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Susan M. Schultz, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Mustafa Mohammed, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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Andrew K. Wood, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Tumor perfusion has varying effects on cancer therapy depending on the nature of the treatment used. While drug delivery and radiation therapy require increased tumoral perfusion for a better response, non invasive ischemic therapy and hyperthermia models require reduced blood flow. The purpose of this study is to investigate the dose-dependent effects of novel antivascular ultrasound therapy (AVUS) on hepatocellular carcinoma (HCC) tumoral blood flow.

METHOD AND MATERIALS

HCC was induced in 15 Wistar rats by ingestion of diethylnitrosamine (DEN) for 12 weeks. Rats received AVUS treatment at low and high doses. Low dose group (n=6) received 1 watt/cm2 ultrasound for 1 min with 0.2 mL microbubbles injected IV. High dose group (n=9) received 2 watts/cm2 for 2 min with 0.7 mL microbubbles IV. Tumoral perfusion was measured before and after AVUS with contrast-enhanced ultrasound (CE-US) and power Doppler (PD-US). Quantitative measures: perfusion index (PI) and peak enhancement (PE) were obtained from each AVUS dose. Histology samples were evaluated for percent area of hemorrhage and findings of tissue injury and repair including inflammation, necrosis, and fibrosis. Histology results were compared with pre- and post-AVUS ultrasound imaging findings.

RESULTS

With high dose AVUS, PE and PI of CE-US decreased from baseline by an average of 29.3% and 28.8%, respectively. Histology showed extensive tissue injury (hemorrhage, necrosis, fibrosis) in 58% of tumor cross-sectional area. Conversely, low dose therapy led to an increase in PE and PI of CE-US by an average of 39.3% and 67.8%, respectively. Histology showed smaller areas of microhemorrhage versus large pools of hemorrhage (only 17% area). PD-US changes were similar to CE-US.

CONCLUSION

Low-dose therapy increased tumoral perfusion, which may improve drug delivery or radiation therapy. Conversely, high-dose therapy decreased tumoral perfusion, an effect that could be used for noninvasive ischemic therapy. This tunable modulation of blood flow in tumors could provide multiple roles for AVUS in cancer therapy.

CLINICAL RELEVANCE/APPLICATION

Increasing availability of ultrasound in developing world could enable AVUS as an inexpensive & less resource-intensive tool for HCC therapy. Titrating the dose of AVUS could allow selective use to enahnce radiation therapy, drug delivery, or for ischemic therapy.

SSQ21-02 Radiofrequency Ablation Using a Separable Clustered Electrode for Treatment of HCCs: Randomized Controlled Trial of a Dual Switching Monopolar Mode versus a Single Switching Monopolar Mode

Thursday, Nov. 29 10:40AM - 10:50AM Room: S403B

Awards
Student Travel Stipend Award

Participants
Jae Won Choi, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Grant, Bayer AG Grant, General Electric Company Grant, Koninklijke Philips NV Grant, STARmed Co, Ltd Grant, RF Medical Co, Ltd Grant, Samsung Electronics Co, Ltd Grant, Guerbet SA

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PURPOSE

To prospectively compare the efficacy, safety and mid-term outcomes of dual-switching monopolar (DSM) radiofrequency ablation (RFA) with those of conventional single-switching monopolar (SSM) RFA in the treatment of hepatocellular carcinoma (HCC)

METHOD AND MATERIALS

This prospective study was performed with approval of the institutional review board, and written informed consent was obtained for all enrolled patients. From January 2015 to May 2016, 80 patients with 94 HCC nodules were enrolled and randomly treated with either DSM-RFA or SSM-RFA, using a separable clustered electrode and a three-channel dual-generator unit. Technical parameters, procedure-related complications, and technical efficacy were assessed at the post-procedural imaging studies. For a mean follow-up of 23.9 months ± 9.2, the patients were observed for local tumor recurrence as well as overall disease progression. Survival analysis was performed with the Kaplan-Meier method, and differences between the survival curves were evaluated with the log-rank test.

RESULTS

Significantly higher ablation energy per given time was delivered in the DSM-RFA group than in the SSM-RFA group (1.61 ± 0.28 kcal/min vs. 1.17 ± 0.28 kcal/min, respectively; P < .0001). Major complications were observed in two (4.9%) of 41 patients in the DSM-RFA group and in one (2.6%) of 39 patients in the SSM-RFA group (P=1.0000). A patient in the DSM-RFA group experienced intercostal arterial bleeding that required embolization. Pleural effusion developed in one patient in each group. Rates of local tumor recurrence in HCC nodules treated with DSM-RFA and SSM-RFA were 8.5% and 4.7%, respectively, at 2 years (P = .3160). The 2-year local recurrence-free survival rates in the DSM-RFA group and the SSM-RFA group were 90% and 94.4%, respectively (P = .3312). The 2-year event-free survival rates in the DSM-RFA group and the SSM-RFA group were 54.9% and 75.7%, respectively (P = .2649).

CONCLUSION

Although dual-switching monopolar radiofrequency ablation using a separable clustered electrode delivers higher ablation energy per given time than the SSM-RFA, it failed to show superior effectiveness to the SSM-RFA in the treatment of HCCs.

CLINICAL RELEVANCE/APPLICATION

Dual-switching monopolar radiofrequency ablation may be considered as a technically more efficient alternative with non-inferior clinical effectiveness to the SSM-RFA.

SSQ21-03 Utility of Change in Volumetric ADC and Enhancement Post TACE in Predicting Histologic Grade of HCC, with Pathologic Correlation

Thursday, Nov. 29 10:50AM - 11:00AM Room: S403B

Participants
Sanaz Ameli, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
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Ihab R. Kamel, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG

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PURPOSE

To investigate the role of change in ADC and enhancement after trans- arterial chemoembolization (TACE) in predicting histological grade of hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

This HIPPA compliant retrospective study was approved by our institutional review board. The study population included 104 HCC patients (128 index lesions) with MR imaging within 6 months before and 6 months after TACE who presented at our institution between 2001 and 2015. All cases had pathologic report of the HCC tumor by biopsy or liver transplantation. Volumetric measurements of venous enhancement (VE) and apparent diffusion coefficient (ADC) were performed on baseline and post TACE MRI. Based on pathology report, the tumors were histologically classified into two groups: Low grade HCC (n=42) and intermediate/high grade HCC (n=86). In case of tumors with mixed differentiation, the worst differentiation grade was considered. The mean ADC (mm2/s) and enhancement (%) of two groups were compared at two-time points. P value<0.05 was considered statistically significant.

RESULTS

Mean ADC increased by (363.88±529.07 x 10 -6 mm2/s) in low grade vs. (136.20±503.73 x 10 -6 mm2/s) in high grade HCC post TACE. ADC change in low grade tumors was higher than in intermediate/high grade tumors (P=0.02). Setting the cutoff of 148.4 x

10 -6 mm2/s or more in ADC change had a sensitivity and specificity of 62% and 55%, respectively in differentiating between the 2 groups. Enhancement decreased by (46 ± 34%) in low grade vs. (28± 36%) in high grade tumors post TACE. Enhancement change was significantly higher in low grade HCC as compared to intermediate/high grade tumors (P=0.011). Setting the cutoff of 39% or more decrease in enhancement had sensitivity and specificity of 65% and 55%, respectively in differentiating between the 2 groups.

CONCLUSION

Low grade tumors demonstrate a greater change in ADC and enhancement post TACE as compared to intermediate/ high grade tumors.

CLINICAL RELEVANCE/APPLICATION

The change in ADC and enhancement in HCC after TACE could potentially be utilized to predict tumor differentiation and can help the clinicians to plan future treatment in these 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/ Ihab R. Kamel, MD, PhD - 2015 Honored Educator

SSQ21-04 Quantitative Arterial Flow Measurement with 4D DSA

Thursday, Nov. 29 11:00AM - 11:10AM Room: S403B

Participants
Gabe Shaughnessy, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate the quantitative accuracy and precision of flow measurements derived from 4D digital subtraction angiography (4D DSA) and to evaluate 4D DSA flow values in a model of hepatic transarterial embolization (TAE).

METHOD AND MATERIALS

4D DSA generates a time-resolved 3D angiogram using a conventional C-arm acquisition consisting of a mask rotation followed by a contrast-enhanced rotation. Methods of quantifying flow in vessel segments of the 4D data are under development. In this work, flow was derived from a Fourier phase analysis of the pulsatile contrast waveform that arises when a constant-rate intra-arterial iodine injection mixes with pulsatile blood flow. 4D DSA flow was compared to reference standard flow measured by an ultrasonic flow probe (Transonic) in a vascular phantom study (range of flow rates 5-20 mL/s). In a porcine model, 4D DSA flow was evaluated before and after selective left or right hepatic TAE with 100-300 m microspheres. Iodinated contrast medium was injected at 2 mL/s during 4D DSA imaging.

RESULTS

4D DSA flow was linearly proportional to reference standard flow in the vessel phantom (R2 = 0.96) with a slope of 1.33 +/- 0.06 and an intercept of -0.2 +/- 0.77 mL/s. The slope was consistent with a flow state between the extremal cases of plug flow and parabolic flow, and the intercept was consistent with zero bias. The standard deviation in the 4D-DSA flow measurement averaged 1.2 mL/s in the phantom. In the porcine study (4 subjects), the mean reductions in 4D DSA flow following embolization were -0.2, -1.3, -2.2, and -1.0 mL/s ($p <= 0.04$). In repeat measurements performed in the same in vivo flow state, the average change in 4D DSA flow was 0.7 mL/s.

CONCLUSION

4D DSA can provide quantitative measurements of pulsatile flow through a vessel. These measurements are sensitive to changes in flow that occur during hepatic transarterial embolization.

CLINICAL RELEVANCE/APPLICATION

4D DSA flow measurements may be used to quantify treatment-related changes in arterial blood flow in the interventional suite, yielding a new, quantitative endpoint for procedures.

SSQ21-06 Radiofrequency Ablation of Primary Parathyroid Adenoma: Preliminary Results for Patients Ineligible for Surgery

Thursday, Nov. 29 11:20AM - 11:30AM Room: S403B

Participants
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Jung Hwan Baek, Seoul, Korea, Republic Of (*Abstract Co-Author*) Consultant, STARmed; Consultant, RF Medical

PURPOSE

The purpose of this study was to retrospectively evaluate the outcomes of ultrasonography (US)-guided radiofrequency ablation (RFA) of parathyroid adenoma in patients who were ineligible for surgery

METHOD AND MATERIALS

Between October 2010 and June 2016, six parathyroid adenomas (mean diameter, 2.0 cm; range, 1.2-3.8 cm) in six patients with primary hyperparathyroidism were treated with US-guided RFA by two radiologists in two hospitals. The inclusion criteria for this study were (1) primary hyperparathyroidism, (2) pathologically confirmed parathyroid adenoma on US-guided fine-needle aspiration, and (3) refusal- or ineligibility- for surgery. RFA was performed using a RF generator and 19-gauge internally cooled electrode. The hydrodissection technique using the 5% dextrose water was applied in all patients. The medical records were reviewed and analysed, focusing on the procedural profiles of RFA, symptoms and complications during and after RFA, and changes in hormone levels on follow-up US.

RESULTS

Before RFA, the mean nodule volume was 1.0 ± 0.5 mL. The mean parathyroid hormone (PTH) level was 210.4 ± 283.9 pg/mL and calcium level was 10.4 ± 0.9 mg/dL. At 1- and 6- month follow-up after RFA, a significant reduction in the mean volume (78.4 ± 3.7% and 89.1 ± 8.4 %, respectively) was noted and five ablation zones (5/6, 83.3%) near completely disappeared (<=0.1mL). The mean PTH level was decreased to the normal range (50.9 ± 6.5 pg/mL) at 1-month follow-up and were progressively decreased at 6-month follow-up in 5 patients (40.1 ± 7.3 pg/mL). The PTH level in one patient was re-increased from 48 pg/mL to the 241 pg/mL at 6-month follow-up. The mean calcium level was decreased to 9.3 ± 0.8 mg/dL at 6-month follow-up. There was no immediate complication during- and after- the procedure.

CONCLUSION

RFA might represent an effective and a safe alternative for managing parathyroid adenomas, especialy in patients ineligible for surgery

CLINICAL RELEVANCE/APPLICATION

RFA might be an alternative treatment option for managing parathyroid adenomas in patients with primary hyperparathyroidism.

SSQ21-07 Conventional versus Drug-Eluting Beads Chemoembolization for Infiltrative Hepatocellular Carcinoma: Comparison of Efficacy and Safety

Thursday, Nov. 29 11:30AM - 11:40AM Room: S403B

Participants
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PURPOSE

To compare the early tumor response and the toxicity in patients with infiltrative hepatocellular carcinoma (iHCC) treated with conventional or drug-eluting beads transarterial chemoembolization (TACE).

METHOD AND MATERIALS

A total of 89 iHCC patients who were treated with either cTACE(n=33) or DEB-TACE(n=56) were included in this retrospective study between April 2016 and September 2017. Tumor response was measured one month after the procedure using Modified Response Evaluation Criteria in Solid Tumors (mRECIST). Toxicity was graded by Common Terminology Criteria for Adverse Events v5.0 (CTCAE v5.0). The difference of tumor response and toxicity were compared between cTACE group and DEB-TACE group using Chi-square test or Fisher's exact test (if appropriate).

RESULTS

There was no difference in objective response rate between cTACE group and DEB-TACE group (12.1% vs. 10.7%, P=0.839). However, disease control rate is significantly higher in DEB-TACE group than cTACE group (85.7% vs. 66.7%, P=0.034). In some advanced disease, such as bilobar lesions, ECOG 1-2, and presence of portal venous tumor thrombus, DEB-TACE showed higher disease control than which cTACE showed (all P<0.05). For side-effect analysis, abdominal pain (P=0.034) and fever (P=0.009) are more frequent in cTACE group, and there was no difference in serious liver toxicity between two groups.

CONCLUSION

DEB-TACE offers more benefits of efficacy and tolerability in iHCC than cTACE, particularly for patients with more advanced disease.

CLINICAL RELEVANCE/APPLICATION

For iHCC patients, especially with ECOG 1-2, bilobular or portal venous tumor thrombus, DEB-TACE is recommended due to the low toxicity and well tolerability.

SSQ21-08 A Matched Study Comparing Right Portal Vein Embolization with and Without Segment 4 Portal Vein Embolization for Right Hepatic Trisectionectomy

Thursday, Nov. 29 11:40AM - 11:50AM Room: S403B

Participants
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PURPOSE

Portal vein embolization (PVE) is widely used before major hepatectomy. However, the necessity of segment 4 (S4) portal veins embolization in addition to embolization of the right portal vein before right hepatic trisectionectomy is controversial. Thus, we examined the effect of S4 PVE on hypertrophy of segments 2 and 3 (S2+3) in a matched retrospective cohort study.

METHOD AND MATERIALS

We retrospectively reviewed patients with biliary carcinoma who underwent preoperative PVE using gelatin sponge and coils between January 2010 and November 2017. Totally, 28 patients underwent right and S4 portal veins embolization (RPVE+4) for right hepatic trisectionectomy, and 100 patients underwent right PVE (RPVE) for right hepatectomy. We measured the liver volumes by CT using the workstation before and after embolization, and 22 patients from each group respectively were matched for the ratio of S2+3 volume to total liver volume (%S2+3 volume) before embolization. Volume changes in S2+3 after embolization were compared among the two groups.

RESULTS

There was no statistically significant difference between the two groups in the time between PVE and volumetric CT (mean, RPVE+4, 26.5days vs RPVE, 23.4days; P = .349). The absolute S2+3 volume increase was significantly more in RPVE+4 group than RPVE (RPVE+4, 129.5±79.5ml vs RPVE, 70.5±29.9ml; P = .002). The %S2+3 volume increased in both groups: from 23.7±4.5% before PVE to 33.0±4.7% after PVE in RPVE+4, and from 23.6±4.4% to 29.6±4.6% in RPVE. The increase of the %S2+3 volume (9.3±3.2% vs 5.9%±1.3; P < .001) and the increase rate of the %S2+3 volume (41.7±22.1% vs 26.3±8.6%; P = .004) were significantly higher in the RPVE+4 group. In multiple regression analysis, the absolute S2+3 volume increase (P = .002) and the increase rate of the %S2+3 volume (P = .003) were also significantly higher in the RPVE+4 group.

CONCLUSION

S4 PVE in addition to right PVE significantly improves S2+3 hypertrophy and increases the proportion of the future liver remnant compared with right PVE alone.

CLINICAL RELEVANCE/APPLICATION

S4 PVE added to right PVE is more effective in preparation for right hepatic trisectionectomy and may make the operation safer.

SSQ21-09 Multicentric Assessment of the Hong Kong Liver Cancer Staging System in Chinese Patients following Transarterial Chemoembolization

Thursday, Nov. 29 11:50AM - 12:00PM Room: S403B

Participants
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PURPOSE

Recently, the hepatitis B-based Hong Kong Liver Cancer (HKLC) staging system was reported to guide treatment options. We aimed to validate the performance of the HKLC compared with the Barcelona Clinic Liver Cancer (BCLC) staging system in Chinese hepatocellular carcinoma (HCC) patients treated with conventional transarterial chemoembolization (cTACE) as initial treatment.

METHOD AND MATERIALS

This retrospective study included patients with HCC who underwent cTACE between January 2008 and December 2016 at three Chinese institutions. All of the patients were calculated HCC stage using 5-substage HKLC (HKLC-5), 9-substage HKLC (HKLC-9), and the BCLC system. Based on overall survival (OS), these three staging systems' performance on treatment outcome prediction were compared using C statistic, Akaike information criterion (AIC), area under the receiver operating characteristic curve (AUC), linear trend chi-square, likelihood ratio chi-square, and calibration plots, respectively.

RESULTS

A total of 715 patients were included. The median OS was 10.1 months. Compared with the BCLC system, the HKLC system, especially HKLC-9 showed better performance on survival prediction (HKLC-9: C=0.689, AIC=6646.162; HKLC-5: C=0.683, AIC=6662.663; BCLC: C=0.680, AIC=6654.146), homogeneity (likelihood ratio chi-square: HKLC-9=232.38, HKLC-5=215.87, and BCLC=224.39, p <0.001) and calibration (R2: HKLC-9=0.923, HKLC-5=0.916, and BCLC=0.914). HKLC-9 outperformed on AUC at 6, 12, and 24 months' survival prediction than HKLC-5 and BCLC. BCLC showed better performance on monotonicity (linear trend chi-square: HKLC-9=121.641, HKLC-5=117.389, and BCLC=125.752; p <0.001).

CONCLUSION

Combining survival prediction, discrimination, and calibration, the HKLC, especially HKLC-9 system performed better for Chinese patients treated with cTACE than the BCLC system.

CLINICAL RELEVANCE/APPLICATION

HKLC outperforms BCLC when regarding patients with HCC treated with conventional TACE as initial treatment.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRT54

ASRT@RSNA 2018: The Importance of Good Technique in Achieving Diagnostic Images

Thursday, Nov. 29 11:45AM - 12:45PM Room: N230B

SQ

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

Participants
Amanda Martin, Farnworth, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

amanda.martin@boltonft.nhs.uk

LEARNING OBJECTIVES

1) To be able to recognize inadequately positioned images of the shoulder, knee and foot; know how to correct the positioning of the patient in order to produce good images. 2) Understand the common pathologies associated with the shoulder, knee and foot; be able to evaluate images of the shoulder, knee and foot in order to identify an abnormality.

ABSTRACT

Radiographers are commonly taught to produce two images when xraying a patient who presents with a musculoskeletal condition. In most cases, these two images are standardised across the profession, for example, a postero-anterior and a lateral projection for wrist injuries. However, there are a number of body areas where the standard projections are performed incorrectly and this can impact on the resultant diagnosis. Shoulders, knees and feet are three areas which can be performed inadequately. This presentation will outline the challenges in interpreting images which are poorly performed and suggest changes in the standard technique used for image acquisition in given scenarios. A systematic way to evaluate these images will be presented, with a range of common conditions and their appearances on these images.

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RCA53

Leveraging Machine Learning Techniques and Predictive Analytics for Knowledge Discovery in Radiology (Hands-on)

Thursday, Nov. 29 12:30PM - 2:00PM Room: S401AB

AI IN RS

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

Participants
Kevin Mader, DPhil,MSc, Basel, Switzerland (*Moderator*) Employee, 4Quant Ltd; Shareholder, 4Quant Ltd
Kevin Mader, DPhil,MSc, Basel, Switzerland (*Presenter*) Employee, 4Quant Ltd; Shareholder, 4Quant Ltd
Barbaros S. Erdal, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Joshy Cyriac, Basel, Switzerland (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the basic principles of predictive analytics. 2) Be exposed to some of the existing validation methodologies to test predictive models. 3) Understand how to incorporate radiology data sources (PACS, RIS, etc) into predictive modeling. 4) Learn how to interpret results and make visualizations.

ABSTRACT

During this course, an introduction to machine learning and predictive analytics will be provided through hands on examples on imaging metadata (scan settings, configuration, timestamps, etc). Participants will use open source as well as freely available commercial platforms in order to achieve tasks such as image metadata and feature extraction, statistical analysis, building models, and validating them. Imaging samples will include datasets from a variety of modalities (CT, PET, MR) and scanners. The course will begin with a brief overview of important concepts and links to more detailed references. The concepts will then be directly applied in visual, easily understood workflows where the participants will see how the data are processed, features are selected, and models are built.

RCC53

Growing Your Business with Social Media: Tips and Tricks for Department and Practice Managers

Thursday, Nov. 29 12:30PM - 2:00PM Room: S501ABC

IN LM

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

Participants

Alex Towbin, MD, Cincinnati, OH (*Moderator*) Author, Reed Elsevier; Grant, Guerbet SA; Grant, Siemens AG; Grant, Cystic Fibrosis Foundation; Consultant, Anderson Publishing, Ltd; Advisory Board, IBM Corporation; Advisory Board, KLAS Enterprises LLC;
Alex Towbin, MD, Cincinnati, OH (*Presenter*) Author, Reed Elsevier; Grant, Guerbet SA; Grant, Siemens AG; Grant, Cystic Fibrosis Foundation; Consultant, Anderson Publishing, Ltd; Advisory Board, IBM Corporation; Advisory Board, KLAS Enterprises LLC;
Saad Ranginwala, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Lindsey A. Shea, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe how social media can be used to promotoe a radiology practice. 2) Name three social media platforms, their benefits, and their contraints.

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/ Alex Towbin, MD - 2014 Honored Educator

MSCB51

Case-based Review of Breast (Interactive Session)

Thursday, Nov. 29 1:30PM - 3:00PM Room: N228

BR

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

FDA Discussions may include off-label uses.

Participants
Jiyon Lee, MD, New York, NY (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify appropriate application of multi-modality breast imaging for routine screening, supplemental screening, and diagnostic indications. 2) Select appropriate methods for image-guided percutaneous biopsy and perform post-biopsy radiologic-pathologic correlation for next management recommendation. 3) Review appropriateness criteria and performance benchmarks, and guidelines for ongoing breast imaging audits as they apply. 4) Appreciate the range of reassuringly common and sometimes not-so common among the international faculty's portrayal of their piece of the globe.

ABSTRACT

Title: *Managing expectations in breast imaging around the world. "Best" versus sufficient?* Abstract: Our case-based review course will use the interactive audience response system (ARS) to walk and skip through the fundamentals of breast imaging. We will present how we use mammography, ultrasound, and MRI in daily screening and diagnostic scenarios, along with reminders of the overarching principles of BI-RADS lexicon for effective communication, and ACR appropriateness criteria and performance metrics as applicable or adapted around the world. Our international faculty (sessions 1 and 2) will also add depth, and the fun added dimensions of how breast imaging works around the world. Varying breast cancer statistics, possible innate ethnic variations, differing cultural expectations and socioeconomic context can and do impact how we carry out our discretionary work. Such interesting details will inform the narrative of the speakers' case scenarios, while the core diagnostic radiology skills aim to be constant, and teachable. The focus is using lots of cases to demonstrate breast imaging now and evolving. Please join us for smart fun!

Active Handout:Jiyon Lee

http://abstract.rsna.org/uploads/2018/18001608/MSCB51 52.pdf

Sub-Events

MSCB51A Tomosynthesis: Evolving Appreciation of the Better Mammogram

Participants
Jiyon Lee, MD, New York, NY (*Presenter*) Nothing to Disclose

MSCB51B From Andes to Patagonia: Breast Imaging in Argentina

Participants
Daniel E. Lehrer, MD, CABA, Argentina (*Presenter*) Speaker, Hologic, Inc; Institutional research agreement, Siemens AG

For information about this presentation, contact:

lehrerdan@cerim.com.ar

LEARNING OBJECTIVES

1) Identify appropriate application of multi-modality breast imaging for routine screening, supplemental screening, and diagnostic indications. 2) Improve basic knowledge and skills relevant to clinical practice. 3) Recommend the appropriate technique and avoid mistakes, incorporating others' clinical experiences.

ABSTRACT

We show cases from different parts of the country, with different realities and possibilities. This cases include a wide range of sophistication, from the optimization of the basic knowledge to the ones that require the latest technologies. You can realize that Tolstoy´s: Paint your village and you will paint the whole world is true for breast imaging.

Active Handout:Daniel E. Lehrer

http://abstract.rsna.org/uploads/2018/18001610/RSNA_Argentina MSCB51B.pdf

MSCB51C The Many 'Faces' of DCIS

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

For information about this presentation, contact:

alourenco@lifespan.org

LEARNING OBJECTIVES

1) Detect the varied appearances of DCIS on mammography, ultrasound, and MRI. 2) Compare how imaging findings may predict pathology.

ABSTRACT

This case-based session will showcase the various appearances of DCIS on mammography, ultrasound and MRI, highlighting how certain imaging findings may predict pathology. The interactive questions will cover management as well as follow-up recommendations, and illustrate key findings that should be included in imaging reports.

Active Handout:Ana P. Lourenco

http://abstract.rsna.org/uploads/2018/18001611/Handout.Lourenco.DCIS MSCB51C.pdf

MSCB51D Spain Explains the Mundane and the Less So

Participants
Lucia Grana Lopez, MD, Lugo, Spain (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lucia.grana.lopez@sergas.es

LEARNING OBJECTIVES

1) Identify appropriate application of multi-modality breast imaging mainly for supplemental screening, diagnosis and define its interventional indications. 2) Learn about the advantages of ultrasound-guided percutaneous removal of benign breast lesions and when and how to perform this procedure, as we've experienced in our practice. 3) Preview emerging molecular breast dedicated imaging tool, define its possible indications and potential use in clinical routine.

ABSTRACT

My case-based review course will use the interactive audience response system (ARS) to walk and skip through the fundamentals of breast imaging. I will present how we use mammography, ultrasound, and MRI in daily supplemental screening and diagnostic scenarios, along with reminders of the overarching principles of BI-RADS lexicon for effective communication, and ACR appropriateness criteria and performance metrics as applicable.I will try to show how breast imaging works in Spain.

Active Handout:Lucia Grana Lopez

http://abstract.rsna.org/uploads/2018/18001612/Spain explains the mundane MSCB51D.pdf

MSCU51

Case-based Review of Ultrasound (Interactive Session)

Thursday, Nov. 29 1:30PM - 3:00PM Room: E450B

GI GU OB US VA

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

FDA Discussions may include off-label uses.

Participants
Deborah J. Rubens, MD, Rochester, NY (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn current techniques and advances in ultrasound imaging. 2) Become familiar with state of the art guidelines for diagnosis and management of imaging findings. 3) Review critical physiology and pathology as it is depicted by ultrasound. 4) Understand the vital role of ultrasound imaging in modern-day patient care.

ABSTRACT

This course is designed to highlight the vital role ultrasound plays in imaging and diagnosis in all parts of radiology. Special emphasis will be placed on technical advances including ultrasound contrast and elastography and interventional guidance. The wide range of ultrasound applications will be covered including vascular, general abdominal, pediatric, gynecology, small parts and obstetrics. Our goal is to provide a broad update in the field while addressing new opportunities and challenges for everyday practice.

Sub-Events

MSCU51A Ultrasound Advances: Elastography and Contrast

Participants
Richard G. Barr, MD, PhD, Campbell, OH (*Presenter*) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Canon Medical Systems Corporation; Research Grant, Esaote SpA; Research Grant, BK Ultrasound; Research Grant, Hitachi, Ltd

LEARNING OBJECTIVES

1) Review the clinical uses of elastography in routine practice. 2) Discuss the advantages and disadvantages of elastography. 3) Review the uses of ultrasound contrast - on label and off label. 4) Discuss how CEUS can be incorporated into a routine practice. 5) Review the materials need to develop a CEUS program.

Honored Educators

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

MSCU51B Vascular Ultrasound

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

For information about this presentation, contact:

leslie.scoutt@yale.edu

LEARNING OBJECTIVES

1) Describe pitfalls in Doppler ultrasound examination of the abdomen and peripheral arteries. 2) Discuss unusual vascular pathology. 3) Discuss how waveform analysis can aid in vascular ultrasound interpretation.

Honored Educators

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MSCU51C Obstetric Ultrasound: Things to Know 2018

Participants
Phyllis Glanc, MD, Toronto, ON (*Presenter*) Advisory Board, General Electric Company

For information about this presentation, contact:

phyllis.glanc@sunnybrook.ca

LEARNING OBJECTIVES

1) Familiarize yourself with emerging trends and research developments. 2) Learn about urgent/emergent obstetrical clinical and imaging scenarios.3) Consider the impact of social media and the internet on our practice.

ABSTRACT

This course is designed to highlight urgent and emergent obstetrical imaging issues in daily practice. It will also examine new research findings which may impact daily practice and examine the role of social media and the internet as it affects obstetrical imaging practice. The course is based on case presentation scenarios.

MSCU51D Abdominal Ultrasound

Participants
Jason M. Wagner, MD, Oklahoma City, OK (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jason-wagner@ouhsc.edu

LEARNING OBJECTIVES

1) Use contrast enhanced ultrasound to evaluate hepatic and renal lesions. 2) Recognize common sonographic pitfalls in the diagnosis of hepatobiliary conditions. 3) Diagnose abdominal wall abnormalities with ultrasound.

SPFF51

Fast 5

Thursday, Nov. 29 1:30PM - 2:00PM Room: Arie Crown Theater

ARRT Category A+ Credit: 0
CME credit is not available for this session.

Participants
Tessa S. Cook, MD, PhD, Philadelphia, PA (*Moderator*) Royalties, Osler Institute

Sub-Events

SPFF51A Patient Feedback for Radiology Reports: Are We Prepared to Be Yelp'd?

Participants
Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose
Arthur J. Pesch III, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Customer feedback pervades nearly all aspects of consumer life, from Amazon to Zappos, though is largely absent from the radiology world. Yet, in the era of value based care, responding to consumer demands and needs will be important to ensure radiologists value proposition. We have developed a novel website for collecting feedback from our "customers" (the patients and ordering providers) via a link included at the end of each of our imaging reports. The feedback we have received has allowed us to improve our reporting practices, increasing both ordering provider and patient satisfaction by responding to the needs and desires of various stakeholders. Taking a cue from the consumer world, and applying it to radiology reporting, is a new way of implementing the principles of value based reporting to our everyday practice.

SPFF51B Human-centered Design in Radiology

Participants
Achala S. Vagal, MD, Mason, OH (*Presenter*) Research Consultant, Nervive; Research Grant, Imaging Core Lab; Research Grant, ENDOLOW ; Grant, Johnson & Johnson

ABSTRACT

Design thinking is a human-centered approach to innovation that was originally developed in the business world to create new products. Although there has been an explosion of design thinking in the industry with companies like IDEO adopting innovative, design led solution to business strategies, healthcare is yet to actively embrace design thinking and holistic, human centered approaches in redesigning operations. We need to invite all our "external and internal customers" to the design table - referring physicians, patients, families, hospital administrators, schedulers, technologists, staff members, radiologists - keeping the needs, desires and behaviors of people at center of the design process. We will discuss how at University of Cincinnati Medical center we are collaborating with one of the world's top design school (UC College of Design, Architecture, Art, and Planning [DAAP]) to incorporate human centered design in our Radiology Department.

SPFF51C Patient-friendly Imaging Appropriateness Criteria Summaries

Participants
Andrea K. Borondy Kitts, MS,MPH, South Glastonbury, CT (*Presenter*) Stockholder, Abbott Laboratories; Stockholder, AbbVie Inc; Stockholder, F. Hoffmann-La Roche Ltd; Stockholder, Johnson & Johnson; Officer, Prosumer Health; Investor, Prosumer Health

ABSTRACT

Helping people understand what imaging or radiologist intervention is appropriate for commonly encounterd medical conditions such as low back pain can help avoid unnecessary interventions. Patients sometimes insist on specific tests such as an MRI for low back pain without concerning symptoms or etiology. Referring physicians comment that it is easier to order the test than to explain why the test is unnecessary to the patient. The Journal of the American College of Radiology started a project to write and publish patient friendly 250 word summary of American College of Radiology Appropriateness Criteria. The summaries are written by lay person authors and co-authored by AC patient subcommittee members to oversee technical accuracy.

SPFF51D Mirage of AI Substituting Radiologists: Lessons from When AI Got it Wrong

Participants
Vasanthakumar Venugopal, MD, New Delhi, India (*Presenter*) Nothing to Disclose

ABSTRACT

There are many AI systems that claim human or super-human performance. We present from our experience of validating various algorithms, instances where, even though the average algorithmic performance was at par with or even better than experienced radiologists, relying on AI results could have translated into clinical disasters. Such cases range from pneumothorax on x-ray to intra-cranial bleeds on CT. Eventually, when implemented unsupervised, not only is it imperative that AI systems have higher accuracy than radiologists, but it is also critical that the AI err only in situations where a human would have erred.

SPFF51E Mentorship/Sponsorship of a New Generation of #RADxx & #RADxy through Social Media

Participants
Amy K. Patel, MD, Boston, MA (*Presenter*) Nothing to Disclose

ABSTRACT

Social media (#SoMe) has transformed medicine by significantly reducing barriers and the traditional hierarchy that the profession inherently possesses. #SoMe has created an innovative avenue which is connecting medical students, residents, and fellows to practicing physicians, especially in the Radiology Twitterverse. As a result, I am now mentoring/sponsoring many female (#RADxx) and male (#RADxy) trainees across the country who have actively sought me out. Our professional relationships have resulted in recruitment into radiology, landing electives, residency/fellowship programs, and even jobs of their choice. My Fast 5 would share the recipe of success on #SoMe to forge these relationships regardless of any level of training and demonstrate the value in making a concerted effort to this do via this avenue to diversify radiology and recruit the best and brightest our field has to offer.

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SPRG51

RadioGraphics' Publication Information for Potential Authors

Thursday, Nov. 29 1:30PM - 2:45PM Room: E353A

ED OT

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Jeffrey S. Klein, MD, Burlington, VT (*Presenter*) Nothing to Disclose
James Clinton, Oak Brook, IL (*Presenter*) Nothing to Disclose
Melissa L. Reen, Milton, VT (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jklein@rsna.org

LEARNING OBJECTIVES

1) Explain the process that RadioGraphics uses to invite manuscripts for consideration of publication. 2) Detail the differences in submitting standard manuscripts and interactive online presentations for the Training and Fundamentals section of the journal. 3) Understand the process of submitting manuscripts for consideration. 4) List criteria used by the journal to render decisions on peer-reviewed papers and online journal presentations.

ABSTRACT

This session will review the journal's methods of invitation for select RSNA annual meeting education exhibits, and the process of submitting both standard manuscripts and selected education exhibit presentations for peer review by RadioGraphics.

VSIO51

Interventional Oncology Series: IO Practice and Clinical Trials

Thursday, Nov. 29 1:30PM - 6:00PM Room: S405AB

IR RS

AMA PRA Category 1 Credits ™: 4.25
ARRT Category A+ Credits: 4.25

Participants
Riad Salem, MD, MBA, Chicago, IL (*Moderator*) Research Consultant, BTG International Ltd; Research Grant, BTG International Ltd; Consultant, Eisai Co, Ltd; Consultant, Exelixis, Inc; Consultant, Bristol-Myers Squibb Company; Consultant, Dove; ;
Luigi Solbiati, MD, Pieve Emanuele (Milano), Italy (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

lusolbia@tin.it

LEARNING OBJECTIVES

1) Understand challenges of clinical trials with locoregional therapies.

Sub-Events

VSIO51-01 Limitations of Clinical Trials in IO

Thursday, Nov. 29 1:30PM - 1:50PM Room: S405AB

Participants
Riad Salem, MD, MBA, Chicago, IL (*Presenter*) Research Consultant, BTG International Ltd; Research Grant, BTG International Ltd; Consultant, Eisai Co, Ltd; Consultant, Exelixis, Inc; Consultant, Bristol-Myers Squibb Company; Consultant, Dove; ;

LEARNING OBJECTIVES

1) To learn about challenges of clinical trials involving locoregional therapies.

VSIO51-02 Are Randomized Clinical Trials Mandatory in IO?

Thursday, Nov. 29 1:50PM - 2:10PM Room: S405AB

Participants
Stacey M. Stein, MD, New Haven, CT (*Presenter*) Nothing to Disclose

VSIO51-03 Cancer-Induced Bone Pain Palliation: A Multicenter, Phase III, Randomized, Case-Control Trial of MR-Guided Focused Ultrasound (MRgFUS) versus External Beam Radiation Therapy (EBRT) for the Evaluation of Patients with Painful Metastatic Bone Disease

Thursday, Nov. 29 2:10PM - 2:20PM Room: S405AB

Participants
Alessandro Napoli, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Scipione, MD , Rome, Italy (*Presenter*) Nothing to Disclose
Andrea Leonardi, MD , Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Fabrizio Andrani, MD , Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Alberto Bazzocchi, MD, Bologna, Italy (*Abstract Co-Author*) Nothing to Disclose
Hans Peter Erasmus, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Michele Anzidei, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

alessandro.napoli@uniroma1.it

PURPOSE

To assess and compare the clinical impact of MR-guided Focused Ultrasound (MRgFUS) and External Beam Radiation Therapy (EBRT) for pain palliation in patients with symptomatic non-spinal bone metastasis.

METHOD AND MATERIALS

Patients with solid malignant tumors and one or more bone metastasis were enrolled in the study. Included patients were >=18 years of age, presented with symptomatic bone metastasis (defined by a pain score >=4 at Visual Analogue Scale, VAS), confirmed at imaging, and could safely undergo both MRgFUS and radiotherapy. Vertebral locations were excluded as considered non-accessible by ultrasound. Participants were randomly assigned (1:1 ratio) to receive MrgFUS or EBRT. Outcomes were compared at 1, 3, 6 and 12 months. Treatment response was defined as a reduction of >= 2 points in worst pain by 1 month, accompanied by a stable or reduced opioid dose, compared with baseline and was considered as primary outcome. Secondary outcomes included

average pain, interference of pain with activity, mood, quality of life, and procedure-related adverse events.

RESULTS

281 patients (M: 151; F: 130) were enrolled and randomly assigned: 140 to MRgFUS and 141 to EBRT. The most common cancers were prostate (n=92; 33%), breast (n=86; 31%), and lung (n=67; 24%). In the MRgFUS arm 109 patients (77.9%) achieved the primary end point, compared with 112 (79.4%) in the EBRT arm (adjusted odds ratio, 1.04; p = 0.728). There were no statistically significant differences in all secondary outcomes between arms, too. Results were stable along the whole follow-up period.

CONCLUSION

MRgFUS results appear comparable to EBRT in pain palliation of patients with symptomatic bone metastasis; this technique does not require radiation exposure, has not any toxic effect, and is performed in a single session. MRgFUS is limited to non-spinal locations.

CLINICAL RELEVANCE/APPLICATION

MRgFUS represents a valid treatment option for pain palliation in patients with bone metastasis and could be routinely introduced in those cases that are technically accessible and do not respond to conventional treatment.

VSIO51-04 Imaging Issues in Interventional Oncology Trials

Thursday, Nov. 29 2:20PM - 2:40PM Room: S405AB

Participants
Mishal Mendiratta-Lala, MD, West Bloomfield, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with the existing tumor response criteria, including RECIST, WHO, mRECIST and EASL. 2) Understand the limitations of using size alone (RECIST/WHO criteria) to assess tumor response after various locoregional therapy, by using hepatocellular carcinoma as a prototype. 3) Identify imaging features, other than size, which help predict response to locoregional therapy.

VSIO51-05 Introduction to Statistics and the P-Value

Thursday, Nov. 29 2:40PM - 3:00PM Room: S405AB

Participants
Jeffrey D. Blume, PhD, Nashville, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

(1) To examine the origins of the p-value and its proper usage. (2) To understand why confidence intervals are critical for interpreting results (3) To appreciate why p-value based inference can go awry when confidence intervals are not presented.

ABSTRACT

Verifying that a statistically significant result is scientifically meaningful is not only good scientific practice, it is a natural way to control the Type I error rate. Here I will review the origins of p-value based inference by contrasting significance testing with hypothesis testing. I will explain the role of the tail area probability in both inferential paradigms and I will show examples to illustrate why p-value based inference, without reference to a confidence interval, can be highly misleading.

VSIO51-06 Introduction to Cost Effectiveness Trials

Thursday, Nov. 29 3:00PM - 3:20PM Room: S405AB

Participants
Nishita Kothary, MD, Stanford, CA (*Presenter*) Scientific Advisor, Siemens AG; Research Grant, Siemens AG; Scientific Advisor, Echopixel; Research Grant, Echopixel

For information about this presentation, contact:

kothary@stanford.edu

LEARNING OBJECTIVES

1) Identify factors that have led to the rising healthcare expenditure and describe the need for cost-effectiveness analysis. 2) Describe the differences between cost-effectiveness and comparative-effectiveness and explain the need for value (whether the benefits of an intervention justify its cost). 3) Describe the general principles of doing a cost-effectiveness comparison with particular attention to assessing the value of healthcare technologies.

VSIO51-07 Outcomes in Interventional Oncology Trials: Survival as an Endpoint for Staged and Repeatable Therapies

Thursday, Nov. 29 3:20PM - 3:40PM Room: S405AB

Participants
Michael C. Soulen, MD, Philadelphia, PA (*Presenter*) Royalties, Cambridge University Press; Consultant, Guerbet SA; Research support, Guerbet SA; Research support, BTG International Ltd; Consultant, Merit Medical Systems, Inc; Proctor, Sirtex Medical Ltd; Consultant, Terumo Corporation; Consultant, Bayer AG

For information about this presentation, contact:

Michael.soulen@uphs.upenn.edu

LEARNING OBJECTIVES

1) Review the many definitons of 'survival' in clinical trials. 2) Describe staisitcal methods for analysis of survival. 3) Apply novel

clinical trial designs that account for staged and repeatable therapies.

ABSTRACT

Traditional oncologic outcomes for cancer clinical trials revlove around survival, be it overall,cancer-specific,or a surrogate measure such as PFS. Survival is estimated using Kaplan-Meier plots, and compared using hazard ratios calculated by the log rank test. This approach applied to systemic therapies assumes that all cancer is treated from a fixed starting timepoint, and progression or death marks the endpoint. Image-guided cancer therapies such as embolization are often staged, with portions of the tumor treated at monthly intervals, so there is no fixed timepoint for start of treatmetn that applies to entire tumor burden. Another conundrum is repeatability; progression on a drug therapy signifies failure, but embolization and ablation can be repeated, restoring a disease-free or diseae-controlled state. Clinical trial designs incorporating staged and repeatabie therpies are a unique challenge for IO.

VSIO51-08 Interventional Oncology Series: 'Other' Organs

Participants
Luigi Solbiati, MD, Pieve Emanuele (Milano), Italy (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

lusolbia@tin.it

LEARNING OBJECTIVES

1) To learn in what organs thermal ablation can be applied, in addition to the 'traditional' organs (liver, kidney, lung, bone). 2) To understand what technical difficulties can be encountered for the treatment of tumors of thyroid, parathyroid, breast, adrenal glands and pancreas and how to get over them. 3) To learn if and how ablation can replace more traditional therapies for tumors of those organs.

VSIO51-09 Irreversible Electroporation of Pancreatic Tumors

Thursday, Nov. 29 3:40PM - 4:00PM Room: S405AB

Participants
Govindarajan Narayanan, MD, Miami, FL (*Presenter*) Consultant, BTG International Ltd; Consultant, AngioDynamics, Inc; Consultant, Medtronic plc;

VSIO51-10 Percutaneous Radiofrequency Ablation of Pancreatic Adenocarcinoma

Thursday, Nov. 29 4:00PM - 4:10PM Room: S405AB

Participants
Alessandro Sarno, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Giorgia Tedesco, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Riccardo De Robertis, MD, Peschiera del Garda, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Tinazzi Martini, MD, Peschiera del Garda, Italy (*Abstract Co-Author*) Nothing to Disclose
Emilio Barbi, Peschiera, Italy (*Abstract Co-Author*) Nothing to Disclose
Mirko D'Onofrio, MD, Verona, Italy (*Presenter*) Speaker, Bracco Group; Speaker, Siemens AG; Consultant, Siemens AG; Speaker, Hitachi, Ltd

PURPOSE

The objective of this study was to evaluate the feasibility and safety of percutaneous radiofrequency ablation (RFA) of locally advanced pancreatic cancer located in the pancreatic body.

METHOD AND MATERIALS

Patients with biopsy-proven locally advanced pancreatic adenocarcinoma were considered for percutaneous radiofrequency ablation. Postprocedural computed tomography studies and CA 19.9 tumor marker evaluation were performed at 24 hours and 1 month. At computed tomography, treatment effect was evaluated by excluding the presence of complications. The technical success of the procedure is defined at computed tomography as the achievement of tumoral ablated area.

RESULTS

Thirty-five patients have been included in the study. Five of the 35 patients were excluded. At computed tomography, the mean size of the intralesional postablation necrotic area was 32 mm (range: 15-65 mm). None of the patients developed postprocedural complications. Mean CA 19.9 serum levels 1 day before, 1 day after, and 1 month after the procedure were 285.8 U/mL (range: 16.6-942.0 U/mL), 635.2 U/mL (range: 17.9-3368.0 U/mL), and 336.0 U/mL (range: 7.0-1400.0 U/mL), respectively. The mean survival after RFA procedure of the Patients, calculated on the data collected for 26 subjects, is 312 days (range: 65 - 718 days)

CONCLUSION

Percutaneous radiofrequency ablation of locally advanced adenocarcinoma has a high technical success rate and is effective in cytoreduction.

CLINICAL RELEVANCE/APPLICATION

Percutaneous RFA of locally advanced pancreatic adenocarcinoma could be proposed as a complementary treatment for this pathology.

VSIO51-11 Breast Cancer: Is There a Role for Ablation?

Thursday, Nov. 29 4:10PM - 4:30PM Room: S405AB

Participants
Jean Palussiere, MD, Bordeaux, France (*Presenter*) Speaker, Boston Scientific Corporation

For information about this presentation, contact:

j.palussiere@bordeaux.unicancer.fr

Active Handout:Jean Palussiere

http://abstract.rsna.org/uploads/2018/18001248/RSNA breast ablation VSIO51-11.pdf

LEARNING OBJECTIVES

1) To know if image guided percutaneous thermal ablation techniques are feasible on breast cancers. 2) To know indications, contraindications and limits of thermal ablation on breast cancers. 3) How to follow up patients and how to manage complications.

ABSTRACT

Thermal ablation techniques are showing promise for the treatment of breast cancer and deserve further investigation in large trials. These techniques may be available in some breast centres, with interventional radiologists taken part in selected cases as part of the core team. • Image-guided percutaneous thermal ablation techniques cinclude hyperthermia induced by application of radiofrequency currents (RFA), laser, microwave (MWA), insonation with high-intensity focused ultrasound (HIFU), or hypothermia by cryotherapy • Breast conservation with lumpectomy remains the standard of care but percutaneous thermal ablation has been proposed as a substitute to surgery, especially for older patients who are not candidates for surgery or who refuse it. Feasibility and efficacy has been demonstrated above all with RFA and cryotherapy. • After thermal ablation, the tumour remains in place, so regular follow-up with imaging is warranted to ensure that the tumour volume has been completely treated.

VSIO51-12 Percutaneous Ablation for Locoregional Treatment of Breast Cancer Patients with Oligometastatic Disease

Thursday, Nov. 29 4:30PM - 4:40PM Room: S405AB

Awards
Student Travel Stipend Award

Participants
Ryan W. England, MD, New York, NY (*Presenter*) Nothing to Disclose
Majid Maybody, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Stephen B. Solomon, MD, New York, NY (*Abstract Co-Author*) Research Grant, General Electric Company; Consultant, Johnson & Johnson; Consultant, BTG International Ltd;
Constantinos T. Sofocleous, MD, PhD, New York, NY (*Abstract Co-Author*) Consultant, General Electric Company; Consultant, Johnson & Johnson; Consultant Terumo; ; Research Support: BTG, Ethicon J&J; ; ;
Lynn A. Brody, MD, New York, NY (*Abstract Co-Author*) Stockholder, Sirtex Medical Ltd
Anne M. Covey, MD, New York, NY (*Abstract Co-Author*) Stockholder, Amgen Inc; Advisory Board, Accurate Medical
Etay Ziv, MD,PhD, New York, NY (*Abstract Co-Author*) Research Grant, Johnson & Johnson; Research Grant, Cycle for Survival ; Research Grant, Functional Genomics Initiative
Serena Wong, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jacqueline Bromberg, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Tiffany A. Traina, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Amy R. Deipolyi, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Percutaneous thermal ablation may be attempted for the eradication of disease in patients with oligometastatic breast cancer (BC). This study aims to describe a single-institution's experience in treating liver, lung, and bone/soft tissue BC metastases.

METHOD AND MATERIALS

From 1999 to 2017, forty-six (35 liver, 7 lung, 4 bone/soft tissue) ablations were performed utilizing microwave, radiofrequency and cryoablation, with CT, MRI or PET/CT guidance, in 33 women with BC (mean age 52±12 years). Thirteen patients also underwent next generation genetic sequencing with MSK-IMPACT or Sequenom. Retrospective chart review established outcomes after first and subsequent ablations. Indication was for either eradication of disease (EOD; no other sites of mestastasis present) or control of disease (COD; growing lesion in the setting of other stable or decreasing sites). Progression after ablation was defined as residual/recurrent disease or other newly growing lesions.

RESULTS

Kaplan-Meier survival analyses demonstrated a median time to progression of 9 months, with a median overall survival of 70 months after first ablation. There was no difference in time to progression between ablations performed for EOD vs. COD (p=0.36). Patients treated for EOD had a trend towards improved overall survival over patients who were treated for COD (p=0.06). ER-positivity was a predictor for both longer overall survival (p=0.03) and longer time to progression (p=0.03) following ablation. Of the 13 patients whose tumors underwent genetic sequencing, no mutations were found that predicted outcome after ablation. Among 33 patients, 7 (21%) maintained no evidence of disease after a mean follow up of 33±26 months. Adverse events requiring additional intervention occurred after 2/35 (6%) liver ablations, 1/4 (25%) bone/soft tissue ablations, and 2/7 (29%) lung ablations.

CONCLUSION

Ablation of oligometastatic BC lesions is a relatively safe procedure associated with long-term survival of about 6 years. Over one fifth of patients may achieve no evidence of disease lasting for nearly three years. ER+ patients survive longer with longer time to progression after ablation. Further work is needed to characterize genetic predictors.

CLINICAL RELEVANCE/APPLICATION

Percutaneous ablation of oligometastatic lesions due to breast cancer is associated with excellent survival and long disease free intervals, particularly in ER+ patients.

VSIO51-13 Percutaneous Ablation of Thyroid Goiter

Thursday, Nov. 29 4:40PM - 5:00PM Room: S405AB

Participants

Fulvio Stacul, MD, Trieste, Italy (*Presenter*) Consultant, Bracco Group

For information about this presentation, contact:

fulvio.stacul@asuits.sanita.fvg.it

LEARNING OBJECTIVES

1) Identify appropriate indication for percutaneous ablation of thyroid goiter. 2) Recommend appropriate technique for percutaneous ablation of thyroid goiter. 3) Estimate expected clinical results after percutaneous ablation of thyroid goiter

VSIO51-14 US-guided Ablations for Thyroid Malignancies

Thursday, Nov. 29 5:00PM - 5:20PM Room: S405AB

Participants
Jung Hwan Baek, Seoul, Korea, Republic Of (*Presenter*) Consultant, STARmed; Consultant, RF Medical

For information about this presentation, contact:

radbaek@naver.com

LEARNING OBJECTIVES

1) Indications of US-guided ablations for thyroid malignancies. 2) Techniques: How to maximize efficacy and minimize complications. 3) Clinical results of recurrent thyroid cancers and primary thyroid cancers.

ABSTRACT

Papillary thyroid carcinoma (PTC) is the most common subtype (> 80% of all thyroid cancers) of thyroid malignancy with good prognosis and a low mortality rate. Although patients with PTC show an excellent outcome, the tumor recurrence in the neck ranged from 20% to 59% according to their risk. Although surgery is the standard treatment, complications can be increased because distortion of neck anatomy by scar tissue formation, especially in patients with repeated neck dissections. For these patients, ultrasound US-guided treatments have been used as an alternative such as ethanol ablation (EA), radiofrequency ablation (RFA) and laser ablation (LA). In Korea, the incidence of thyroid cancer increased explosively from 2004. This phenomenon was induced by over-diagnosis. The increased incidence of thyroid cancer is a worldwide phenomenon, and the necessity of active surveillance (AS) was proposed by surgeons from Japan. The 2015 American Thyroid Association (ATA) guidelines suggested AS as an alternative for papillary thyroid microcarcinoma (PTMC). However, the concept of AS of PTMC has been recently introduced, so more evidence is required to prove its long-term clinical efficacy and safety. Moreover recent studies have suggested the application of RFA for low-risk PTMC. The goal of this review is to evaluate the possible indications, devices, techniques, and clinical outcomes of US-guided ablations based on the scientific evidence available and an expert opinion regarding the use of ablations for the recurrent and primary thyroid cancers in clinical practice.

VSIO51-15 Percutaneous Ablation of Parathyroid Adenoma

Thursday, Nov. 29 5:20PM - 5:40PM Room: S405AB

Participants
Luigi Solbiati, MD, Pieve Emanuele (Milano), Italy (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lusolbia@tin.it

LEARNING OBJECTIVES

1) To learn what instrumentations can be used for ablation of parathyroid adenomas and how to use them.2) To understand what complications can be caused by ablation of parathyroid adenomas and what solutions can be adopted to avoid them. 3) To learn indications and contraindications of thermal ablation of parathyroid adenomas.

VSIO51-16 Percutaneous Ablation of Adrenal Tumors

Thursday, Nov. 29 5:40PM - 6:00PM Room: S405AB

Participants
Paul B. Shyn, MD, Boston, MA (*Presenter*) Research Grant, Siemens AG

For information about this presentation, contact:

pshyn@bwh.harvard.edu

LEARNING OBJECTIVES

1) Assess the appropriateness of clinical indications for adrenal tumor ablation. 2) Compare the advantages and disadvantages of various adrenal tumor ablation technologies. 3) Appraise and manage the risks of adrenal tumor ablation.

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PS52

Thursday Plenary Session: Toward Ambient Intelligence in AI-Assisted Healthcare Spaces

Thursday, Nov. 29 2:00PM - 3:00PM Room: Arie Crown Theater

OT

ARRT Category A+ Credit: 0
CME credit is not available for this session.

Participants

Vijay M. Rao, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Abstract

Artificial intelligence (AI) has begun to impact health care in areas including electronic health records, medical images and genomics. But one aspect of health care that has been largely left behind thus far, says Fei-Fei Li, PhD, is the physical environment in which health care delivery takes place: hospitals, clinics and assisted living facilities, among others. In Dr. Li's Thursday afternoon plenary lecture, she will discuss her team's work on endowing health care spaces with ambient intelligence, using computer vision-based human activity understanding in the health care environment to assist clinicians with complex care. She will present pilot implementations of AI-assisted health care spaces equipped with visual sensors and discuss her work on human activity understanding, a core problem in computer vision. Deep learning methods for dense and detailed recognition of activities will be covered, including efficient action detection, important requirements for ambient intelligence in the context of several clinical applications. Dr. Li will discuss future directions for integrating this new source of health care data into the broader clinical data ecosystem.

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RCA54

Case Review: Rectal MRI - Bring Your Own Device (Hands-on)

Thursday, Nov. 29 2:30PM - 4:00PM Room: S404CD

GI MR

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

Participants
David H. Kim, MD, Middleton, WI (*Moderator*) Shareholder, Cellectar Biosciences, Inc; Shareholder, Elucent Medical;
Marc J. Gollub, MD, New York, NY (*Presenter*) Nothing to Disclose
David H. Kim, MD, Middleton, WI (*Presenter*) Shareholder, Cellectar Biosciences, Inc; Shareholder, Elucent Medical;
Gaiane M. Rauch, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Elena K. Korngold, MD, Portland, OR (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Critically evaluate the primary tumor, particularly in the differentiation between T2/early T3 -and- advanced T3 status. 2) Apply criteria to determine regional lymph node status. 3) Recognize relevant anatomic landmarks used in Rectal MR cancer staging.

ABSTRACT

Participants will review cases on their own devices and answer questions. The cases will then be reviewed by the presenters. Note: this activity is best done on a laptop or tablet. Although phones will work, their small size limits optimal image view. This workshop will be led by members of the Society of Abdominal Radiology Rectal Cancer Disease Focused Panel. This group helps set the interpretation standards for rectal cancer MRI in the United States. In this 1.5 hour Hands-on Workshop, the participants will have the opportunity to review a number of rectal staging MRI cases on stand-alone computers or on a personal mobile device. The selected cases are intended to give a broad overview of the common issues encountered in rectal cancer staging, including appropriately categorizing the correct T category of the tumor as well as determining regional lymph node status. The relevant anatomic relationships of the tumor with adjacent structures for surgical and potential neoadjuvant options will be emphasized. An interactive platform will allow participants to see overall class performance for questions posed by the expert reviewer. Each case will be reviewed after a short interval to allow a participant to form an opinion prior to the expert review. This workshop is intended to give a practical, hands-on approach to rectal cancer staging by MRI.

RCB54

Reject Rate Analysis in the Digital Era: Leveraging Informatics to Enhance Quality Control in Radiography

Thursday, Nov. 29 2:30PM - 4:00PM Room: S401CD

IN SQ

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

Participants
Kevin Little, PhD, Columbus, OH (*Moderator*) Nothing to Disclose

Sub-Events

RCB54A Setting Up a Unified Database for Multi-vendor Reject Analysis

Participants
Kevin Little, PhD, Columbus, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define rejected images and reject rate. 2) Identify sources of rejected image data. 3) Develop a plan for data aggregation. 4) Recognize pitfalls of data collection and analysis.

Active Handout:Kevin Little

http://abstract.rsna.org/uploads/2018/17002568/Kevin Little RSNA Reject RCB54A.pdf

RCB54B Initial Clinical Experience: Reasons for Rejects and Remedial Actions

Participants
Ingrid Reiser, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ireiser@uchicago.edu

LEARNING OBJECTIVES

1) Understand the importance of monitoring reject rates in digital radiography. 2) Develop effective remedial actions. 3) Recognize pitfalls of remedial actions. 4) Understand the trade-off between reject rate and quality standards.

Active Handout:Ingrid Reiser

http://abstract.rsna.org/uploads/2018/17002569/RejectRateRSNA2018_dist RCB54B.pdf

RCB54C Strategies for Repeat Analysis Program: Implementation and Expectations

Participants
Alisa Walz-Flannigan, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the scope of information needed for repeat analysis aimed at quality improvement. 2) Learn how to harness a repeat analysis program for quality improvement: objectives, workflow, and practice engagement. 3) Appreciate the clinical value of a comprehensive repeat analysis program through practical examples of quality improvement. 4) Recognize the role of informatics: the need for standard data and analytics tools.

Active Handout:Alisa Walz-Flannigan

http://abstract.rsna.org/uploads/2018/17002570/Strategies for Reject Analysis_RSNA_2018 RCB54C.pdf

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RCC54

IHE on FHIR

Thursday, Nov. 29 2:30PM - 4:00PM Room: S501ABC

IN

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

Participants

David S. Mendelson, MD, Larchmont, NY (*Moderator*) Spouse, Employee, Novartis AG; Advisory Board, Nuance Communications, Inc; Advisory Board, General Electric Company; Advisory Board, Canon Medical Systems Corporation; Advisory Board, Bayer AG; Advisory Board, Nines
Brad Genereaux, Waterloo, ON (*Presenter*) Employee, Agfa-Gevaert Group
Wyatt M. Tellis, PhD, San Francisco, CA (*Presenter*) Officer, EyePACS, LLC
Tone Southerland, Cambridge, MA (*Presenter*) Employee, IQVIA
Stephen M. Moore, MS, Saint Louis, MO (*Presenter*) Employee, Corista; Employee, Gestalt; Employee, Hamamatsu Photonics KK; Employee, Leico; Employee, Pathcore; Employee, Koninklijke Philips NV; Employee, F. Hoffmann-La Roche Ltd; Employee, Sectra AB; Employee, Neagen OY;

For information about this presentation, contact:

moore.stephen.m@wustl.edu

brad.genereaux@agfa.com

wyatt.tellis@ucsf.edu

LEARNING OBJECTIVES

1) Learn about HL7 FHIR- Fast Healthcare Interoperability Resources- an emerging standard using RESTful web services. 2) Review IHE- profile' guides for using standards to address clinical use cases and workflows. 3) Discuss how FHIR is being incorporated into IHE. 4) Review some specific IHE Profiles which have integrated FHIR. 5) Discuss the DICOMweb RESTful services and how they relate to FHIR and IHE.

ABSTRACT

RESTful services have become a mainstay of current network-based transaction and communications technologies, often employed in consumer services on the internet. HL7 FHIR is a standard currently in development that uses RESTful services to exchange healthcare data. Over time FHIR is likely to replace legacy versions provided earlier versions of HL7 that are currently widely used. Similarly, DICOM has introduced REST-based services for communicating medical images in its DICOMWeb standards. IHE coordinates the use of standards to provide interoperable solutions that improve communication and workflow. IHE uses HL7, DICOM and other standards in its profiles. We will review the current work to incorportate FHIR in IHE profiles replacing legacy standards where appropriate and introducing new capabilities. We will discuss specific use cases and standards, some from the domain of Radiology but also some from other healthcare domains. Interoperability has become a major focus of the worldwide HIT community and the intelligent incorporation of RESTful services in the standards we use daily is of paramount importance in delivering the highest quality of healthcare services in a cost-effective and robust manner.

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SPDL51

Peds, IR, Potpourri (Case-based Competition)

Thursday, Nov. 29 3:00PM - 4:00PM Room: E451B

IR PD

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

Participants
Paul J. Chang, MD, Chicago, IL (*Presenter*) Co-founder, Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Researcher, Bayer AG; Advisory Board, Bayer AG; Advisory Board, Aidoc Ltd; Advisory Board, EnvoyAI; Advisory Board, Inference Analytics
Kate A. Feinstein, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Brian S. Funaki, MD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

kfeinstein@radiology.bsd.uchicago.edu

LEARNING OBJECTIVES

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

ABSTRACT

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

SPSH51

Hot Topic Session: Cardiometabolic Imaging

Thursday, Nov. 29 3:00PM - 4:00PM Room: E353C

CA

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

Participants
Jadranka Stojanovska, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SPSH51A Background and Epidemiology

Participants
David A. Bluemke, MD,PhD, Bethesda, MD (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

dbluemke@rsna.org

LEARNING OBJECTIVES

1) Define currently used concepts applied to metabolic disease. 2) Discuss components of metabolic syndrome and their impact on cardiovascular disease. 3) Analyze the results of large cohort studies assessing the metabolic disease in relationship to cardiovascular disease.

ABSTRACT

Ischemic disease of the heart is the leading cause of death and disability worldwide. A major contributor to cardiovascular disease increasingly results from metabolic disease. An underlying concept in consideration of metabolic disease is defined as metabolic syndrome. Metabolic syndrome is thought to affect 23 percent of men and women in the United States, with increasing numbers of individuals world-wide. The presence of metabolic syndrome is associated with elevated risk of cardiovascular disease related to atherosclerosis and organ dysfunction. Metabolic syndrome is defined by 3 or more of the following characteristics: abdominal obesity, hypertriglyceridemia, low HDL, hypertension and elevated fasting glucose. In this presentation, the epidemiology of metabolic syndrome and its underlying relationship to cardiovascular disease is presented on the basis of large cohort epidemiologic studies, typically using imaging methods to characterize outcomes and detect subclinical disease.

SPSH51B Coronary Artery Disease and Outcomes

Participants
Udo Hoffmann, MD, Boston, MA (*Presenter*) Institutional Research Grant, Kowa Company, Ltd; Institutional Research Grant, Abbott Laboratories; Institutional Research Grant, HeartFlow, Inc; Institutional Research Grant, AstraZeneca PLC

LEARNING OBJECTIVES

1) Identify imaging cardic and non-cardiac findings that reflect metabolic state and ahve prognostic impaortance for advrese cardiovascular outcomes. 2) Understand the methodology of using Artificial Intelligence to quantify the controbution of each of these findings to increased cardiovascuolar event risk.

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/ Udo Hoffmann, MD - 2015 Honored Educator

SPSH51C Cardiac Function and Non-ischemic Disease

Participants
Jadranka Stojanovska, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jstoanov@umich.edu

LEARNING OBJECTIVES

1) Understand the importance of imaging-based characterization of cardiomatabolic phenotypes in non-coronary artery disease. 2) Discuss the association between apicardial adiposity and cardiac function/mass. 3) Discuss the association of epicardial adiposity with inflammatory triggered cardiovascular diseases. 4) Discuss challanges and future direction of cardiometabolic imaging.

ABSTRACT

Interest in epicardial adipose tissue as a visceral adipose tissue of the heart and coronary arteries is rapidly growing as the

scientific evidence indicates that the anatomic specificity is an important contributor to the cardiometabolic disease. A greater epicardial adipose tissue volume is associated with diastolic dysfunction, LV hypertrophy, and non-ischemic cardiovascular disease (CVD). Epicardial adipose tissue has dual role, it can be cardioprotective to protect against CVD and proinflammatory that promotes CVD. It has been hypothesized that an epicardial pro-inflammatory phenotype triggers inflammation that correlates with LV hypertrophy, diastolic dysfunction, and CVD such as atrial fibrillation, and pulmonary hypertension. In this presentation we will demonstrate the role of quantifying epicardial adiposity in patients with atrial fibrillation, systemic sclerosis-pulmonary arterial hypertension, and diastolic dysfunction. The future role of cardiometabolic imaging is to understand epicardial adipose tissue biology by developing a diagnostic tool for analysis of epicardial adipose tissue by imaging, molecular/genetic, metabolite, and clinical profiling.

SPSH51D **Panel Discussion**

SPSH52

Hot Topic Session: Biomarker and Personalized Medicine in Lung Cancer Imaging

Thursday, Nov. 29 3:00PM - 4:00PM Room: E350

AI BQ CH CT NM

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

Participants
Patricia M. de Groot, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SPSH52A Personalized Medicine and Lung Cancer Biomarkers: The Oncologist's Perspective

Participants
John V. Heymach, MD,PhD, Houston, TX (*Presenter*) Consultant, AstraZeneca PLC; Consultant, Boehringer Ingelheim GmbH; Consultant, Merck KGaA; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Eli Lilly and Company; Consultant, Merck & Co, Inc; Consultant, Spectrum Dynamics Ltd; Consultant, Guardant; Consultant, Johnson & Johnson; Consultant, Novartis AG

LEARNING OBJECTIVES

1) Describe the goals and current state of personalized therapy for patients with non-small cell lung cancer. 2) Identify the lung cancer biomarkers now in clinical use as well as those in experimental trials. 3) Understand the barriers to optimal selection of individual patient therapy from the clinical and basic research perspective.

SPSH52B Imaging Biomarkers in Non-small Cell Lung Cancer

Participants
Brett W. Carter, MD, Houston, TX (*Presenter*) Editor, Reed Elsevier;

For information about this presentation, contact:

bcarter2@mdanderson.org

LEARNING OBJECTIVES

1) Identify the imaging manifestations and patterns of disease associated with specific non-small cell lung cancer genetic mutations such as EGFR and KRAS and rearrangements such as ALK on computed tomography (CT) and FDG positron emission tomography (PET)/CT. 2) Describe the role of established response criteria and emerging and novel imaging techniques on the assessment of treatment response in non-small cell lung cancer. 2) Understand the continuously evolving impact of radiogenomics, defined as the linking of medical images with the genomic properties of neoplasms, in predicting the presence of specific genetic alterations, response to therapy, and survival of patients with non-small cell lung cancer.

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SPSH52C Using Artificial Intelligence to Develop Non-invasive Biomarkers in Lung Cancer

Participants
Hugo Aerts, PhD, Boston, MA (*Presenter*) Stockholder, Sphera Inc

LEARNING OBJECTIVES

1) Learn about the motivation and methodology of AI technologies in lung cancer imaging. 2) Learn about scientific studies investigating the role of radiologic AI with other -omics data for precision medicine. 3) Learn about open-source informatics developments.

SPSH53

Hot Topic Session: Imaging of Inflammation

Thursday, Nov. 29 3:00PM - 4:00PM Room: S404AB

NR

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

FDA Discussions may include off-label uses.

Participants

Donna J. Cross, PhD, Salt Lake City, UT (*Moderator*) Nothing to Disclose
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

For information about this presentation, contact:

d.cross@utah.edu

ABSTRACT

This session will highlight molecular imaging techniques to image inflammation including neuroinflammation as well as inflammatory disease. Topics will include new PET tracers, MRI methodologies and quantitative analyses.

Sub-Events

SPSH53A Inflammation: A Generalized Process in Many Diseases: Needs for Specific Imaging

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

Honored Educators

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SPSH53B Molecular Imaging of Neuroinflammation

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Presenter*) Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd;

SPSH53C Brain in Flame: Pathology and Imaging of Non-infectious CNS Inflammation

Participants
Anne G. Osborn, MD, Salt Lake Cty, UT (*Presenter*) Author, Reed Elsevier;

For information about this presentation, contact:

anne.osborn@hsc.utah.edu

LEARNING OBJECTIVES

1) Identify microglial activation as the central response to brain inflammation. 2) Identify inflammasome assembly as the event that triggers downstream events in noninfectious brain inflammation. 3) Name at least three disorders that exhibit inflammation as a key component of their underlying pathology.

ABSTRACT

Microglia are the less well-known component of the neuropil, yet they function as the brain's resident macrophages. Once thought to be the 'bad guys' of the CNS, microglia are now recognized as the brain's 'security guards' and 'housekeepers.' In this session we will briefly discuss microglial activation and the role of the 'super molecules' called inflammasomes in a broad spectrum of CNS pathologies ranging from trauma and noninfectious inflammations to neoplasms and brain degenerations. The role of standard imaging (e.g., MRI) will be emphasized in this section as the new radiotracers that can detect microglial activation are discussed in subsequent parts of the course.

SPSH54

Hot Topic Session: Immunotherapy for Cancer-A Demanding New Imaging Frontier

Thursday, Nov. 29 3:00PM - 4:00PM Room: S503AB

CT MR NM

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

FDA Discussions may include off-label uses.

Participants
Janet F. Eary, MD, Bethesda, MD (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

janet.eary@nih.gov

LEARNING OBJECTIVES

1) Understand the unique role that quantitative clinical imaging plays as costly, highly effective immunotherapies are increasingly approved by FDA for advanced cancer treatments and their dependence on imaging. 2) Learn the pitfalls confronting joint oncologist - imager teams can expect to encounter during the time course of cancer treatments and the need to modify existing intellectual models used by clinical cancer imagers. 3) By showing specific case examples that distinguish immune cancer treatments from conventional cytotoxic chemotherapies, attendees will comprehend the need to carefully exercise and reserve judgment when analyzing treatment care patterns.

Sub-Events

SPSH54A The Unmet Imaging Needs in Immunotheraphy Drug Development

Participants
Elad Sharon, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSH54B The Role of PET-CT in Immunotherapy

Participants
Regis Otaviano Bezerra, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

regisfranca@gmail.com

LEARNING OBJECTIVES

1) Brief overview of basic concepts in immunotherapy. 2) To review key points of imaging response patterns according to IRECIST: partial response, complete response, pseudo-progression, and disease progression. 3) To illustrate PET-CT cases with emphasis in response patterns. 4) To recognize immune-related adverse events: pneumonitis, hepatitis, pancreatitis, colitis,, and nephritis. 5) Others uncommon events: abscopal effect and sarcoid-like reaction.

ABSTRACT

Evidence is now accumulating on the use of functional imaging for evaluation of immunotherapy, once this is a treatment option for a wide range of FDG-avid:tumors, including: melanoma, colorectal, breast,and lung cancers. New response patterns have arisen with the use of this treatment, which currently represent a challenge for conventional imaging and standard therapy assessment criteria. A delayed response and even a transient tumor enlargement are often seen, and can be misdiagnosed as disease progression.Moreover, unusual side effects may occur and these can be subtle or very difficult to recognize in regular anatomical images, such as CT or MRI. Especially in this scenario, PET/CT plays a pivotal role, since adverse events might be detected earlier, even preceding clinical symptoms.The most common immune-related adverse events such as pneumonitis, hepatitis, pancreatitis and nephritis will be discussed. Another out-of-target tumor response is demonstrated, known as the abscopal effect, part of immunomodulation effect of check point inhibitors. This presentation will demonstrate initial assessment; response patterns following immunotherapy, and tumor recurrence using PET/CT illustrative cases. Perspectives on new imaging probes will be addressed as well.

URL

https://www.hospitalsiriolibanes.org.br/Paginas/default.aspx

SPSH54C Imaging of Tumor Associated Macrophages with Ferumoxytol-enhanced MRI

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

For information about this presentation, contact:

heiked@stanford.edu

LEARNING OBJECTIVES

1) To understand basic principles of tumor immune responses. 2) To learn MR imaging approaches for the detection of tumor associated macrophages (TAM) in patients. 3) To learn, how to assess tumor response to TAM-modulating cancer immunotherapies.

ABSTRACT

Many malignant tumors, including breast cancer, lung cancer, colon cancer, pancreatic cancer, lymphomas, sarcomas and neuroblastomas (among many others) are associated with an anti-inflammatory tumor microenvironment, which is characterized by infiltration of leukocytes where increases in some leukocyte subsets parallels disease progression and worse clinical outcomes. Tumor-associated macrophages (TAMs) play a key role in this context. New therapeutic drugs that target TAM are currently being developed and are starting to enter the clinic. Therefore, it becomes increasingly important to identify patients whose tumors are heavily infiltrated by TAM. To serve this goal, an imaging test is advantageous over invasive biopsy because it is non-invasive, can cover the whole tumor and can interrogate treatment effects repeatedly in vivo, in patients. Unfortunately, existing clinical imaging tests do not provide a good method for evaluating response to immunotherapies because most immune modulating therapeutics do not cause changes in tumor size, at least not in the immediate post-treatment time period. This presentation will show how TAM can be detected with an immediately clinically applicable imaging approach, using the FDA-approved iron supplement ferumoxytol off label as an MR contrast agent. Our team showed that ferumoxytol nanoparticles exert an initial perfusion effect of the tumor tissue, followed by retention in the tumor via the 'enhanced permeability and retention (EPR) effect' and subsequent phagocytosis by TAM, which results in a marked negative (dark) signal effect on delayed T2-weighted MR images. This can be used to accurately and noninvasively track the degree of macrophage infiltration in a tumor tissue. This new TAM imaging test could represent a significant breakthrough for clinicians as a new biomarker for risk stratification and for monitoring tumor response to novel TAM-modulating immunotherapies. Ferumoxytol is particularly suited for tracking cancer immune responses due to its intrinsic pro-inflammatory effects on the cancer microenvironment.

URL

http://daldrup-link-lab.stanford.edu/

SPSH54D Assessment of Tumor Dynamics beyond RECIST

Participants
Sean Khozin, MD, Silver Spring, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

SPSH55

Hot Topic Session: Prostatic Artery Embolization for Primetime

Thursday, Nov. 29 3:00PM - 4:00PM Room: S402AB

GU IR

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

FDA Discussions may include off-label uses.

Participants
Janice M. Newsome, MD, Alexandria, VA (*Moderator*) Nothing to Disclose
Justin P. McWilliams, MD, Los Angeles, CA (*Presenter*) Consultant, NeuWave Medical, Inc; Consultant, Penumbra, Inc; Consultant, Boston Scientific Corporation; Consultant, Merit Medical Systems, Inc
Zachary Bercu, MD, Atlanta, GA (*Presenter*) Speaker, Terumo Medical Corporation; Grant, Coulter Translational Program, Steerable Robotic Guidewire
Aaron M. Fischman, MD, New York, NY (*Presenter*) Advisory Board and Consultant- Terumo Interventional Systems, Embolx Inc.; ; Speakers Bureau - Boston Scientfic, BTG; ; Royalties - Merit Medical; ; Investor - Adient Medical
Jafar Golzarian, MD, Minneapolis, MN (*Presenter*) Officer, EmboMedics Inc; Consultant, Boston Scientific Corporation; Consultant, Medtronic plc; Consultant, Penumbra, Inc

For information about this presentation, contact:

jumcwilliams@mednet.ucla.edu

aaron.fischman@mountsinai.org

zbercu@emory.edu

LEARNING OBJECTIVES

1) Discuss the most current PAE data. 2) Understand how to develop a PAE program. 3) Discuss pre- and post-treatment management.

ABSTRACT

Lesson 1: Patients come from many different sources. Lesson 2: Understand the urology perspective of PAE. Lesson 3: Stand your ground! PAE plays a critical role in the management of patients with lower urinary tract symptoms (LUTS) secondary to BPH. Lesson 4: Deal with the "learning curve." Lesson 5: The "details" - MRI? CTA? Radial? Femoral? Same day or overnight stay? y?

SPSH56

Controversies in Radiology: Optimized Screening and the Importance of DCIS

Thursday, Nov. 29 3:00PM - 4:00PM Room: E451A

BR

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

Participants
Mitchell D. Schnall, MD, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME

Sub-Events

SPSH56A An Analysis of 11.3 Million Screening Tests Examining the Association between Recall and Cancer Detection Rates in the English NHS Breast Screening Programme

Participants
Roger G. Blanks, PhD, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Rosalind M. Given-Wilson, FRCR,MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sue Cohen, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Matthew G. Wallis, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

matthew.wallis@addenbrookes.nhs.uk

PURPOSE

To model the relationship between cancer detection and recall rates to understand the optimal balance of harm and benefit

METHOD AND MATERIALS

Annual screening programme information for the 80 English breast screening units (11.3 million screening tests) supplemented by data from the Dutch screening programme. Non-linear models were used to produce modelled maximum values (MMV) of cancer detection for different grades. The recall rates at which 95% and 99% of the MMV is reached are termed the P95 and P99 recall rate values

RESULTS

For combined invasive/microinvasive and high grade DCIS (IHG) the detection rate reaches a near plateau with the P99 recall rate value of 7% prevalent and 4% incident screens. The model predicts above this almost all recalls are false positive.Low/intermediate DCIS (LIG) detection rate has no discernible plateau P99 value increasing linearly at a rate of 0.12(prevalent) and 0.18(incident) per 1000 for every 1% increase in recall rate.At recall rates below p95 values of 4.6% prevalent and 2.6% incident the models suggest an increasing drop off in IHG cancer detection rates.

CONCLUSION

Our model predicts that there is a recall rate range P97 to P99 that optimises detection of life threatening cancers whilst minimising harm. In the NHSBSP 99% of IHG cancers are detected at prevalent recall rate below 7% (incident below4%) and as recall rate increases more LIG are detected with a rapidly increasing rate of false positive referrals.

CLINICAL RELEVANCE/APPLICATION

Screening programmes should consider setting both upper and lower limits to recall rate to minimise harms and maximise benefits of screening.

FIGURE

http://abstract.rsna.org/uploads/2018/18010448/18010448_q7it.jpg

SPSH56B Digital Mammography Has Persistently Increased High Grade and Overall DCIS Detection without Altering Upgrade Rate

Participants
Colleen H. Neal, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Annette I. Joe, MD, Farmington Hills, MI (*Abstract Co-Author*) Nothing to Disclose
Stephanie K. Patterson, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Akshat C. Pujara, MD, Chicago, IL (*Abstract Co-Author*) Institutional Research Grant, General Electric Company
Mark A. Helvie, MD, Ann Arbor, MI (*Abstract Co-Author*) Institutional Grant, General Electric Company

For information about this presentation, contact:

hawleyc@med.umich.edu

hawleyc@med.umich.edu

PURPOSE

To evaluate whether digital mammography (DM) has been associated with persistent increased detection of ductal carcinoma in situ (DCIS) or altered the upgrade of DCIS to invasive cancer.

METHOD AND MATERIALS

A HIPAA-compliant, IRB-approved retrospective single institution search identified DCIS diagnosed in women with mammographic calcifications between 2001 and 2014. Ipsilateral cancer within 2 years, masses, papillary DCIS, and patients with outside imaging were excluded, yielding a cohort of 484 cases. Medical records were reviewed for: features of mammographic calcifications, mammographic technique, and pathology outcomes. Mammograms were prospectively interpreted by MQSA-certified breast imaging radiologists and pathology by breast pathologists using standard criteria. The institution transitioned from film screen mammography (FSM) at study inception to exclusive DM by 2010. DBT was not used. Statistical analyses were performed using chi-square test.

RESULTS

Of 484 cases of DCIS, 158 (33%) were detected using FSM and 326 (67%) were detected with DM. The detection rate was higher with DM (1.4/1000 mammograms) than FSM (0.7/1000 mammograms), $p<0.0001$. The detection rate of high-grade DCIS also doubled with DM (0.8/1000) compared to FSM (0.4/1000), $p<0.0001$. The prevalent peak of DM-detected DCIS was 2008 at 2.7/1000. Subsequent incident DM detection remained double FSM (1.3 vs 0.7/1000). Similar proportions of high-grade DICS vs. Low/intermediate-grade were detected with DM and FSM. There was no significant difference in the upgrade rate of DCIS to invasive cancer between DM 10.4% (34/326) and FSM-9.5% (15/158), $p=0.74$. High-grade DCIS led to 71% (35/49) of upgrades to invasive cancer. The median size of calcifications was 10 mm for both modalities. The most common calcification distribution and morphology were clustered pleomorphic calcifications.

CONCLUSION

DM was associated with a significant doubling in the detection of DCIS and high-grade DCIS which persisted after the prevalent peak. The majority of upgrades to invasive cancer arose from high-grade DCIS. DM was not associated with decreased upgrade to invasive cancer.

CLINICAL RELEVANCE/APPLICATION

Improved detection of DCIS may result in reduced treatment morbidity and prevention of invasive breast cancer. Similar proportions of high-grade DCIS suggest that DM has not resulted in overdiagnosis.

MSCB52

Case-based Review of Breast (Interactive Session)

Thursday, Nov. 29 3:30PM - 5:00PM Room: N228

BR

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

Participants
Jiyon Lee, MD, New York, NY (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify appropriate application of multi-modality breast imaging for routine screening, supplemental screening, and diagnostic indications. 2) Select appropriate methods for image-guided percutaneous biopsy and perform post-biopsy radiologic-pathologic correlation for next management recommendation. 3) Review appropriateness criteria and performance benchmarks, and guidelines for ongoing breast imaging audits as they apply. 4) Appreciate the range of reassuringly common and sometimes not-so common among the international faculty's portrayal of their piece of the globe.

ABSTRACT

Title: Managing expectations in breast imaging around the world. "Best" versus sufficient? Abstract: Our case-based review course will use the interactive audience response system (ARS) to walk and skip through the fundamentals of breast imaging. We will present how we use mammography, ultrasound, and MRI in daily screening and diagnostic scenarios, along with reminders of the overarching principles of BI-RADS lexicon for effective communication, and ACR appropriateness criteria and performance metrics as applicable or as adapted around the world. Our international faculty (sessions 1 and 2) will also add depth, and the fun added dimensions of how breast imaging works around the world. Varying breast cancer statistics, possible innate ethnic variations, differing cultural expectations and socioeconomic context can and do impact how we carry out our discretionary work. Such interesting details will inform the narrative of the speakers' case scenarios, while the core diagnostic radiology skills aim to be constant, and teachable. The focus is using lots of cases to demonstrate breast imaging now and evolving. Please join us for smart fun!

Active Handout:Jiyon Lee

http://abstract.rsna.org/uploads/2018/18001613/MSCB51 52.pdf

Sub-Events

MSCB52A Breast Care for 'Challenging' Populations

Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Presenter*) Research Grant, Delphinus Medical Technologies, Inc

LEARNING OBJECTIVES

1) Describe and discuss how to appropriately image and manage patients with special needs.

Active Handout:Cherie M. Kuzmiak

http://abstract.rsna.org/uploads/2018/18001614/US Prison System Health Care MSCB52A.pdf

MSCB52B Greek Philosophy and Cases to Ponder Personalized Screening

Participants
Athina Vourtsi, MD, Athens, Greece (*Presenter*) Consultant, General Electric Company; Educator, ABUS

LEARNING OBJECTIVES

1) To assess the benefits of DBT, US, and MRI in various screening and diagnostic studies. 2) Identify the applications of multi-modality breast imaging of supplemental screening in women of average, intermediate, and high risk for developing breast cancer. 3) Appreciate some of the Greek life style trends and health care system details with respect to breast cancer detection and clinical management.

Active Handout:Athina Vourtsi

http://abstract.rsna.org/uploads/2018/18001615/RSNA-6. Vourtsis. Greece MSCB52B.pdf

MSCB52C False Positives and False Negatives: How to Minimize the Bunch

Participants
Elizabeth S. McDonald, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define false negative exam and identify common reasons for cancer misses in breast imaging and how to avoid them. 2) Define false positive exam and discuss radiologic signs indicating that breast biopsy is not needed.

MSCB52D J-Start and Breast Density in the Land of the Rising Sun

Participants
Youichi Machida, MD, PhD, Chuo-City, Japan (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

machida.yoichi@kameda.jp

LEARNING OBJECTIVES

1) Learn how 'dense breasts' are recognized by Japanese women and physicians, and how they will be involved in breast cancer screening in Japan. 2) Learn the low examination rate of breast cancer screening, as well as other problems we are facing in breast cancer care. 3) Learn the results of J-START, and the concept of 'combined assessment guideline', published by Japan Association of Breast Cancer Screening.

Active Handout:Youichi Machida

http://abstract.rsna.org/uploads/2018/18001617/MSCB52D.pdf

MSCU52

Case-based Review of Ultrasound (Interactive Session)

Thursday, Nov. 29 3:30PM - 5:00PM Room: E450B

GU IR PD US

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

FDA Discussions may include off-label uses.

Participants
Deborah J. Rubens, MD, Rochester, NY (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn current techniques and advances in ultrasound imaging. 2) Become familiar with state of the art guidelines for diagnosis and management of imaging findings. 3) Review critical physiology and pathology as it is depicted by ultrasound. 4) Understand the vital role of ultrasound imaging in modern-day patient care.

ABSTRACT

This course is designed to highlight the vital role ultrasound plays in imaging and diagnosis in all parts of radiology. Special emphasis will be placed on technical advances including ultrasound contrast, elastography and interventional guidance. The wide range of ultrasound applications will be covered incuding vascular, general abdominal, pediatric, gynecology, small parts and obstetrics. Our goal is to provide a broad update in the field while addressing new opportunities and challenges for everyday practice.

Sub-Events

MSCU52A Gynecologic and Endovaginal Ultrasound

Participants
Mindy M. Horrow, MD, Philadelphia, PA (*Presenter*) Spouse, Employee, Merck & Co, Inc

For information about this presentation, contact:

horrowm@einstein.edu

LEARNING OBJECTIVES

View Learning Objectives under main course title.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Mindy M. Horrow, MD - 2013 Honored EducatorMindy M. Horrow, MD - 2016 Honored Educator

MSCU52B Interventional Ultrasound

Participants
Hisham A. Tchelepi, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCU52C Pediatric Ultrasound

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

LEARNING OBJECTIVES

1) Be able to discuss the US imaging features of several common pediatric disorders.

ABSTRACT

USimaging plays a critical role in the clinical evaluation of many pediatric disorders. The sonographic imaging features of a number of important pediatric abnormalities will be reviewed.

MSCU52D Small Parts Ultrasound

Participants
William D. Middleton, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be able to interpret high resolution ultrasound images from superficial structures in different parts of the body.

ABSTRACT

Ultrasound is often the modality of choice to image superficial structures. The sonographic imaging features of a number of important abnormalities of superficial structures will be reviewed.

RC701

Imaging of Thoracic Neoplasms: Update 2018 (Interactive Session)

Thursday, Nov. 29 4:30PM - 6:00PM Room: E450A

CH CT MR OI

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

Participants
Edith M. Marom, MD, Tel Aviv, Israel (*Moderator*) Speaker, Bristol-Myers Squibb Company; Speaker, Boehringer Ingelheim GmbH;

For information about this presentation, contact:

edith.marom@gmail.com

LEARNING OBJECTIVES

1) Utilize MR for imaging lung cancer. 2) Evaluate tumor response. 3) Image thymoma. 4) Stage lung cancer with the 8th edition TNM staging.

Sub-Events

RC701A Lung Nodule Management

Participants
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Research Grant, Samsung Electronics Co, Ltd; Research Grant, Lunit Inc

For information about this presentation, contact:

jmgoo@plaza.snu.ac.kr

LEARNING OBJECTIVES

1) List the major components in determining lung nodule management. 2) Compare the management guidelines for lung cancer screening and those for incidental nodules. 3) Describe how to measure lung nodules at CT.

RC701B Lung Cancer Staging: TNM 8th Edition

Participants
Girish S. Shroff, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review revisions to the TNM staging system. 2) Review how the new TNM staging system addresses lung adenocarcinoma.

RC701C Advances in MR Imaging of Lung Cancer

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Canon Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Fuji Pharma Co, Ltd; Research Grant, Guerbet SA;

For information about this presentation, contact:

yosirad@kobe-u.ac.jp

LEARNING OBJECTIVES

1) Understand the appropriate MR sequence for answering each clinical question, especially lung cancer patients. 2) Identify the clinical relevance of MR imaging as compared with other modalities in not only lung cancer, but also pulmonary nodule and mass. 3) Recognize the potential of state-of-the-art MR imaging for thoracic oncologic patients.

ABSTRACT

Since the clinical application of MR imaging in thoracic diseases, numerous basic and clinical researchers reported technical advances in sequencing, scanners and coils, image acquisition and reconstruction techniques, contrast media utilization, and development of post-processing tools. As a result, state-of-the art thoracic MR imaging now has the potential to be used as a substitute for traditional imaging techniques and/or play a complimentary role in patient management. In this lecture, I will have a lecture for 1) understanding the appropriate MR sequence for answering each clinical question, especially lung cancer patients, 2) demonstrating the clinical relevance of MR imaging as compared with other modalities in not only lung cancer, but also pulmonary nodule and mass, and 3) showing the potential of state-of-the-art MR imaging for thoracic oncologic patients.

RC701D Evaluating Tumor Response

Participants
Tina D. Tailor, MD, Durham, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the role of CT for tumor response assessment. 2) Discuss limitations for traditional CT response criteria, including WHO and RECIST. 3) Discuss therapy response in the setting of novel lung cancer therapies, including immunotherapy.

Active Handout:Tina Dinesh Tailor

http://abstract.rsna.org/uploads/2018/17000321/Handout_Tailor_TumorResponse_RSNA2018 RC701D.pdf

RC701E Imaging of Thymoma

Participants
Edith M. Marom, MD, Tel Aviv, Israel (*Presenter*) Speaker, Bristol-Myers Squibb Company; Speaker, Boehringer Ingelheim GmbH;

For information about this presentation, contact:

edith.marom@gmail.com

LEARNING OBJECTIVES

1) Identify an incidental thymoma. 2) Apply the most appropriate imaging modality for the evaluation of thymoma. 3) Assign the newly proposed TNM stage to a newly diagnosed thymoma.

Active Handout:Edith Michelle Marom

http://abstract.rsna.org/uploads/2018/17000322/STAGING THYMOMA RC701E.pdf

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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/ Edith M. Marom, MD - 2015 Honored EducatorEdith M. Marom, MD - 2018 Honored Educator

RC702

Education Survival Techniques: Often Overlooked Educational Issues

Thursday, Nov. 29 4:30PM - 6:00PM Room: S403B

ED

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

Participants
Tara M. Catanzano, MD, Springfield, MA (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

tara.catanzano@bhs.org

LEARNING OBJECTIVES

1) 'How my learning today differs from when I was a child' and how to apply that for teaching new generation students? 2) Principles of learning including 'problem centered' than only 'content oriented' learning etc. 3) Understanding 'Five Stages of Skill Acquisition'. 4) Understanding types of Bloom's taxonomy - cognitive, affective and psychomotor. 5) Is dedicated classroom teaching is obsolete? 6) Identify challenges encountered by female trainees during residency and fellowship. 7) Apply new approaches to assist female trainees navigate the academic environment. 8) Recognize the importance of wellness for faculty and trainees. 9) Describe signs and symptoms of burnout. 10) Identify ways to create a sustainable culture of wellness and mental resiliency.

Sub-Events

RC702A The Adult Learner: A Neglected Species

Participants
Dhiraj Baruah, MD, Milwaukee, WI (*Presenter*) Educator, Boehringer Ingelheim GmbH;

For information about this presentation, contact:

dbaruah@mcw.edu

LEARNING OBJECTIVES

1) 'How my learning today differs from when I was a child' and how to apply that for teaching new generation students? 2) Principles of learning including 'problem centered' than only 'content oriented' learning etc. 3) Understanding 'Five Stages of Skill Acquisition'. 4) Understanding types of Bloom's taxonomy - cognitive, affective and psychomotor. 5) Is dedicated classroom teaching is obsolete?

ABSTRACT

There are different theories of learning and that may be not similar for an adult as compared to a child. This was laid down by Malcolm Shepherd Knowles for adult learning in his 1973 publication 'The Adult Learner: A neglected species'. Goal of this presentation will be to highlight Knowles ideas and expanding that with current literature on learning. I will highlight some facts that I learned from my experiences in learning and how it changed from my childhood.

RC702B Women in Radiology: An Underrepresented Group

Participants
Tara M. Catanzano, MD, Springfield, MA (*Presenter*) Nothing to Disclose
Amy M. Oliveira, MD, Springfield, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

tara.catanzano@bhs.org

amy.oliveira@bhs.org

LEARNING OBJECTIVES

1) Identify challenges encountered by female trainees during residency and fellowship. 2) Apply new approaches to assist female trainees navigate the academic environment.

RC702C Faculty and Trainee Wellness: An Often Overlooked Concern

Participants
Chloe M. Chhor, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose
Cecilia L. Mercado, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the importance of wellness for faculty and trainees. 2) Describe signs and symptoms of burnout. 3) Identify ways to

create a sustainable culture of wellness and mental resiliency.

RC703

Infections and Inflammatory Cardiac Disorders

Thursday, Nov. 29 4:30PM - 6:00PM Room: S402AB

CA

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

FDA Discussions may include off-label uses.

Participants
Pamela K. Woodard, MD, Saint Louis, MO (*Moderator*) Research agreement, Siemens AG; Research, Eli Lilly and Company; Research, F. Hoffmann-La Roche Ltd; ; ; ; ; ;

For information about this presentation, contact:

woodardp@wustl.edu

Sub-Events

RC703A Endocarditis (Including Loefflers)

Participants
Harold Goerne, MD, Zapopan, Mexico (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

haroldgoerne@hotmail.com

LEARNING OBJECTIVES

1) To identify the imaging features of endocarditis. 2) To apply diagnostic algorithm using different imaging modalities. 3) To illustrate the appearance of endocarditis and its complications. 4) To recognize several differential diagnosis.

RC703B Pericarditis

Participants
Diana Litmanovich, MD, Haifa, Israel (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

dlitmano@bidmc.harvard.edu

LEARNING OBJECTIVES

1) To identify the imaging features of pericarditis. 2) To apply diagnostic algorithm using different imaging modalities. 3) To illustrate the appearance of pericarditis and its complications. 4) To be familiar with differential diagnosis of percarditis.

RC703C Myocarditis

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

For information about this presentation, contact:

jens.bremerich@usb.ch

LEARNING OBJECTIVES

1) To understand pathophysiology of myocarditis. 2) To review the impact of imaging on clinical decision making. 3) To enhance knowledge of technical aspects of imaging.

RC703D Cardiovascular Manifestations of HIV

Participants
Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Presenter*) Nothing to Disclose
Harold Goerne, MD, Zapopan, Mexico (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the cardiovascular manifestations of HIV. 2) To illustrate the imaging features of cardiovascular manifestations of HIV. 3) To describe the impact of cardiovascular disease in HIV.

Honored Educators

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educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator

RC703E Chagas Disease and other Cardiovascular Infections

Participants
Carlos E. Rochitte, MD,PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

rochitte@incor.usp.br

LEARNING OBJECTIVES

1) Recognize MRI characteristics of Chagas disease and other infectious diseases affecting the heart and understand their basic pathophysiology. 2) Gain information on new and recent research data on MRI use to investigate and understand pathophysiology of Chagas disease and other infectious disease. 3) Recognize signs in cardiovascular MR images to suspect or make the probable diagnosis of Chagas disease and other infections.

RC704

Imaging of the Hand and Wrist: How to Add Value

Thursday, Nov. 29 4:30PM - 6:00PM Room: S406B

MK

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

Participants
Soterios Gyftopoulos, MD, Scarsdale, NY (*Director*) Nothing to Disclose

For information about this presentation, contact:

Soterios.Gyftopoulos@nyumc.org

llenchik@wakehealth.edu

LEARNING OBJECTIVES

1) Review the most common bone, ligamentous, and tendon conditions found in the hand and wrist. 2) Review the imaging options for common hand and wrist pathologies. 3) Describe how to accurately diagnose common hand and wrist bone, ligamentous, and tendon conditions using imaging.

Sub-Events

RC704A Bones

Participants
Laura W. Bancroft, MD, Orlando, FL (*Presenter*) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc ; ;

For information about this presentation, contact:

laura.bancroft.md@flhosp.org

LEARNING OBJECTIVES

1) Review which imaging modalities can add value to the diagnostic evaluation of hand and wrist injuries. 2) Review specific osseous injury patterns in the hand and wrist.

RC704B Tendons

Participants
Scott D. Wuertzer, MD, MS, Winston-Salem, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be able to recognize the normal and abnormal MRI appearance of tendons in the hand and wrist. 2) Be familiar with the relevant anatomy associated with these tendons. 3) Be able to diagnose common pathologic conditions of tendons in the hand and wrist.

RC704C Ligaments

Participants
Christine B. Chung, MD, La Jolla, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify current challenges and gaps in clinical practice for evaluation of intrinsic and extrinsic wrist ligaments. 2) Apply diagnostic algorithms that improve diagnosis and characterization of wrist ligaments.

RC704D TFCC

Participants
Soterios Gyftopoulos, MD, Scarsdale, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Soterios.Gyftopoulos@nyumc.org

LEARNING OBJECTIVES

1) Review the normal anatomy of the TFCC. 2) Review the most common types of acute and chronic TFCC pathology and their locations.

RC705

Spine Imaging: Diagnosis & Intervention

Thursday, Nov. 29 4:30PM - 6:00PM Room: S504AB

NR

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

Participants
Wende N. Gibbs, MD,MA, Pasadena, CA (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

wende.gibbs@med.usc.edu

Sub-Events

RC705A Advanced Imaging of the Spine in Clinical Practice: What Works

Participants
Vinil Shah, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

vinil.shah@ucsf.edu

LEARNING OBJECTIVES

1) Describe advanced imaging techniques of the spinal cord and peripheral nerves that can be implemented in daily clinical practice, with a particular emphasis on diffusion tensor imaging (DTI). 2) Understand how DTI can play an important problem-solving role in patients with spinal cord pathology and peripheral nerve diseases. 3) Describe the practical value of DTI in preoperative planning, differentiating benign from malignant entities, assessing severity of nerve injury, and monitoring early nerve regeneration.

RC705B Practical Neurography: Brachial and Lumbosacral Plexus

Participants
Carlos H. Torres, MD,FRCPC, Ottawa, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

catorres@toh.ca

LEARNING OBJECTIVES

1) Simplify the complex imaging anatomy of the brachial and lumbosacral plexi. 2) Outline different MR protocols to image the brachial plexus and the lumbosacral plexus. 3) Review brachial plexus and lumbosacral plexus pathologies, using a case-based approach.

ABSTRACT

Magnetic Resonance Imaging (MRI) is the imaging modality of choice for the evaluation of the brachial plexus and lumbosacral plexus due to its superior soft tissue resolution and multiplanar capabilities. The evaluation of both plexi however represents a diagnostic challenge for the clinician and the radiologist. The imaging assessment of the brachial and lumbosacral plexi has been traditionally challenging due to the complexity of the anatomy and due to technical factors. The presentation will emphasize the different MR protocols that could be used at 1.5T and 3T in order to improve the visualization of the different segments of the brachial and lumbosacral plexi. In addition, the normal anatomy as well as the common and infrequent pathologies involving both plexi will be reviewed.

Honored Educators

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

RC705C Optimized Imaging of the Postoperative Spine: Artifact Reduction

Participants
Lawrence N. Tanenbaum, MD, New York, NY (*Presenter*) Speaker, General Electric Company; Speaker, Siemens AG; Speaker, Guerbet SA; Speaker, Koninklijke Philips NV; Consultant, Enlitic, Inc; Consultant, icoMetrix NV; Consultant, CorTechs Labs, Inc; Consultant, Arterys Inc

For information about this presentation, contact:

nuromri@gmail.com

LEARNING OBJECTIVES

1) Learn the fundamental and more advanced principles used to mitigate the susceptibility related challenges associated with metal implants in postoperative spine MR examinations. 2) Understand and apply fundamental and more advanced techniques such as dual energy imaging and metal artifact reduction software to mitigate the instrumentation related challenges associated with metal implants in postoperative spine CT examinations

ABSTRACT

RC705D Spine Oncology: Improving Quality and Adding Value in Patient Care

Participants
Wende N. Gibbs, MD,MA, Pasadena, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

wende.gibbs@med.usc.edu

LEARNING OBJECTIVES

1) Describe advances in spine oncology and the new algorithms that guide management. 2) Understand the vital role of the radiologist in multidisciplinary decision-making and treatment. 3) Explain methods of increasing our value through optimized reporting, and the role this will play in enhanced patient care, quality improvement, and research.

RC706

12 AM Head & Neck Radiology: Emergency Presentations of Head and Neck Pathology

Thursday, Nov. 29 4:30PM - 6:00PM Room: E350

ER HN NR

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

For information about this presentation, contact:

shatzkes@hotmail.com

LEARNING OBJECTIVES

1) Define the facial buttresses. 2) Classify the common fracture patterns of the face. 3) Identify imaging features that may impact patient management. 4) Explain the role of multidetector CT in recognizing and classifying temporal bone fractures. 5) Identify the imaging signs of injury to critical structures in the temporal bone with attention to the information most relevant to referring physicians. 6) Detect the imaging features of the complications and sequelae of temporal bone trauma. 7) Identify common causes of facial swelling in the emergency setting. 8) Anticipate the subsequent management of the various causes of facial swelling in the emergency setting.

Sub-Events

RC706A Facial Trauma

Participants
Robert E. Morales, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the common approaches to facial fracture reporting. 2) Classify the common fracture patterns of the face. 3) Identify imaging features that may impact patient management.

RC706B Temporal Bone Trauma

Participants
Hillary R. Kelly, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

hillary.kelly@mgh.harvard.edu

LEARNING OBJECTIVES

1) Explain the role of multidetector CT in recognizing and classifying temporal bone fractures. 2) Identify the imaging signs of injury to critical structures in the temporal bone with attention to the information most relevant to referring physicians. 3) Detect the imaging features of the complications and sequelae of temporal bone trauma.

RC706C Neck/Face Swelling

Participants
Tabassum A. Kennedy, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

tkennedy@uwhealth.org

LEARNING OBJECTIVES

1) Identify common causes of facial swelling in the emergency setting. 2) Anticipate the subsequent management of the various causes of facial swelling in the emergency setting.

RC706D Dysphagia/Odynophagia

Participants
Tanya J. Rath, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Differentiate oropharyngeal dysphagia from odynophagia. 2) Recommend the appropriate imaging modality for evaluation of adult patients presenting to the emergency room with oropharyngeal dysphagia and odynophagia. 3) Identify and describe the imaging features of the most common diseases causing emergent oropharyngeal dysphagia or odynophagia.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
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RC707

Imaging Assessment of Advanced Genitourinary Malignancies Treated with Novel Anticancer Agents: What Your Reports Should Include

Thursday, Nov. 29 4:30PM - 6:00PM Room: E351

GU OI

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

Participants

Atul B. Shinagare, MD, Boston, MA (*Moderator*) Advisory Board, Arog Pharmaceuticals, Inc; Research Grant, GTx, Inc
Priya R. Bhosale, MD, Bellaire, TX (*Presenter*) Nothing to Disclose
Andrew D. Smith, MD,PhD, Birmingham, AL (*Presenter*) President and Owner, Radiostics LLC; President and Owner, eRadioMetrics LLC ; President and Owner, Liver Nodularity LLC ; President and Owner, Color Enhanced Detection LLC ; Patent holder
Atul B. Shinagare, MD, Boston, MA (*Presenter*) Advisory Board, Arog Pharmaceuticals, Inc; Research Grant, GTx, Inc

For information about this presentation, contact:

ashinagare@bwh.harvard.edu

andrewdennissmith@uabmc.edu

LEARNING OBJECTIVES

1) Know the mechanisms of action and rationale behind use of various novel anticancer agents available to treat advanced renal, bladder, prostate and gynecologic malignancies. 2) Identify the typical and atypical patterns of tumor response with the novel anticancer agents using a combination of size-based, morphologic and immune-response criteria, and avoid common pitfalls in response assessment. 3) Detect adverse events and complications associated with the novel anticancer agents including immune-related adverse events, and understand the role of certain adverse events as imaging biomarkers.

ABSTRACT

Molecular targeted therapies, immune checkpoint inhibitors and hormonal therapies represent three classes of novel anticancer agents with distinct mechanisms of action, response patterns and toxicities. With the burgeoning use of these agents to treat advanced GU malignancies, the role of the radiologist as a key member of the treatment team has evolved. After attending this course, attendees will know how novel anticancer agents change the radiologic assessment of advanced genitourinary cancers, including their typical and atypical response patterns and common toxicities seen on imaging. This knowledge will inform the radiologists how to render appropriate reports of imaging exams and conduct an effective dialogue with the referring physicians about the management of genitourinary cancers.

Active Handout:Atul Bhanudas Shinagare

http://abstract.rsna.org/uploads/2018/18000682/RSNA Refresher Course Handout RC707.pdf

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RC708

Mass Casualty and Forensic Imaging: Thinking About the Unthinkable

Thursday, Nov. 29 4:30PM - 6:00PM Room: E352

ER

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

Participants
Barry D. Daly, MD, Baltimore, MD (*Moderator*) Nothing to Disclose
Howard T. Harcke, MD, Wilmington, DE (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

bdaly@umm.edu

howard.harcke@gmail.com

LEARNING OBJECTIVES

1) Explain radiology involvement in the phases of mass casualty and disaster operations. 2) Recognize the complex injury patterns that occur when imaging casualties from a disaster event. 3) Identify areas where virtual autopsy and forensic imaging concepts are used to assist mass casualty and disaster mortuary operations.

ABSTRACT

When disaster and mass casualty events occur radiology facilities will be called upon to support operations during all phases of the response. Active management of acute casualties will be governed by the facility Disaster Management Plan. Disasters often have a high dead to wounded ratio and radiology may be called upon to assist mortuary operations. Here the employment of virtual autopsy forensic imaging is being utilized.

Sub-Events

RC708A Mass Casualty Imaging: The Radiologist's Perspective

Participants
Ferco H. Berger, MD, Toronto, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ferco.berger@sunnybrook.ca

LEARNING OBJECTIVES

1) Describe the setting of an MCI and the impact on radiologist. 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 (MCIs), 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 also be used to increase the accuracy of triaging MCI victims, since overtriage (falsely higher triage category) and undertriage (falsely lower triage category) can severely impact resource availability and mortality rates, respectively. This presentation emphasizes the importance of including the radiology department in hospital preparations for a MCI and highlights factors expected to influence performance during hospital DMP activation including issues pertinent to effective simulation, such as establishing proper learning objectives. After action reviews including performance evaluation and debriefing on issues are invaluable following simulation drills and DMP activation, in order to improve subsequent preparedness. Historically, most hospital DMPs have not adequately included radiology department operations, and they have not or to a little extent been integrated in the DMP activation simulation. This presentation aims to increase awareness of the need for radiology department engagement in order to increase radiology department preparedness for DMP activation after a MCI occurs.

Active Handout:Ferco H. Berger

http://abstract.rsna.org/uploads/2018/18000606/Handout MCI RSNA 2018 RC708A.pdf

RC708B Ballistic Trauma

Participants
Noah G. Ditkofsky, MD, Toronto, ON (*Presenter*) Grant, NVIDIA Corporation

For information about this presentation, contact:

ditkofsky@gmail.com

LEARNING OBJECTIVES

1) Understand and be able to explain the mechanism of Ballistic injuries. 2) Define the term 'permanant tract'. 3) Describe injuries associated with the permanent tract. 4) Define the term 'temporary cavity'. 5) Describe injuries associated with the temporary cavity. 6) Be able to detect these injuries. 7) Recognize characteristic patterns of injury associated with gunshot wounds.

ABSTRACT

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RC708C Introduction to the Virtual Autopsy

Participants
Barry D. Daly, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the technological advances in both multi-detector row CT and high resolution whole body 3D imaging leading to the recent development of postmortem CT (PMCT) as a potential noninvasive 'Virtual Autopsy' tool. 2) To describe the early applications of PMCT by diagnostic radiologists and forensic pathologists who foresaw a valuable role for this new technique in the investigation of death. 3) To address the potential development of infrastructure and logistics that would allow PMCT to become a valuable tool in mass casualty situations.

ABSTRACT

The introduction of faster multi-detector row CT scanners and high resolution 3D whole body imaging 2 decades ago attracted the interest of forensic pathologists who foresaw a valuable role for postmortem CT (PMCT) as a noninvasive 'Virtual Autopsy' in the investigation of death. The role of PMCT has become well-established for non-invasive investigation of many different causes of death including blunt force and projectile or blast injuries, burns, drowning, suspected pediatric abuse or elder abuse. It also has a role in cases of undetermined cause of death and for evaluation of decomposed or unidentified bodies. In some cases it may replace or curtail the extent of autopsy, of great importance in mass casualty situations.

RC708D The Virtual Autopsy: Current Concepts

Participants
Howard T. Harcke, MD, Wilmington, DE (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

howard.harcke@gmail.com

LEARNING OBJECTIVES

1) List potential benefits of CT assisted autopsy in mass casualty and disaster events. 2) Explain the major limitations of postmortem CT in trauma compared to anatomic autopsy.

ABSTRACT

The military has acquired considerable experience with application of virtual autopsy in mass casualty and disaster events. These events demonstrate the variety of injury encountered (blast, ballistic, blunt force, thermal) often in combination. CT prior to autopsy enhances performance and accuracy of the autopsy. Currently external examination by the forensic pathologist coupled with CT findings has been used to replace full autopsy in some situations.

RC709

LI-RADS Update (Interactive Session)

Thursday, Nov. 29 4:30PM - 6:00PM Room: S406A

GI

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

Participants
Claude B. Sirlin, MD, San Diego, CA (*Moderator*) Research Grant, Gilead Sciences, Inc; Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Bayer AG; Research Grant, ACR Innovation; Research Grant, Koninklijke Philips NV; Research Grant, Celgene Corporation; Consultant, General Electric Company; Consultant, Bayer AG; Consultant, Boehringer Ingelheim GmbH; Consultant, AMRA AB; Consultant, Fulcrum Therapeutics; Consultant, IBM Corporation; Consultant, Exact Sciences Corporation; Advisory Board, AMRA AB; Advisory Board, Guerbet SA; Advisory Board, VirtualScopics, Inc; Speakers Bureau, General Electric Company; Author, Medscape, LLC; Author, Resoundant, Inc; Lab service agreement, Gilead Sciences, Inc; Lab service agreement, ICON plc; Lab service agreement, Intercept Pharmaceuticals, Inc; Lab service agreement, Shire plc; Lab service agreement, Enanta; Lab service agreement, Virtualscopics, Inc; Lab service agreement, Alexion Pharmaceuticals, Inc; Lab service agreement, Takeda Pharmaceutical Company Limited; Lab service agreement, sanofi-aventis Group; Lab service agreement, Johnson & Johnson; Lab service agreement, NuSirt Biopharma, Inc ; Contract, Epigenomics; Contract, Arterys Inc
Khaled M. Elsayes, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

GENERAL INFORMATION

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

Sub-Events

RC709A Major LI-RADS Features

Participants
Elizabeth M. Hecht, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ehecht@columbia.edu

LEARNING OBJECTIVES

1) Explain the rationale behind and scientific evidence supporting LI-RADS major features for CT and MRI diagnosis of hepatocellular carcinoma (HCC). 2) Define and describe the major CT and MRI imaging features used in LI-RADS to categorize LI-RADS 3, 4 and 5 lesions using the LI-RADS lexicon. Features discussed include arterial phase hyper enhancement, washout appearance, capsule appearance, size and threshold growth. 3) Identify LI-RADS CT/MRI major features through case examples using extracellular and hepatobiliary specific contrast agents. 4) Categorize observations using the CT/MR LI-RADS algorithm with emphasis on major features.

ABSTRACT

NA

RC709B Ancillary LI-RADS Features

Participants
Victoria Chernyak, MD,MS, Bronx, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

vichka17@hotmail.com

LEARNING OBJECTIVES

1) To learn the appearance, biological rationale and scientific evidence supporting use of ancillary features (AFs) in LI-RADS categorization. 2) To know and correctly use the rules for application of the AFs in LI-RADS v2017. 3) To apply the knowledge of AFs and their applications for various practice cases.

RC709C LI-RADS Treatment Response

Participants
Richard Kinh Gian Do, MD, PhD, New York, NY (*Presenter*) Consultant, Bayer AG

LEARNING OBJECTIVES

1) Identify differences and similarities between locoregional therapies for HCC. 2) Compare response criteria for HCC. 3) Apply the LI-RADS Treatment Response Algorithm.

ABSTRACT

HCC treatment response to locoregional therapy is assessed routinely by diagnostic radiologists. However, assessment of treatment response is complicated by the proliferation of response criteria and guidelines in recent years. Differences between locoregional therapies, from radiofrequency ablation for solitary masses to transarterial radioembolization of entire lobes, further complicate standardization of response assessment. This lecture will provide an overview of commonly used locoregional therapies for HCC and compare existing response criteria, such as Response Evaluation in Solid Tumors (RECIST) and modified RECIST. These provide context for the recent development of the LI-RADS Treatment Response Algorithm, which will be illustrated in selected cases.

RC709D Challenging LI-RADS Topics

Participants
Mustafa R. Bashir, MD, Cary, NC (*Presenter*) Research Grant, Siemens AG; Research Grant, General Electric Company; Research Grant, NGM Biopharmaceuticals, Inc; Research Grant, TaiwanJ Pharmaceuticals Co, Ltd; Research Grant, Madrigal Pharmaceuticals, Inc; Research Consultant, RadMD

For information about this presentation, contact:

mustafa.bashir@duke.edu

LEARNING OBJECTIVES

1) Review challenging topics in 2017 CT/MRI LI-RADS, including hepatobiliary agents, LR-M criteria, and the patient populations in which LI-RADS is/is not applicable.

ABSTRACT

2017 CT/MRI LI-RADS provides guidelines for diagnosis of hepatocellular carcinoma and risk stratification of hepatocellular nodules that are not clearly malignant. However, the assessment of patients who may or may not be at elevated risk for developing hepatocellular carcinoma is more nuanced and requires an understanding of a number of additional concepts. This discussion will focus on the use of hepatobiliary contrast agents, the diagnosis of non-hepatoceillular malignancy, and patient populations in which LI-RADS should or should not be applied.

RC710

Vascular Ultrasound and Doppler

Thursday, Nov. 29 4:30PM - 6:00PM Room: N226

US VA

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

FDA Discussions may include off-label uses.

Sub-Events

RC710A The Aorta and Its Branches

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

For information about this presentation, contact:

leslie.scoutt@yale.edu

LEARNING OBJECTIVES

1) Discuss the ultrasound approach to screening for abdominal aortic aneurysms and follow up of patients who have undergone endograft repair of an abdominal aortic aneurysm. 2) Describe the US findings of dissections of the abdominal aorta and mesenteric arteries. 3) Discuss the US criteria for the diagnosis of mesenteric ischemia.

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RC710B Carotid Doppler: Current Diagnostic Strategies

Participants
John S. Pellerito, MD, Manhasset, NY (*Presenter*) Research Grant, General Electric Company

For information about this presentation, contact:

jpelleri@northwell.edu

LEARNING OBJECTIVES

1) Apply current diagnostic criteria for diagnosis of carotid disease. 2) Determine appropriate diagnostic criteria for specific patterns of disease. 3) Recognize important pitfalls in diagnosis.

RC710C Lower Extremity Venous Doppler

Participants
Michelle L. Robbin, MD, Birmingham, AL (*Presenter*) Consultant, Koninklijke Philips NV; Speaker, Koninklijke Philips NV;

For information about this presentation, contact:

mrobbin@uabmc.edu

LEARNING OBJECTIVES

1) Review the indications and performance of the lower extremity ultrasound examination. 2) Discuss the results of the recent SRU consensus conference on the need to include calf veins in the routine lower extremity ultrasound. 3) Be able to describe the recommended calf vein ultrasound examination.

RC711

Improving PET Interpretation (Interactive Session)

Thursday, Nov. 29 4:30PM - 6:00PM Room: S504CD

CT NM

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

LEARNING OBJECTIVES

1) Understand the patient preparation issues with performing PET/CT. 2) Review recommendations on patient preparation prior to performing PET/CT. 3) Review the issues in performing PET/CT scans on diabetic patients and learn ways to optimize the glucose level. 4) With the aid of challenging case examples, this activity aims improve PET-CT interpretation through recognition of pitfalls and variants. In addition, it aims to review typical as well as unusual examples of commonly encountered oncologic diagnoses. 5) Learn how to discriminate malignancy from benign FDG-avid changes caused by surgery and procedures, radiation, and chemotherapy.

Sub-Events

RC711A Interpretive Pitfalls

Participants
Gary A. Ulaner, MD, PhD, New York, NY (*Presenter*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd; Research support, Novartis AG

For information about this presentation, contact:

ulanerg@mskcc.org

LEARNING OBJECTIVES

1) Identify FDG-avid lesions caused by surgery, radiation, and chemotherapy that could be mistaken for malignancy. 2) Demonstrate how to integrate FDG PET and CT findings on FDG PET/CT to distinguish benign from malignancy causes of FDG-avidity.

RC711B Impact of Patient Preparation

Participants
Don C. Yoo, MD, E Greenwich, RI (*Presenter*) Consultant, Endocyte, Inc

For information about this presentation, contact:

dyoo@lifesapn.org

LEARNING OBJECTIVES

1) Understand the patient preparation issues with performing PET/CT. 2) Review recommendations on patient preparation prior to performing PET/CT. 3) Review the issues in performing PET/CT scans on diabetic patients and learn ways to optimize the glucose level.

ABSTRACT

F18-FDG PET/CT is a valuable tool for a variety of oncologic applications. The purpose of this educational activity is to discuss the importance of appropriate patient preparation prior to performing oncologic F18-FDG PET/CT scans. The recommendations from the American College of Radiology (ACR), the Society of Nuclear Medicine and Molecular Imaging (SNMMI), and the National Cancer Institute (NCI) for patient preparation will be discussed. Issues that will be discussed include fasting, limiting exercise, hydration, sedation, low carbohydrate meals, and diabetic patients. Patients are typically asked to fast for at least 4 hours before tracer injection for oncologic PET/CT scans. The ACR and SNMMI both recommend checking glucose levels on all patients prior to administration of F18-FDG. SNMMI guidelines recommend that patients with glucose of greater than 150-200 mg/dL should usually be rescheduled. Performing PET/CT scans in poorly controlled diabetic patients can result in a PET/CT scan with an altered biodistribution limiting interpretation of the study. In a poorly controlled diabetic patient with a glucose level of greater than 200 mg/dl, the study should usually be rescheduled if it does not critically affect patient care. Hyperglycemia will dilute the FDG uptake by tumors through competitive inhibition. Subcutaneous insulin should not be administered to a diabetic patient with high glucose within 4 hours of a PET/CT scan as insulin will stimulate FDG uptake by skeletal muscle resulting in an altered biodistribution which can severely limit interpretation.

RC711C Effective Reporting and Communication

Participants
Eric M. Rohren, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Eric.Rohren@bcm.edu

LEARNING OBJECTIVES

1) With the aid of challenging case examples, this activity aims improve PET-CT interpretation through recognition of pitfalls and variants. 2) Aims to review typical as well as unusual examples of commonly encountered oncologic diagnoses.

ABSTRACT

Best practices in reporting are a critical aspect of a successful PET program. In this presentation, effective reporting methods will be demonstrated, along with common pitfalls in reporting that should be avoided.Emphasis will be placed on the eight 'C's' of effective reporting: Correctness, Completeness, Consistency, Communication, Clarity, Confidence, Concision, and Consultation.

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RC711D Challenging Case Examples

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

For information about this presentation, contact:

eakin@mfa.gwu.edu

LEARNING OBJECTIVES

1) Review challenging case examples of FDG PET-CT of the abdomen and pelvis with particular emphasis on genitourinary and gynecologic imaging.

ABSTRACT

FDG PET-CT is an effective modality for staging, restaging and treatment follow up of various malignancies. In this session, a review of challenging cases will be presented. Variants and pitfalls that may impact interpretation will be discussed with special emphasis on genitourinary and gynecologic imaging. Updtaes on imaging and interpretation parameters and guidlines will be reviewed.

RC712

Thoracic Aortic Emergencies (Interactive Session)

Thursday, Nov. 29 4:30PM - 6:00PM Room: S103AB

VA ER

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

Participants
John P. Lichtenberger III, MD, Bethesda, MD (*Moderator*) Nothing to Disclose
Daniel Vargas, MD, Aurora, CO (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

daniel.vargas@ucdenver.edu

jlichtenberger@mfa.gwu.edu

LEARNING OBJECTIVES

1) Implement and adapt various imaging modalities for imaging of aortic emergencies. 2) Appreciate the potential of advanced imaging in the clinical management of various aortic emergencies. 3) Identify the risk factors for aortic aneurysms and rupture. 4) Differentiate treatment options for patients with aortic emergencies.

Sub-Events

RC712A The Spectrum of Type A Dissection

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

For information about this presentation, contact:

daniel.vargas@ucdenver.edu

LEARNING OBJECTIVES

1) Implement and adapt various imaging modalities for imaging of aortic emergencies. 2) Appreciate the potential of advanced imaging in the clinical management of various aortic emergencies. 3) Identify the risk factors for aortic aneurysms and rupture. 4) Differentiate treatment options for patients with aortic emergencies.

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.

Honored Educators

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

RC712B Acute and Chronic Complications of Aortic Dissection

Participants
Anna M. Sailer, MD,PhD, West Hollywood, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the types of complications in aortic dissections. 2) Compare and illustrate the underlying pathophysiology of acute and chronic complications in aortic dissections. 3) Appreciate the potential of advanced aortic imaging in the clinical management of uncomplicated and complicated dissections. 4) Differentiate risk stratification and treatment options for patients with aortic dissections.

RC712C Traumatic Aortic Injuries

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

For information about this presentation, contact:

savvas.nicolaou@vch.ca

LEARNING OBJECTIVES

1) Discuss the mechanism of injury, pathophysiology, and types of traumatic aortic injuries including aortic dissection, laceration, transection, pseudoaneurysm and intramural hematoma. 2) Understand the role of various imaging modalities in work up of traumatic aortic injury wth emphasis on MDCT and problem solving techniques using Multi Energy CT. 3) Discuss the grading scheme for traumatic aortic injuries. 4) Demonstrate imaging pitfalls which can lead to misinterpretation of traumatic aortic injuries. 5) Review the management and treatment options.

RC712D Bicuspid Aortic Valve

Participants
John P. Lichtenberger III, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jlichtenberger@mfa.gwu.edu

LEARNING OBJECTIVES

1) Describe the current genetic and pathophysiologic understanding of bicuspid aortic valve and associated aortopathy. 2) List the emergent and long-term aortic complications associated with bicuspid aortic valve. 3) Illustrate a comprehensive imaging approach to bicuspid aortic valve evaluation with a focus on necessary data for clinical management and surgical planning. 4) Discuss treatment options for bicuspid aortic valve, emphasizing the imaging appearances of common complications.

ABSTRACT

Bicuspid aortic valve (BAV) is the most common cardiovascular malformation, occurring in 1-2% of the population. Rather than a discrete clinical entity, BAV encompasses a spectrum of fusion abnormalities of the normal trileaflet aortic valve. Similarly, the associated diseases of the aortic valve and aorta have a broad range. The diseased bicuspid valve may be complicated by aortic valve stenosis, regurgitation and endocarditis. The associated aortic diseases include aneurismal dilation of the ascending aorta, dissection and coarctation. Aneurismal dilation of the ascending aorta in patients with BAV is thought to be a consequence of an underlying aortopathy similar to that seen in connective tissue diseases. Understanding of bicuspid aortic valve associated aortopathy has changed the guidelines for intervention on ascending aortic aneurysm based on size. The precise imaging evaluation of BAV requires knowledge of phenotypic variance, associated aortopathy, clinical management, surgical repair and complications.

RC713

Pediatric Neuroimaging Emergencies

Thursday, Nov. 29 4:30PM - 6:00PM Room: S404AB

ER HN NR PD

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

Sub-Events

RC713A Pediatric Brain Emergencies: Traumatic

Participants
V. Michelle Silvera, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

vmichellesilvera81@gmail.com

LEARNING OBJECTIVES

1) Identify basic patterns of acute traumatic head injury in children. 2) Recognize traumatic head injuries that are pediatric-specific. 3) Apply appropriate clinical recommendations for acute pediatric traumatic head injuries.

RC713B Pediatric Brain Emergencies: Non-traumatic

Participants
Sarah S. Milla, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sarah.milla@emory.edu

LEARNING OBJECTIVES

Learning Objectives:1) Identify non traumatic emergencies including infectious and vascular conditions2) Illustrate subtle intracranial findings to help make accurate diagnoses3) Discuss CT and MR techniques to optimize diagnostic capabilities

RC713C Pediatric Head and Neck Emergencies

Participants
Alok I. Jaju, MD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ajaju@luriechildrens.org

LEARNING OBJECTIVES

1) Identify the imaging findings of common pediatric head and neck emergencies. 2) Describe the complications and routes of spread for pediatric head and neck pathological processes. 3) Recommend the next best step in imaging or management of these conditions.

Active Handout:Alok Indraprakash Jaju

http://abstract.rsna.org/uploads/2018/18000665/H&N Emerg_ Alok Jaju RC713C.pdf

RC713D Pediatric Spine Emergencies

Participants
Luke L. Linscott, MD, Salt Lake City, UT (*Presenter*) Author, Reed Elsevier

LEARNING OBJECTIVES

1) Identify the most important spine emergencies in children. 2) Understand the optimal imaging strategy for spine injuries in children.

RC714

Dialysis Interventions

Thursday, Nov. 29 4:30PM - 6:00PM Room: E353A

IR

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

Participants
Charles E. Ray JR, MD,PhD, Chicago, IL (*Moderator*) Nothing to Disclose
James T. Bui, MD, Chicago, IL (*Moderator*) Stockholder, ImmersiveTouch

For information about this presentation, contact:

jtbui@uic.edu

LEARNING OBJECTIVES

1) Learn of updates in dialysis interventions. 2) Apply newer techniques into current practice of dialysis interventions.

ABSTRACT

n/a

Sub-Events

RC714A Surveillance of the Dialysis Circuit

Participants
Paul J. Rochon, MD, Aurora, CO (*Presenter*) Moderator and Speaker, Penumbra, Inc; Speakers Bureau, C. R. Bard, Inc; Speaker, Cook

LEARNING OBJECTIVES

1) To identify methods of surveillance of dialysis fistulas and grafts. 2) To identify advantages and disadvantages of surveillance methods. 3) To discuss future directions of dialysis circuit surveillance.

RC714B Nontraditional Dialysis Access

Participants
James T. Bui, MD, Chicago, IL (*Presenter*) Stockholder, ImmersiveTouch

For information about this presentation, contact:

jtbui@uic.edu

LEARNING OBJECTIVES

1) Describe nontraditional HD access options. 2) List when nontraditional HD options are clinically useful. 3) Apply nontraditional HD options to clinical practice.

ABSTRACT

n/a

RC714C Failing Access Circuits-Venous

Participants
Bulent Arslan, MD, Chicago, IL (*Presenter*) Advisory Board, Medtronic plc; Advisory Board, Guerbet SA; Speakers Bureau, Biocompatibles International plc; Speakers Bureau, C. R. Bard, Inc; Advisory Board and Speakers Bureau, Boston Scientific Corporation; Speakers Bureau, Penumbra, Inc

LEARNING OBJECTIVES

1) To recognize the pathologies that contribute to dialysis access failure. 2) To be familiar with standard technical approaches to treating dialysis access failure. 3) To describe the clinical outcome of dialysis access interventions.

RC714D Failing Access Circuits-Arterial

Participants
Charles E. Ray JR, MD,PhD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the common issues that may arise from arterial inflow that may affect the integrity of the dialysis access circuit.

ABSTRACT

n/a

RC715

Tomosynthesis

Thursday, Nov. 29 4:30PM - 6:00PM Room: E353C

BR

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

Participants
Margarita L. Zuley, MD, Pittsburgh, PA (*Moderator*) Investigator, Hologic, Inc

Sub-Events

RC715A Use in Screening

Participants
Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, iCAD, Inc; Speaker, iiCME

For information about this presentation, contact:

emily.conant@uphs.upenn.edu

LEARNING OBJECTIVES

1) Review outcomes from breast cancer screening with digital breast tomosynthesis (DBT). 2) Discuss the implementation of synthetic imaging in DBT screening. 3) Demonstrate case-based examples of pearls and pitfalls in DBT screening.

RC715B Current Trials

Participants
Valentina Iotti, MD, Reggio Emilia, Italy (*Presenter*) Speaker fee and travel grants from GE Healthcare.

For information about this presentation, contact:

valentina.iotti@ausl.re.it

LEARNING OBJECTIVES

1) List the current trials with digital breast tomosynthesis. 2) Compare the different study designs, interventions and setting. 3) Examine the outcomes and potential impact on the future screening and clinical practice with tomosynthesis.

RC715C Use in Diagnostics

Participants
Margarita L. Zuley, MD, Pittsburgh, PA (*Presenter*) Investigator, Hologic, Inc

For information about this presentation, contact:

zuleyml@upmc.edu

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RC716

The Newly Hired Radiologist: Noninterpretive Skills for Success (Sponsored by the RSNA Professionalism Committee)

Thursday, Nov. 29 4:30PM - 6:00PM Room: S503AB

PR

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

Participants
Brandon P. Brown, MD, MA, Indianapolis, IN (*Moderator*) Nothing to Disclose
Anastasia L. Hryhorczuk, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Kate Hanneman, MD, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose
Brent J. Wagner, MD, West Reading, PA (*Presenter*) Nothing to Disclose
Michael C. Veronesi, MD, PhD, Indianapolis, IN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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mverones@iu.edu

brpbrown@iu.edu

LEARNING OBJECTIVES

1) Describe the needs and challenges faced by the beginning radiologist, including how to find an expertise 'niche' and how to divide time between clinical work, committee volunteerism, and leadership roles. 2) Examine the impact of social media and patient portals on the physician-patient interaction and identify the risks and benefits of these new opportunities for communication. 3) Identify the issues facing a private practice group when incorporating a new partner including questions of fairness/transparency, patience with colleagues, formal and informal mentorship, and communicating expectations. 4) Discuss the ways in which a radiology group can assist a new radiologist transitioning out of training, in order to bring out the best in their new colleague and help them to live up to and exceed their highest potential.

ABSTRACT

While residency/fellowship training, board certification, and the job search are familiar topics among the radiology community, an equally important yet oft-neglected topic is that of the newly hired radiologist. Although formal training is focused on clinical and diagnostic skills, navigating professional practice requires building relationships, identifying areas of focus, and learning how best to collaborate with partners and other clinical colleagues. For the beginning faculty member, the demands of teaching and research create additional dilemmas in how best to prioritize time. In addition, new technologies and communication norms now face the practicing radiologist. Social media and patient portals provide radiologists with new forums for interacting with the public and patients. In theory, social media can be leveraged for professional outreach, to improve public understanding of radiologists' roles and to increase departmental profiles. However, it is imperative that radiologists balance this potential with the ethical and professional considerations surrounding patient privacy and autonomy. Finally, in both academic and private practice settings, unique challenges face the new partner, challenges not previously faced and for which training might not have fully prepared them. Although the new hire is full of promise, the impact of their colleagues in helping them rise to the challenge and fulfill expectations can be essential.

Honored Educators

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RC717

Emerging Technology: Imaging of Dementias

Thursday, Nov. 29 4:30PM - 6:00PM Room: S505AB

CT MR NR NM

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

FDA Discussions may include off-label uses.

Participants
Rathan M. Subramaniam, MD,PhD, Dallas, TX (*Moderator*) Consultant, Blue Earth Diagnostics Ltd; Speaker, Blue Earth Diagnostics Ltd

For information about this presentation, contact:

rathan.subramaniam@utsouthwestern.edu

LEARNING OBJECTIVES

1) To review the value of FDG and amyloid PET/CT in diganosis of dementia. 2) To review the value of MR imaging in diagnosis of dementia. 3) To review the value of tau PET/CT in diagnosis of dementia.

ABSTRACT

This session will review the importance and value of FDG PET, Amyloid PET, MRI and Tau PET imaging in diagnosis of dementia.

Sub-Events

RC717A Imaging Dementias 2018

Participants
Rathan M. Subramaniam, MD,PhD, Dallas, TX (*Presenter*) Consultant, Blue Earth Diagnostics Ltd; Speaker, Blue Earth Diagnostics Ltd

For information about this presentation, contact:

rathan.subramaniam@utsouthwestern.edu

LEARNING OBJECTIVES

1) To discuss the value of FDG brain PET/CT in differentiating various dementias in cognitive decline. 2) To discuss the value of Amyloid brain PET/CT in patients with cognitive decline and Alzheimer's disease.

RC717B Imaging Dementias: FDG and Amyloid PET/CT

Participants
William A. Moore, MD, Dallas, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand which FDA approved MR techniques are currently available for improving differential diagnosis in patients with dementia. 2) Improve basic knowlege of how MR results correspond to clinical dementia phenotypes. 3) Discuss recent technological advances including applications of dynamic susceptability contrast (DSC) MR, arterial spin labelling (ASL) and resting state functional connectivity MRI (rs-fcMRI) in the setting of patients with dementia.

RC717C Imaging Dementias: MRI

Participants
Kejal Kantarci, MD, Rochester, MN (*Presenter*) Data Safety Monitoring Board, Takeda Pharmaceutical Company Limited; Data Safety Monitoring Board, Pfizer Inc; Data Safety Monitoring Board, Johnson & Johnson; Research funded, Eli Lilly and Company

For information about this presentation, contact:

kantarci.kejal@mayo.edu

LEARNING OBJECTIVES

1) Describe the MRI techniques used in the imaging of cognitve impairment and dementia. 2) Understand the clinical utility. 3) Discuss the findings with pathologic confirmation.

RC717D Imaging Dementias: Tau PET/CT

Participants
Val J. Lowe, MD, Rochester, MN (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Eli Lilly and Company; Advisory Board, Merck & Co, Inc

LEARNING OBJECTIVES

1) Describe the basic science principles behind tau PET/CT imaging. 2) Understand the utility of tau PET/CT imaging in neurodegenerative disease. 3) Identify the findings of a positive tau PET/CT scan.

RC718

Interrogating Tumor Heterogeneity Using Imaging

Thursday, Nov. 29 4:30PM - 6:00PM Room: N229

OI

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

Participants
Evis Sala, MD, PhD, Cambridge, United Kingdom (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Emphasize the role of oncologic imaging in the era of precision medicine. 2) Review the definitions of Radiomics and Radiogenomics. 3) Identify the gaps in imaging tumor heterogeneity and its metastatic potential.

Sub-Events

RC718A Cancer Genomics: Making Sense of Inter- and Intra-tumor Heterogeneity

Participants
Britta Weigelt, New York, NY (*Presenter*) Spouse, Advisor, Goldman Sachs; Spouse, Scientific Advisory Board, VolitionRx

LEARNING OBJECTIVES

1) Review the results of large-scale massively parallel sequencing endeavors of human cancers. 2) Assess the inter- and intra-tumor genetic heterogeneity found in human cancers. 3) Define the implications of genetic heterogeneity on the biological and clinial behavior of cancers.

RC718B Imaging Genomics-proteomics Interactions: New Frontiers Ahead

Participants
Evis Sala, MD, PhD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Provide the rationale for assessing tumor heterogeneity. 2) Review the definitions of Radiomics, Radiogenomics and Proteomics. 3) Provide insights into the role of habitat imaging in unravelling tumor heterogeneity.

Honored Educators

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RC718C Making Sense of Big Imaging Data: What Comes Next?

Participants
Robert J. Gillies, PhD, Tampa, FL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

robert.gillies@moffitt.org

LEARNING OBJECTIVES

1) Describe a future role of radiologists in capturing and curating image data. 2) Differentiate conventional radiomic analyses from deep learning. 3) Outline the steps needed to curate useful data and ways that these can be automated. 4) Describe future approaches that may enable multi-institutional models to be built without sharing the actual data.

ABSTRACT

The practice of medicine is undergoing seismic shifts from being primarily experience-based to data-driven. Further, the emergence of data-driven quantitative diagnostic, prognostic, and predictive methods will see an exponential increase in coming years due to the emergence of tools that can mine large amounts of data across sites. Such systems are already in place for many data types, and tools for analyses of radiological data are just emerging, and are likely to change the practice of radiology forever from a semantic lexicon based discipline to one that is increasingly analytical, driven by machine learning algorithms. The power of these analytics is primarily limited by access to sufficiently large data sets of highly curated patients, with images, co-variates, treatments and outcomes. In the field of cancer, the Cancer Image Archive (TCIA) houses over 30 million radiographic images that can be mined for associations with multiple core data elements (CDE) and this has been used extensively to generate predictive and prognostic models. Although 30 million sounds like a lot, it is a mall fraction of the >100 million radiological exams that are acquired annually in the U.S. Going forward, tools are being developed that will allow sharing of processed image data along with CDEs without the need to share images themselves, lowing the barriers to building large cohorts. These will likely take decades to deploy, however. In the meantime tools are being deployed to prospectively capture data within single institutions to automatically

build and populate focused cohorts.

RC721

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

Thursday, Nov. 29 4:30PM - 6:00PM Room: S105AB

CT PH

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

Participants
Ehsan Samei, PhD, Durham, NC (*Coordinator*) Research Grant, General Electric Company; Research Grant, Siemens AG; Advisory Board, medInt Holdings, LLC; License agreement, 12 Sigma Technologies; License agreement, Gammex, Inc
Lifeng Yu, PhD, Chicago, IL (*Coordinator*) Nothing to Disclose

ABSTRACT

CT has become a leading medical imaging modality, thanks to its superb spatial and temporal resolution to depict anatomical details. New advances have enabled extending the technology to depict physiological information. This has enabled a wide and expanding range of clinical applications. These advances are highlighted in this multi-session course. The course offers a comprehensive and topical depiction of these advances with material covering CT system innovations, CT operation, CT performance characterization, functional and quantitative applications, and CT systems devised for specific anatomical applications. The sessions include advances in CT system hardware and software, CT performance optimization, CT practice management and monitoring, spectral CT techniques, quantitative CT techniques, functional CT methods, and special CT use in breast, musculoskeletal, and interventional applications.

Sub-Events

RC721A Practice Management

Participants
Timothy P. Szczykutowicz, PhD, Madison, WI (*Presenter*) Equipment support, General Electric Company; License agreement, General Electric Company; Founder, Protocolshare.org LLC; Medical Advisory Board, medInt Holdings, LLC; Co-owner, LiteRay Medical LLC

For information about this presentation, contact:

tszczykutowicz@uwhealth.org

LEARNING OBJECTIVES

1) Apply the master protocol concept to their CT fleet to obtain protocol performance uniformity. 2) Understand what information is needed to document a CT protocol and how it impacts the diagnostic utility of the resulting CT images and/or CT exam workflow. 3) Apply the CT protocol documentation template and team model discussed in the course to your own CT practice.

ABSTRACT

The talk will cover two CT protocol management strategies. The first is called the master protocol concept. The concept groups together phases of indications requiring similar: levels of image quality, body regions, scan times, and contrast enhancement. Once grouped, 'master' acquisition parameters can be defined for each master protocol. We will show how this simplifies protocol management across a diverse fleet of CT scanners. In other words, it changes a three phase abdomen CTA protocol from being thought of as composed of three unique sets of acquisition parameters into: abdomen CTA master, then 2 phases using the routine abdomen master. The second management strategy is CT protocol documentation. All parameters and instructions influencing the diagnostic utility and workflow of executing a CT order will be reviewed. This review will motivate a comprehensive definition of what constitutes a CT protocol. Example templates for efficiently documenting this information will be presented so the audience member can implement a CT protocol documentation strategy at their own institution.

RC721B Practice Optimization

Participants
Mannudeep K. Kalra, MD, Boston, MA (*Presenter*) Research Grant, Siemens AG; Research Grant, Canon Medical Systems Corporation

For information about this presentation, contact:

mkalra@mgh.harvard.edu

LEARNING OBJECTIVES

1) Problems with practice optimization for CT protocols and radiation dose. 2) Role of peronnel and processes for optimizing CT protocols and radiation dose. 3) Best practices in CT practice optimization with a 'regional-indication' based approach.

RC721C Practice Monitoring

Participants
Joshua Wilson, PhD, Durham, NC (*Presenter*) License agreement, Sun Nuclear Corporation
Ehsan Samei, PhD, Durham, NC (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Advisory Board, medInt Holdings, LLC; License agreement, 12 Sigma Technologies; License agreement, Gammex, Inc

For information about this presentation, contact:

joshua.wilson@duke.edu

LEARNING OBJECTIVES

1) Describe conventional radiation dose monitoring workflows and analytics. 2) Understand the limitations and future potential value of dose monitoring solutions. 3) Identify opportunities for improving clinical operations and consistency using dose monitoring.

ABSTRACT

Recent legislative and accreditation requirements have driven rapid development and implementation of radiation dose monitoring platforms. Multiple solutions are available that require financial commitment and oversight. How can institutions derive added-value, beyond minimum regulatory requirements, from their monitoring program by improving the quality of their clinical performance? Global alert thresholds, the standard in commercial products, naïve to system model and patient size have limited value. Setting a threshold presupposes a clinically-relevant level is known. For an arbitrary level, appropriately-dosed obese patients triggered false alerts, but over-dosed small patients were missed. Numerous study parameters must be retained because chronologic trends, the industry standard, are rarely useful without controlling for other moderators. Dashboards must be interactive enabling dynamic drill-down into cohorts. Dose databases require curation tools and maintenance, largely absent from all solutions, because wrong information will be inadvertently entered, and the utility of the analytics is entirely dependent on the data quality. Dose monitoring can satisfy requirements with global alert thresholds and patient dose records, but a program's real value is in optimizing patient-specific protocols, balancing image quality trade-offs that dose-reduction strategies promise, and improving the performance and consistency of a clinical operation.

RC722

Machine Learning for Radiotherapy Applications

Thursday, Nov. 29 4:30PM - 6:00PM Room: N227B

AI PH RO

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

Participants
Jayashree Kalpathy-Cramer, MS, PhD, Charlestown, MA (*Moderator*) Consultant, Infotech Software Solution

Sub-Events

RC722A Deep Learning for Image Segmentation, Analysis and Reconstruction

Participants
Jonas Teuwen, MSc,PhD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jonas.teuwen@radboudumc.nl

LEARNING OBJECTIVES

1) Learn about the types of clinical problems which are best suited for deep learning solutions. 2) Learn about the current state-of-the-art deep learning technology in the analysis and segmentation of medical images, and learn about the advantages of reconstructing images using deep learning technology. 3) Being able to critically estimate the impact and assess the applicability of newly developed deep learning technology.

ABSTRACT

Deep learning has recently attracted much interest from the medical community, mainly due the successful application to problems which were previously considered to be purely within the human realm. The availability of an ever growing amount of medical images, and the increasing availability of affordable computation resources allows to apply deep learning technologies to many different problems. However, the scope of problems for which deep learning currently performs on par or outperforms humans is rather narrow. The required human and financial effort makes it important to be able to determine clinical problems where deep learning could bring an advantage. After this refresher course, you will be aware of the state-of-the-art in deep learning for image segmentation, analysis and reconstruction. You will be able to critically assess the impact and applicability of deep learning technology and be able to find future clinical opportunities.

RC722B Machine Learning Tumor Classification

Participants
Jayashree Kalpathy-Cramer, MS, PhD, Charlestown, MA (*Presenter*) Consultant, Infotech Software Solution

For information about this presentation, contact:

kalpathy@nmr.mgh.harvard.edu

LEARNING OBJECTIVES

1) Learn about applications of machine learning including radiomics and deep learning in classifiying tumor sub-types. 2) Learn about risk stratification using machine learning of MR and CT images. 3) Understand the challenges when applying machine learning to tumor analysis. 4) Review best practices for applying machine learning in cancer imaging.

ABSTRACT

Machine learning has shown great potential for a range of applications in oncology from diagnosis to therapy planning and response assessment. Large repositories of clinical and imaging data typicially available at most institutions can be be used to train and validate models. We will discuss the use of machine learning including radiomics and deep learning for the analysis of CT and MR imaging in a variety of cancer types for risk stratification, radiogenomics and response assessment..

RC722C Machine Learning for Automated Treatment Planning

Participants
Laurence E. Court, PhD, Houston, TX (*Presenter*) Nothing to Disclose

RC723

Diagnostic Imaging: Contrast Makes all the Difference (Interactive Session)

Thursday, Nov. 29 4:30PM - 6:00PM Room: E353B

PH

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

FDA Discussions may include off-label uses.

Participants
Charles E. Willis, PhD, Houston, TX (*Coordinator*) Medical Advisory Board, General Electric Company

For information about this presentation, contact:

chwillis@mdanderson.org

LEARNING OBJECTIVES

1) Define "contrast" as a fundamental descriptive metric in a diagnostic image. 2) Describe how contrast is developed during image formation in different diagnostic modalities. 3) Explain how contrast can degraded by the physical characteristics of acquisition and the patient. 4) Compare methods for improving contrast including advanced imaging technologies. 5) Assess how contrast affects the human observer's ability to detect important clinical features.

GENERAL INFORMATION

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

Sub-Events

RC723A Diagnostic Imaging: Contrast Makes all the Difference 1

Participants
Andrew D. Maidment, PhD, Philadelphia, PA (*Presenter*) Research support, Hologic, Inc; Research support, Barco nv; Research support, Analogic Corporation; Spouse, Employee, Real-Time Tomography, LLC; Spouse, Stockholder, Real-Time Tomography, LLC; Scientific Advisory Board, Real-Time Tomography, LLC;

For information about this presentation, contact:

Andrew.Maidment@uphs.upenn.edu

LEARNING OBJECTIVES

1) Assess how contrast affects the human observer's ability to detect important clinical features. 2) Identify sources of noise in clinical images and explain how they affect contrast. 3) List other fundamental image properties that affect contrast.

RC723B Diagnostic Imaging: Contrast Makes all the Difference 2

Participants
J. Anthony Seibert, PhD, Sacramento, CA (*Presenter*) Advisory Board, Bayer AG

LEARNING OBJECTIVES

1) Explain how contrast can degraded by the physical characteristics of acquisition and the patient. 2) List countermeasures for enhancing, restoring, or preventing the loss of contrast. 3) Compare methods for improving contrast including advanced imaging technologies.

RC723C Diagnostic Imaging: Contrast Makes all the Difference 3

Participants
Robert L. Dixon, PhD, Winston-Salem, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define "contrast" as a fundamental descriptive metric in a diagnostic image. 2) Describe how contrast is developed during image formation in different diagnostic modalities. 3) Explain how contrast can degraded by the physical characteristics of acquisition and the patient.

RC724

The Human Side of Artificial Intelligence

Thursday, Nov. 29 4:30PM - 6:00PM Room: E451B

AI

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

Participants
Richard B. Gunderman, MD, PhD, Indianapolis, IN (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the respects in which, to be effective, artificial intelligence must serve human needs.

Sub-Events

RC724A Will We Trust AI?

Participants
Saurabh Jha, MD, Philadelphia, PA (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation

For information about this presentation, contact:

saurabh.jha@uphs.upenn.edu

LEARNING OBJECTIVES

1) Understand the epistemic controversies regarding artificial intelligence. 2) Do we attach an inordinate importance on 'how' and 'why'? 3) Appreciate the implications of the 'incompleteness theorem' in formal logic.

ABSTRACT

The incompleteness theorem, in formal logic, states that a system cannot vouch for its own validity. This begs a broader question - how will we know if AI is speaking the truth? Will we be the machine's umpire or will the machine be our umpire? The answers to these questions have profound implications for the interaction between artificial intelligence and radiology

RC724B Voices of AI: Highlighting Perspective from the Radiology AI Journal Club

Participants
Judy W. Gichoya, MBChB,MS, Portland, OR (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jgichoya@iu.edu

RC724C How AI Can Go Ethically Awry

Participants
Richard B. Gunderman, MD, PhD, Indianapolis, IN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the respects in which artificial intelligence must meet ethical as well as technical needs.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Richard B. Gunderman, MD, PhD - 2018 Honored Educator

RC725

Mini-course: Radiation Safety for Patients and Staff - Practice Tools and Approaches for Radiation Safety

Thursday, Nov. 29 4:30PM - 6:00PM Room: S102CD

PH SQ

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

FDA Discussions may include off-label uses.

Participants
Madan M. Rehani, PhD, Boston, MA (*Coordinator*) Nothing to Disclose

For information about this presentation, contact:

madan.rehani@gmail.com

Sub-Events

RC725A Decision Support Systems as Effective Tools

Participants
James A. Brink, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand how imaging utilization may be guided by robust appropriate use criteria. 2) To consider the impact that effective decision support mechanisms may have on utilization management. 3) To explore how computer-assisted reporting may reduce variation in follow-up imaging recommendations consequent to clinically significant findings.

RC725B Safety in CT of Children

Participants
Donald P. Frush, MD, Durham, NC (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

donald.frush@duke.edu

LEARNING OBJECTIVES

1) Become familiar with the unique considerations relevant to safety for pediatric CT. 2) Understand the domain of safety for pediatric CT. 3) Learn risks of pedaitric CT. 4) Be able to apply strategies for safe practice for pediatric CT.

RC725C Safety in Nuclear Medical Procedures

Participants
Andrew J. Einstein, MD, PhD, New York, NY (*Presenter*) Consultant, General Electric Company; Research Grant, Canon Medical Systems Corporation

LEARNING OBJECTIVES

1) Explain how radiation from nuclear medicine procedures is quantified. 2) Compare radiation dose from a variety of nuclear medicine tests to other imaging tests. 3) Discuss approaches to optimizing radiation dose from nuclear medicine procedures.

RC725D Safety in Interventional Fluoroscopic Procedures

Participants
Donald Miller, MD, Silver Spring, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Integrate methods for radiation protection of patients into interventional fluoroscopy procedures. 2) Employ occupational radiation protection correctly. 3) Describe the components of a quality assurance program for radiation protection for interventional fluoroscopy.

Active Handout:Donald Miller

http://abstract.rsna.org/uploads/2018/18001519/Safety in Interventional Fluoroscopic Procedures RC725D.pdf

RC727

Physician Payment Reform and Radiology: Where Do We Stand and Where Are We Going?

Thursday, Nov. 29 4:30PM - 6:00PM Room: S103CD

HP

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

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

LEARNING OBJECTIVES

1) To describe recent federal legislation seeking to implement healthcare payment reform by linking physician payment to the quality and value of care. 2) To recognize the specific impact of such legislation on radiologists and how radiologists can best prepare for the legislation's implementation. 3) To explore examples of how such federal policy may be applied in breast imaging, interventional radiology, and quality and safety in radiology.

ABSTRACT

Recent federal legislation aims to reform Medicare's traditional fee-for-service approach through new payment models that will eventually base the large majority of physician payments on quality and value. Of note, the Medicare Access and CHIP Reauthorization Act (MACRA) of 2015 implements a new federal Quality Payment Program (QPP) through which physicians will be paid through Advanced Alternative Payment Models or the Merit-Based Incentive Payment System (MIPS). The QPP will result in physicians being subject to potentially substantial payment bonuses or penalties depending on their performance in new physician-focused evaluation systems. The QPP will grant special considerations in performance evaluation to physicians with unique practice patterns, such as radiologists. However, physicians will need to have a robust understanding of the legislation and prepare accordingly in order to achieve favorable outcomes. This session will provide background of recent federal physician payment reform as relevant to radiology and also actions that radiology practices should pursue, both generally and in specific contexts within radiology, to ultimately attain success in the new system.

Sub-Events

RC727A Quality and Safety: A Policy Perspective

Participants
Kimberly E. Applegate, MD, MS, Lexington, KY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

keapple@uky.edu

LEARNING OBJECTIVES

1) Introduce the participant to pertinent health policy language essential for understanding the Medicare Access and CHIP Reathorization Act of 2015 (MACRA). 2) Briefly review 3 broad clincian value based payment models outlined within MACRA: Merits-based Incentive Payment System (MIPS), Advanced Alternative Payment Models (AAPM), and Physician-focused Payment Models (MIPS). 3) Dive deeper into MIPS exploring the requirements for each of the 4 performance categories (Quality, Cost, Advancing Care Information, Improvement Activities) as they apply to the 2018 performance year.

RC727B The Need for Price Transparency in Radiology and How to Achieve It

Participants
David C. Levin, MD, Philadelphia, PA (*Presenter*) Consultant, HealthHelp, LLC; Board Member, Outpatient Imaging Affiliates, LLC

For information about this presentation, contact:

david.levin@jefferson.edu

LEARNING OBJECTIVES

1) Become aware of the misinformation that is often found at web sites purporting to help patients know what their imaging tests will cost. 2) Learn about possible ways to provide more accurate information to patients with high deductible health plans about what the true costs will be for their imaging exams.

RC727C MACRA and the MIPS: Impact for Radiology

Participants
Gregory N. Nicola, MD, River Edge, NJ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To be familiar with the radiology quality and safety metrics on the cms.gov compare site. 2) To explain some of the organizational resources available to the radiologist to measure and report quality and process improvement. 3) To explore how quality in radiology will be measured under emerging physician performance evaluation models.

RC727D Breast Screening Bundled Payments

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

For information about this presentation, contact:

gbm9002@med.cornell.edu

LEARNING OBJECTIVES

1) Describe how bundled payments are created and how they are believed to impact health outcomes. 2) Describe how bundled payments have impacted imaging reimbursement. 3) Describe a potential model for a bundled payment for breast screening.

RC729

Pancreaticobiliary MR Imaging (Interactive Session)

Thursday, Nov. 29 4:30PM - 6:00PM Room: S404CD

GI MR OI

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

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

Sub-Events

RC729A The Incidentally Detected Cystic Pancreatic Lesion: What to Do Next

Participants
Ihab R. Kamel, MD, PhD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG

For information about this presentation, contact:

ikamel@jhmi.edu

LEARNING OBJECTIVES

1) Discuss the differential diagnosis of cystic pancreatic neoplasm. 2) Describe the role of MRI/MRCP in the diagnosis of these lesions. 3) Review the various guidelines for the follow up of cystic pancreatic lesions.

Honored Educators

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RC729B The Dilemma of Autoimmune Pancreatitis

Participants
Ashish R. Khandelwal, MD, Rochester, MN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

khandelwal.ashish@mayo.edu

LEARNING OBJECTIVES

1) Understand the current diagnostic criteria and subtypes of autoimmune pancreatitis (AIP). 2) Recognize the characteristic imaging manifestations of AIP. 3) Differentiate AIP from pancreatic cancer. 4) Attendees will know common complications and expected post-treatment appearance of AIP on imaging.

RC729C MRI Staging and Treatment Planning of Extrahepatic Cholangiocarcinoma

Participants
Peter S. Liu, MD, Solon, OH (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

liup3@ccf.org

LEARNING OBJECTIVES

1) Identify the various morphologic classifications of cholangiocarcinoma. 2) Describe modern MR techniques used to assess hilar cholangiocarcinoma. 3) Explain relevant anatomic relationships for potential hilar cholangiocarcinoma resection, including vascular and biliary involvement. 4) Discuss key features of modern cholangiocarcinoma staging systems and their imaging manifestations.

RC729D MRI for Staging and Assessment of Response of Pancreatic Cancer to Therapy

Participants
Marc Zins, MD, Paris Cedex 14, France (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mzins@hpsj.fr

LEARNING OBJECTIVES

1) To define the role of MRI in the staging of pancreatic ductal adenocarcinoma (PDA). 2) To specify the respective advantages and limitations of MRI and CT for PDA staging and to explain when one technique is more applicable and when the two modalities

should be associated. 3) To describe the basic principles and standards of imaging evaluation after neoadjuvant therapy of PDA and to identify the remaining limitations in that setting.

RC731

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

Thursday, Nov. 29 4:30PM - 6:00PM Room: E263

MK NR IR

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

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

LEARNING OBJECTIVES

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

Sub-Events

RC731A Pre- and Post Biopsy Assessment

Participants
Richard Silbergleit, MD, Royal Oak, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be familiar with all required aspects of the pre-biopsy work-up, including medications, laboratory values, and review of relevant prior imaging. 2) Be familiar with solutions to address complications or other unexpected events which may arise during the course of spine biopsy. 3) Be comfortable in performing the post procedure assessment of the patient after spinal biopsy.

RC731B Equipment Used for Image-guided Biopsies of the Spine

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

LEARNING OBJECTIVES

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

RC731C Thoracic and Lumbar Biopsies

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

LEARNING OBJECTIVES

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

RC731D 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.

RC731E Disc Biopsy and Aspiration

Participants
Amish H. Doshi, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

amish.doshi@mountsinai.org

LEARNING OBJECTIVES

1) To reveiw 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

The lecture will focus on the indications for imaging guided biopsy in the setting of discitis/osteomyelitis and describe a variety of CT and Fluoroscopic guided techniques in obtaining aspirate and tissue sample. Additionally, the lecture will review of the various types of needles used in the procedures and in what setting specific needles should be used. A brief review of current literature on yield of imaging guided biopsy will also be discussed.

RC732

Physician Leadership Through Change

Thursday, Nov. 29 4:30PM - 6:00PM Room: E261

LM

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

Participants
John T. Wald, MD, Rochester, MN (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

wald.john2@mayo.edu

LEARNING OBJECTIVES

1) Develop a physician leadership skillset to gain influence and organizational support during change in your organization. 2) Gain a better understanding of dos and don'ts of physician leadership. 3) Define key physician leadership traits that allow physicians to position their organizations for success. 4) Discuss the Mayo Clinic model of physician/administrator leadership and its role in leading through change. 5) Determine appropriate and practical strategies to manage change in your organization.

Sub-Events

RC732A Physician Leadership Through Change

Participants
John T. Wald, MD, Rochester, MN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

wald.john2@mayo.edu

LEARNING OBJECTIVES

1) Develop a physician leadership skilllset to gain influence and organizational support during change in your organization. 2) Gain a better understanding of the 'dos and don'ts' of physician leadership. 3) Define key physician leadership traits that allow physicians to position organizations for success. 4) Discuss the Mayo Clinic model of physician/administrator leadership and its role in leading through change. 5) Determine appropriate and practical strategies to manage change in your organization.

RC732B Innovation Drives Change: Leading Your Organization Through a Successful Transformation

Participants
Amy L. Kotsenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

kotsenas.amy@mayo.edu

LEARNING OBJECTIVES

1) Develop a physician leadership skillset to gain influence and organizational support during change in your organization. 2) Gain a better understanding of dos and donts of physician leadership. 3) Determine appropriate and practical strategies to manage change in your organization.

RC732C Leadings Teams to Face Challenges

Participants
Leonardo Vedolin, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

leonardo,vedolin@dasa.com.br

LEARNING OBJECTIVES

1) Review data, failures and learning points in chance management from a large healthcare provider. 2) Understand change management, strategy and leadership interaction and how these issues affect the leader's role. 3) Identify leadership skill sets to drive organization to success.

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RC750

MR Imaging-guided Breast Biopsy (Hands-on)

Thursday, Nov. 29 4:30PM - 6:00PM Room: E260

BR MR

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

Participants
Amy L. Kerger, DO, Columbus, OH (*Presenter*) Nothing to Disclose
Rifat A. Wahab, DO, Cincinnati, OH (*Presenter*) Nothing to Disclose
Vandana M. Dialani, MD, Boston, MA (*Presenter*) Nothing to Disclose
Deepa Sheth, MD, Chicago, IL (*Presenter*) Research Grant, Guerbet SA
Lara D. Richmond, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Gary J. Whitman, MD, Houston, TX (*Presenter*) Nothing to Disclose
Kirti M. Kulkarni, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Jill J. Schieda, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Brandy Griffith, DO, Columbus, OH (*Presenter*) Nothing to Disclose
Amado B. del Rosario, DO, Tucson, AZ (*Presenter*) Nothing to Disclose
Karla A. Sepulveda, MD, Houston, TX (*Presenter*) Nothing to Disclose
Wendi A. Owen, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Laurie R. Margolies, MD, New York, NY (*Presenter*) Research Consultant, FUJIFILM Holdings Corporation
Mitra Noroozian, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Jeffrey R. Hawley, MD, Columbus, OH (*Presenter*) Nothing to Disclose
Nikki S. Ariaratnam, MD, Voorhees, NJ (*Presenter*) Nothing to Disclose
Su-Ju Lee, MD, Cincinnati, OH (*Presenter*) Spouse, Stockholder, General Electric Company; Spouse, Stockholder, Siemens AG
Mai A. Elezaby, MD, Madison, WI (*Presenter*) Research Grant, Exact Sciences Corporation
Anika N. Watson, MD, New York, NY (*Presenter*) Nothing to Disclose
Alena Levit, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Esther N. Udoji, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Brandy.Griffith@osumc.edu

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Jeffrey.hawley@osumc.edu

dsheth@radiology.bsd.uchicago.edu

NinaWatson@emory.edu

LEARNING OBJECTIVES

1) Explain why MR-guided breast biopsy is needed for patient care. 2) Identify relative and absolute contraindications to MR-guided breast biopsy. 3) Describe criteria for MR-guided breast biopsy patient selection. 4) Debate risks and benefits of pre-biopsy targeted ultrasound for suspicious MRI findings. 5) Understand the basic MR-guided biopsy procedure, protocol and requirements for appropriate coil, needle and approach selection. 6) Manage patients before, during and after MR-guided breast biopsy. 7) Define the benefits and limitations of MR-guided vacuum assisted breast biopsy. 8) How to problem shoot complicated cases due to lesion location, patient anatomy, etc.

ABSTRACT

This course is intended to provide basic didactic instruction and hands-on experience for MR-guided breast biopsy. Because of the established role of breast MRI in the evaluation of breast cancer through screening and staging, there is a proven need for MR-guided biopsy of the abnormalities that can only be identified at MRI. This course will be devoted to the understanding and identification of: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy technologies and techniques 5) potential problems and pitfalls and 6) practice audits. Participants will spend 30 minutes in didactic instruction followed by 60 minutes practicing MR-guided biopsy using provided phantoms. Various combinations of full size state-of-the-art breast MRI coils, biopsy localization equipment and needles from multiple different vendors will be available for hands-on practice. Some stations will have monitors loaded with targeting software. Expert breast imagers from around the world will be at each of 10 stations to provide live coaching, tips, techniques and advice.

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RC752

US-guided Interventional Breast Procedures (Hands-on)

Thursday, Nov. 29 4:30PM - 6:00PM Room: E264

BR US

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

Participants
Karen S. Johnson, MD, Durham, NC (*Presenter*) Nothing to Disclose
Jocelyn A. Rapelyea, MD, Washington, DC (*Presenter*) Speakers Bureau, General Electric Company; Consultant, Transmed7;
Anita K. Mehta, MD, MSc, Washington DC, DC (*Presenter*) Nothing to Disclose
Kathleen R. Gundry, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Michael N. Linver, MD, Albuquerque, NM (*Presenter*) Medical Advisory Board, Solis; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc
Tilden L. Childs III, MD, Fort Worth, TX (*Presenter*) Nothing to Disclose
Evguenia J. Karimova, MD, Memphis, TN (*Presenter*) Nothing to Disclose
Caroline M. Ling, MD, Darby, PA (*Presenter*) Nothing to Disclose
Sora C. Yoon, MD, Durham, NC (*Presenter*) Nothing to Disclose
Connie E. Kim, MD, Durham, NC (*Presenter*) Spouse, Consultant, ClarVista Medical, Inc Spouse, Royalties, Leica Biosystems Nussloch GmbH Spouse, Intellectual property, Leica Biosystems Nussloch GmbH
Mary S. Soo, MD, Durham, NC (*Presenter*) Nothing to Disclose
Christina G. Marks, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Margaret M. Szabunio, MD, Lexington, KY (*Presenter*) Nothing to Disclose
Jean M. Kunjummen, DO, Atlanta, GA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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margaret.szabunio@uky.edu

LEARNING OBJECTIVES

1) Describe the equipment needed for ultrasound guided interventional breast procedures. 2) Review the basic principles of ultrasound guidance and performance of minimally invasive breast procedures. 3) Practice hands-on technique for ultrasound guided breast interventional procedures.

ABSTRACT

This course is intended to familiarize the participant with equipment and techniques in the application of US guided breast biopsy and needle localization. Participants will have both basic didactic instruction and hands-on opportunity to practice biopsy techniques on tissue models with sonographic guidance. The course will focus on the understanding and identification of: 1) optimal positioning for biopsy 2) imaging of adequate sampling confirmation 3) various biopsy technologies and techniques 4) potential problems and pitfalls

RC753

Platforms and Infrastructures for Accelerated Discoveries in Machine Learning and Radiomics

Thursday, Nov. 29 4:30PM - 6:00PM Room: E451A

AI IN

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

Participants
Katherine P. Andriole, PhD, Dedham, MA (*Moderator*) Research Grant, NVIDIA Corporation; Research Grant, General Electric Company; Research Grant, Nuance Communications, Inc; Advisory Board, McKinsey & Company, Inc

For information about this presentation, contact:

kandriole@bwh.harvard.edu

LEARNING OBJECTIVES

1) Understand the challenges involved in creating machine learning and radiomics experiments with standard clinical systems. 2) Review some of the tools that can bridge the gap between existing clinical systems and translational research in medical imaging. 3) Provide use case examples using open source tools.

ABSTRACT

Machine Learning and Radiomics promise to revolutionize the field of Radiology by allowing more quantification of medical images exposing previously "hidden" information within the imaging data. More recently, the combination machine learning techniques such as deep learning with radiomics, open new opportunities for researchers in this space. However, standard clinical systems are not suited for machine learning and radiomics experiments posing a significant challange for individuals together started. The pupose of this session is to review existing and custom developed infrastructures and platforms to bridge this gap.

Sub-Events

RC753A Overview of the R&D Process Pipeline for Machine Learning in Radiology

Participants
Mark H. Michalski, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand clinical data integration standards available to enable translational research in machine learning. 2) Gain introductory knowledge on enterprise data warehouses and understand how they can be used to augment machine learning systems. 3) Understand complexities associated with handling sensitive patient data.

RC753B Infrastructure and Software Platforms for Model Development, Training, Validation, and Clinical Integration

Participants
Neil Tenenholtz, PhD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ntenenholtz@partners.org

LEARNING OBJECTIVES

1) Identify cohorts for model development leveraging radiology reports and imaging metadata. 2) Rapidly annotate reports and imaging data on which machine learning models can be trained. 3) Build a pipeline for acquiring imaging data from a PACS for model development. 4) Train machine learning models on imaging data. 5) Validate machine learning models in the clinical workflow.

RC753C Machine Learning and Radiomics in Practice: Tools and Case Example

Participants
Daniel L. Rubin, MD, MS, Stanford, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

daniel.l.rubin@stanford.edu

LEARNING OBJECTIVES

1) To understand the role of image annotations in capuring essential information about images in radiomics. 2) To learn about tools, platforms, infrastructures, standards, and machine learning methods that can leverage medical images to better understand disease and enable decision support. 3) To see example use cases of radiomics and machine learning methods for accelerating research and improving clinical practice.

Honored Educators

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RC754

Value-based Imaging in the Accountable Care Organization Model

Thursday, Nov. 29 4:30PM - 6:00PM Room: N230B

HP IN

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

Participants
James Whitfill, MD, Scottsdale, AZ (*Moderator*) President, Lumetis LLC
James Whitfill, MD, Scottsdale, AZ (*Presenter*) President, Lumetis LLC
Rodney S. Owen, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose
Gary H. Dent, MD, Macon, GA (*Presenter*) Officer, Radius, LLC; Stockholder, Radius, LLC;

For information about this presentation, contact:

Dent_gh@mercer.edu

rowen@esmil.com

LEARNING OBJECTIVES

1) Review the forces at work which are pushing the US Healthcare system to adopt value based care models. 2) Learn the mechanisms currently used to contract for value based care contracts. 3) Learn how imaging and radiology currently relate to new value based care models. 4) Hear from radiologists who are active leaders in value based models in their community.

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RCA55

3D Printing Hands-on with Open Source Software Introduction (Hands-on)

Thursday, Nov. 29 4:30PM - 6:00PM Room: S401AB

IN

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

Participants
Beth A. Ripley, MD, PhD, Seattle, WA (*Presenter*) Nothing to Disclose
Tatiana Kelil, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Michael W. Itagaki, MD, MBA, Lynnwood, WA (*Presenter*) Stockholder, Embodi3D, LLC
Anish Ghodadra, MD, New Haven, CT (*Presenter*) Advisory Board, axial3D Limited
Dmitry Levin, Seattle, WA (*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, MeBio ; Research collaboration, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

For information about this presentation, contact:

beth.ripley2@va.gov

LEARNING OBJECTIVES

1) To learn about basic 3D printing technologies and file formats used in 3D printing. 2) To learn how to segment a medical imaging scan with free and open-source software and export that anatomy of interest into a digital 3D printable model. 3) To perform basic customizations to the digital 3D printable model with smoothing, text, cuts, and sculpting prior to physical creation with a 3D printer.

ABSTRACT

'3D printing' refers to fabrication of a physical object from a digital file with layer-by-layer deposition instead of conventional machining, and allows for creation of complex geometries, including anatomical objects derived from medical scans. 3D printing is increasingly used in medicine for surgical planning, education, and device testing. The purpose of this hands-on course is to teach the learner to convert a standard Digital Imaging and Communications in Medicine (DICOM) data set from a medical scan into a physical 3D printed model through a series of simple steps using free and open-source software. Basic methods of 3D printing will be reviewed. Initial steps include viewing and segmenting the imaging scan with 3D Slicer, an open-source software package. The anatomy will then be exported into stereolithography (STL) file format, the standard engineering format that 3D printers use. Then, further editing and manipulation such as smoothing, cutting, and applying text will be demonstrated using MeshMixer and Blender, both free software programs. Methods described will work with Windows, Macintosh, and Linux computers. The learner will be given access to comprehensive resources for self-study before and after the meeting, including an extensive training manual and online video tutorials.

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/ Tatiana Kelil, MD - 2017 Honored Educator

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RCB55

Transpositions of the Great Arteries in Your Hands (Hands-on)

Thursday, Nov. 29 4:30PM - 6:00PM Room: S401CD

CA IN VA

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

Participants
Shi-Joon Yoo, MD, Toronto, ON (*Presenter*) Owner, 3D HOPE Medical; CEO, IMIB-CHD; Spouse, CEO, 3D PrintHeart;
Cynthia K. Rigsby, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Rajesh Krishnamurthy, MD, Columbus, OH (*Presenter*) Nothing to Disclose
Whal Lee, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hyun Woo Goo, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Andreas Giannopoulos, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Lorna Browne, MD, FRCR, Aurora, CO (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

shi-joon.yoo@sickkids.ca

crigsby@luriechildrens.org

LEARNING OBJECTIVES

1) Understand the classic and complicated morphology of complete and congenitally corrected transposition in terms of relationship and connections among cardiac chambers and great arterial trunks and coronary arterial anatomy. 2) Learn the choices of surgical procedures for classic and complicated forms of transpositions. 3) Learn how to visualize the surgically important features of transpositions at CT and MR. 4) Correlate findings at 3D print models with imaging findings.

ABSTRACT

Complete and congenitally corrected transpositions of the great arteries are not uncommon congenital heart diseases that require surgical repair early or later in life. The surgical options and procedures vary according to the given intracardiac, extracardiac and coronary arterial anatomy. This hands-on congenital heart morphology session will provide the audience with an opportunity to learn the basic and complicated morphology of the two forms of transposition of the great arteries with special emphasis on surgical anatomy. The session will consist of 25-minute introductory lecture, 40-minute hands-on observation and 25-minute discussion and evaluation. Experts on congenital heart disease pathology will be available for guidance and answering questions throughout the session.

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RCC55

Patient-Centric Radiology

Thursday, Nov. 29 4:30PM - 6:00PM Room: S501ABC

IN LM

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

Participants
Olga R. Brook, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) To learn about strategies and initiatives for patient-centric radiology.

Sub-Events

RCC55A Leveraging Informatics Tools to Improve Patient Experience

Participants
Safwan Halabi, MD, Stanford, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

safwan.halabi@stanford.edu

LEARNING OBJECTIVES

1) Identify tools that can improve patient experience and satisfaction. 2) Discuss communication platforms including social media that can improve patient experience and satisfaction. 3) Discuss strengths, opportunities, weaknesses and threats to the physician-patient relationship.

ABSTRACT

As the health care industry moves towards value-based care, patient experience remains an untapped opportunity for increasing quality and value in patient care. Focusing on patient experience in imaging, a high volume area of health care, is critical to the success of a medical imaging group and healthcare system. One way of bridging the quality and value gap is to leverage digital tools that can help connect imaging experts to their referring providers and patients.

RCC55B Personal Health Portals: What Do Our Patients Want?

Participants
Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Royalties, Osler Institute

For information about this presentation, contact:

tessa.cook@uphs.upenn.edu

LEARNING OBJECTIVES

1) Describe the features that patients desire from their health portals and how those pertain to radiology examinations and results.

RCC55C Direct Patient Access to Radiologists: A Patient's Perspective

Participants
Dana Habers, MPH, Ann Arbor, MI (*Presenter*) Nothing to Disclose

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dhabers@umich.edu

LEARNING OBJECTIVES

1) Review a patient's perspective on direct access to the Radiologist & Radiology Reports. 2) Assess the impact of technology and patient portals on direct interaction between the Radiologist and patient. 3) Discuss whether this insight may modify practice style or systems in place in your own practice.

ABSTRACT

The interaction between patients and Radiologists is changing - as patients improve awareness of their conditions through online references, connect with others who have the same diagnosis through social media and other networking tools, or gain direct access to their own health records through online patient portals, the expectations of the level of interaction patients expect from their providers, Radiologists included, is evolving. In this session we will explore the patient's perspective - peeling apart patient

stories that lead us through the challenges and questions that arise from this phenomenon. We will explore it from both angles - the patient and the Radiologist - and land on a list of potential considerations for your own practice.

RCC55D Radiologists' Experience with Patient Interactions in the Era of Open Access of Patients to Radiology Reports

Participants
Olga R. Brook, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

obrook@bidmc.harvard.edu

LEARNING OBJECTIVES

1) Learn from a large tertiary center experience where radiology reports are available for patients review during last 15 years.

ABSTRACT

Most respondents (78.7% [74 of 94]) found interactions with patients to be a satisfying experience. More than half of radiologists (54.3% [51 of 94]) desired more opportunities for patient interaction, with no significant difference in the proportion of staff and trainee radiologists who desired more patient interaction (56.9% [29 of 51] versus 51.2% [22 of 43], P = .58). Only 4.2% of radiologists (4 of 94) found patient interactions to be detrimental to normal workflow, with 19.1% of radiologists (18 of 94) reporting having to spend more than 15 min per patient interaction.

RCC55E Disclosing Medical Errors to the Patients: How to Do It

Participants
Stephen D. Brown, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

stephen.brown@childrens.harvard.edu

LEARNING OBJECTIVES

1) Explain basic principles of talking to patients directly about errors. 2) Appraise how approaches to the conversation may vary according to circumstances.

ABSTRACT

Talking to patients openly and honestly about errors is among the most difficult, stressful and high-stakes conversations in medicine. Quality and safety experts, bioethicists, and risk managers increasingly agree that it is "the right thing to do." However, most radiologists (like most physicians) lack training in how to proceed when these conversations are necessary. Such conversations are thankfully rare, but this only compounds the difficulty in approaching them when the need arises. This session will consider some practical aspects and basic principles of talking to patients about errors in imaging and reporting. It will consider a spectrum of cases in which discussion with patients about errors may be appropriate and/or necessary, and offer suggestions on how to proceed.

RCC55F Cultural Responsivity: Caring for Diverse, Marginalized, and Vulnerable Patients in Radiology

Participants
Hannah Perry, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand which patient groups may be considered diverse, marginalized, and vulnerable. 2) Gain familiarity with the spectrum of knowledge necessary to provide respectful and effective care to diverse, marginalized, and vulnerable patient populations.