Centennial Showcase

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

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

PS10
Opening Session
Plenary Sessions

PS10A
Presentation of the Outstanding Educator Award
Paula J. Woodward MD (Presenter): President, Amirsys, Inc Recipient

PS10B
Presentation of the Outstanding Researcher Award
Theodore Steven Lawrence MD, PhD (Presenter): Consultant, MedImmune, Inc Consultant, ImClone Systems Incorporated Recipient

PS10C
The scientific and educational program of the 100th Scientific Assembly and Annual Meeting of the Radiological Society of North America is dedicated to all those who have gone before us--to those who have established and joined the RSNA, and helped our Society pursue its mission and realize its vision for the past 100 years
N. Reed Dunnick MD (Presenter): Nothing to Disclose

PS10D
President's Address: Reflect on the Past, Prepare for the Future
N. Reed Dunnick MD (Presenter): Nothing to Disclose , G. Scott Gazelle MD, PhD Consultant, General Electric Company Consultant, Marval Biosciences Inc

As the RSNA begins its Centennial Celebration, it is appropriate for us to not only reflect upon our past but also to look forward to how we want our field to evolve and how we will reach that goal. The RSNA was founded in 1915 as the Western Roentgen Society, only 20 years after Wilhelm Roentgen announced his discovery of the X-ray. As a result, the history of the RSNA and radiology are intertwined such that our Centennial is a celebration of medical imaging and image-guided therapy. We have seen enormous advances in medical imaging in the past 100 years. Throughout this period, diagnostic radiologists, radiation oncologists and medical physicists have led the way. Radiography and fluoroscopy have been refined and made safer. The newer cross-sectional imaging modalities - ultrasound, computed tomography and magnetic resonance imaging - have added tremendously to our ability to not only diagnose medical illness, but also to guide treatment, using external beam radiation, brachytherapy, percutaneous ablation or other interventional techniques. Many new radiotracers have been developed to evaluate patients at the cellular level and they are helping to unravel the mysteries of disease pathophysiology. It is hard to imagine what the next 100 years will bring, but for medical imaging to reach its full potential, imaging scientists must maintain our intellectual leadership. We must partner with industry to develop needed tools, and we must understand the clinical settings and the role imaging plays in directing effective and efficient patient care. Most importantly must keep the patient utmost in our minds to assure that our interventions lead to an improved quality of life. As radiology, the field of medicine, and the entire healthcare system become even more complex we will need to conduct more sophisticated research so that we can continue to innovate and apply our imaging and interventional tools to healthcare appropriately.
With these goals in mind, the RSNA Research and Education Foundation has awarded more than $3 million in each of the last two years to help investigators conduct imaging studies, especially the feasibility studies needed to support NIH grant applications. The NIH awarded $397 million in grants to principal investigators with primary appointment in departments of diagnostic radiology or radiation oncology. If we are to maintain the intellectual leadership in our field, we must foster a culture that values research and uses those resources to advance our field. "Our future is so bright, I gotta wear shades!"

**PS10E**

**Special Lecture: Exceptional Opportunities in Biomedical Research**

Francis S. Collins MD, PhD (Presenter): Nothing to Disclose, N. Reed Dunnick MD Nothing to Disclose

In this Special Lecture, the Director of the National Institutes of Health (NIH) will help celebrate the RSNA's centennial meeting by examining the exceptional opportunities that scientific and technological breakthroughs offer for biomedical research. With particular focus on NIH-supported imaging research, the talk will examine recent advances in fundamental knowledge about biology and highlight the ways in which that knowledge is serving to improve human health. Topics may include the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative; the Accelerating Medicines Partnership (AMP); and affordable technologies to extend imaging insights to low-resource settings. The lecturer will conclude with a discussion of future challenges, such as training the next generation of researchers; supporting the development of innovative research, programs, and partnerships; and encouraging broader appreciation and support for the biomedical research enterprise.

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**Hologic: Low-dose 3D Mammography for Breast Cancer Screening.**

**Vendor Workshops**

*Sun, Nov 30 10:15 AM - 11:45 AM  Location: Booth 1465*

**LEARNING OBJECTIVES**

Hologic is offering a series of 90 minute sessions that include a brief lecture by a leading breast radiologist providing their clinical perspective on the use of Hologic Low-dose 3D Mammography using C-View™ software. The lecture will be followed by hands-on experience reading 3D mammograms in combination with conventional and generated 2D images. The sessions are intended for radiologists interested in learning more about 3D mammography for screening and diagnosis. Please note the program will provide a certificate of completion that may be used towards the FDA mandated training for tomosynthesis. The course is not accredited for CME. Please visit [www.hologic.com/RSNAtoomo-courses](http://www.hologic.com/RSNAtoomo-courses) to register for this Vendor Workshop.

**Business Session**

**Miscellaneous**

*Sun, Nov 30 10:15 AM - 10:35 AM  Location: Arie Crown Theater*

**ABSTRACT**

According to Section 8.10 of the RSNA Bylaws, the Society shall hold at least one business meeting of the members of the Society in each calendar year. At the sessions of the business meeting on Sunday, November 30, and Tuesday, December 2, awards are announced; nominations and elections are held; and proposed amendments to the Bylaws are considered. A third session is scheduled on Thursday, December 4, if necessary.

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**Hologic: Essentials of 3D Mammography Self-Guided Training**

**Vendor Workshops**

*Sun, Nov 30 10:30 AM - 12:30 PM  Location: Booth 1465*

**LEARNING OBJECTIVES**

Hologic is offering a series of ongoing sessions to allow radiologists to participate in an online Hologic 3D Mammography interactive virtual training. Each session takes approximately 2 hours to complete, therefore the last session will commence no later than 3:00 p.m. each day. Participants will be provided a workstation with headphones to enhance their learning experience. The sessions will include a lecture by a leading breast radiologist and an interactive case review module. The sessions are intended for radiologists interested in learning more about 3D mammography for screening and diagnosis. Please note the program will provide a certificate of completion that may be used towards the FDA mandated training for tomosynthesis. The course is not accredited for CME. Please visit [www.hologic.com/RSNAtoomo-courses](http://www.hologic.com/RSNAtoomo-courses) to register for this Vendor Workshop.

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**SPMT11**

**Mock Jury Trial**

**Special Courses**

AMA PRA Category 1 Credits ™: 5.00
ARRT Category A+ Credits: 6.00

*Sun, Nov 30 10:30 AM - 3:30 PM  Location: S406A*
LEARNING OBJECTIVES

1) Learn the various components of a medical malpractice lawsuit trial that is conducted in front of a jury in a courtroom. 2) Understand the specific roles of the presiding judge, the attorney for the plaintiff, the attorney for the defendant, and the expert witnesses who testify that the defendant radiologist either complied with, or breached, the standard of medical care. 3) Become apprised of how a jury of lay persons evaluate and judge the testimony of the witnesses, and the arguments of the opposing attorneys, by observing and listening to the jurors’ deliberations. 4) Appreciate the dilemma faced by radiologists when observing an incidental finding which is observed on a radiologic exam obtained for unrelated reasons.

ABSTRACT

A mock trial will be held that focuses on an allegation of negligence against a radiologist who observed an incidental finding on an abdominal CT scan that was obtained for reasons unrelated to the finding. The radiologist evaluated the finding, and determined that it was an insignificant and clinically unimportant finding, and thus reported that the finding can be ignored by the referring physician. The finding was forgotten until 18 months later when it was determined that the incidental finding had in fact been an early carcinoma. By that time the patient was inoperable, and despite treatment, died 8 months later. The deceased patient’s family filed a malpractice lawsuit against the defendant-radiologist, alleging negligence because the radiologist had failed to raise the suspicion of malignancy and suggest additional studies. Attempts to settle the lawsuit out of court were unsuccessful, and thus the lawsuit was ready to be tried before a jury. Ordinarily such a trial would last one to two weeks, but because of time restraints, the trial will be conducted over a period of 3 hours. A real Judge who presides over malpractice trials in Chicago’s courtroom, and prominent plaintiff’s and defense attorneys, will conduct the trial, in an abbreviated fashion, as they would in a real trial. Two radiologist-expert witnesses will testify, one critical, and the other supportive, of the defendant radiologist. When the testimony is over, there will be a video and audio feed of the jury’s deliberations to the audience. Following the rendering of a verdict, an open discussion among the participants and the audience will be held.

SPOI11

Oncodiagnosis Panel: Breast Cancer

Special Courses

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

Sun, Nov 30 10:45 AM - 12:15 PM   Location: E353C

Sub-Events

SPOI11A Innovations in Breast Cancer Diagnosis and Targeting for Therapy

Ellen Bachman Mendelson MD (Presenter): Research support, Siemens AG Speakers Bureau, Siemens AG Medical Advisory Board, Quantason, LLC Consultant, Quantason, LLC

LEARNING OBJECTIVES

1) Learn how to sequence multimodality imaging and interventions to provide specific diagnoses and map disease extent as well assess responses to breast cancer therapies.

ABSTRACT

At the conclusion of this presentation, which will provide an update on state-of-the art breast imaging, attendees will learn how to sequence multimodality imaging and interventions to provide specific diagnoses and map disease extent as well assess responses to breast cancer therapies.

SPOI11B Changing Paradigms of Radiation Therapy in Breast Cancer, Maximizing Tumor Control and Minimizing Toxicity

Jean Lundberg Wright MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the principles of radiation therapy, including external and brachytherapy and various treatment fractionation and dose schedules. 2) Learn to apply specific imaging modalities and techniques for radiation therapy planning to maximize target coverage. 3) New techniques to reduce dose to normal tissue and novel radiation therapy modalities will be reviewed.

SPOI11C New Paradigms of Breast Cancer Surgery

Kelly K. Hunt MD (Presenter): Nothing to Disclose
LEARNING OBJECTIVES

1) Following this program, participants should have an understanding of the important controversial aspects of coordinated local treatment of breast cancer. 2) Participants will learn different approaches to nodal staging and management of the axilla in patients with positive lymph nodes. 3) They will obtain a better understanding of the pros and cons of neoadjuvant and adjuvant systemic therapies based on breast cancer subtypes.

SSA01

ISP: Breast Imaging (Ultrasound Screening)

Scientific Papers

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 10:45 AM - 12:15 PM Location: Arie Crown Theater

Participants

Moderator
Wendie A. Berg MD, PhD : Research Grant, Gamma Medica, Inc Research Grant, General Electric Company Equipment support, Gamma Medica, Inc Equipment support, General Electric Company
Moderator
Regina J. Hooley MD : Nothing to Disclose

Sub-Events

SSA01-01
Breast Imaging Keynote Speaker: State of the Art—Ultrasound for Breast Cancer Screening
Regina J. Hooley MD (Presenter): Nothing to Disclose

SSA01-03
The Connecticut Experiment Continues: Ultrasound in the Screening of Women with Dense Breasts Years 3 and 4
Jean M. Weigert MD (Presenter): Stockholder, Tractus Company Limited

PURPOSE
To determine if the addition of screening breast ultrasound in women with mammographically normal but dense breasts in the 3rd and 4th year since the legislation was enacted has continued to improve breast cancer detection while demonstrating an improvement in PPV.

METHOD AND MATERIALS
The study utilized a retrospective chart review. Data collected included: (1) total number of screening mammograms; (2) total number of dense breast screening ultrasounds; (3) screening ultrasound Breast Imaging Reporting Data System (BI-RADS) code results; (4) biopsy results; and (5) demographic data on women with malignant biopsies. Data was obtained from included sites throughout 2012 and 2013.

RESULTS
Data from 2 Connecticut radiology practices with 5 sites was collected. A total of 32230 screening mammograms and 4128 dense breast ultrasounds were performed in year 3 and 27937 screening mammograms and 3330 dense breast ultrasounds in year 4. In year 3, of the screening ultrasounds 148 were BI-RADS 4 or 5, and 13 were found to have a cancer on biopsy. In year 4, there were 52 BI-RADS 4 or 5 ultrasounds and 10 cancers. The rate of detection is 3.1/1000 in year 3 and 3.0/1000 in year 4. The positive predictive value increased from 8.1% in year 3 to 16.1% in year 4. Of the women eligible for the screening ultrasound, 32% and 30% requested the test respectively in years 3 and 4.

CONCLUSION
Based on the data collected from these sites, screening breast ultrasound in women with dense breast parenchyma continues to detect mammographically occult malignancy in years 3 and 4 at the same rate as year 1 and 2. The rate of detection remains stable at 3.0/1000. However, the PPV increased in year 4 indicating that the selection of lesions biopsied was more accurate with fewer false positives. Of concern, the number of eligible women who elect to have the additional test remains low at about 30% which is due to several factors including education and cost.

CLINICAL RELEVANCE/APPLICATION
Adding screening breast ultrasound in patients with mammographically dense breasts continues to diagnose a significant number of additional cancers in the 3rd and 4th year since the legislation was enacted and the PPV has also improved.

SSA01-04
Impact of Breast Density Notification Law in the Detection of Breast Cancer: Initial 15 Months Experience
Islamiat O. Ego-Osuala MD (Presenter): Nothing to Disclose, Kristin Elias MD : Nothing to Disclose, Sara Daniel Shaylor MD : Nothing to Disclose, Marissa Lauren Albert MD, MSc : Nothing to Disclose, Hildegard B. Toth MD : Nothing to Disclose, Linda Moy MD : Nothing to Disclose
PURPOSE

To determine the utilization and role of adjunct ultrasound (US) screening examination with the implementation of the breast density notification law.

METHOD AND MATERIALS

IRB approved retrospective review of women who underwent a hand held high resolution whole breast US exam performed by one of 11 experienced breast US technologists from Jan 1, 2013 to March 31, 2014. Screening mammogram and US exams were performed at a large academic center and two satellite private practices and evaluated by 1 of 16 breast imaging radiologists. The findings of the screening mammograms were known by the sonographer before the US exam was performed. Repeat scanning for lesions identified by the technologists was performed by the radiologists. The follow up rate, biopsy rates and added cancer detection rates were determined.

RESULTS

A total of 42,341 screening mammograms were performed in 36,523 women. Breast density was predominantly fatty in 3980 (9.4%), scattered fibroglandular tissue in 17,106 (40.4%), heterogeneously dense in 17,910 (42.3%) and extremely dense in 3345 (7.9%). Of 3044 women who underwent 3167 screening US exam, 2253 (74%) of women had dense breasts and 1857 (61%) had average risk for breast cancer. Screening US exam was performed within 1 month of the screening mammogram in 80.5% of the cases and 19.0% between 4-6 months from the mammogram. Of 3,167 US exams, 2614/3167 (82.5%) US exams were assessed as BIRADS 1 or 2, 276 (8.7%) as BIRADS 3, 277 (8.7%) as BIRADS 4 or 5. 18 biopsies were cancelled because the lesion was no longer seen or reassessed as benign. Biopsy was performed in 259 lesions, yielding 249 (96.1%) benign results, 5 high-risk lesions and 5 malignancies. Of 249 benign lesions, 109 (43.8%) were complex cyst and 59 (23.7%) were fibrocystic change. Of 10 lesions that underwent surgical excision, 6 were malignancies, 3 IDCs and 3 DCIS, yielding a PPV of 2.32%. 4 of 6 cancers were less than 1cm. 4 of 6 cancers were detected in women with abnormal mammographic finding. Screening US led to an additional cancer yield of 2/ 3167 (0.06%).

CONCLUSION

Supplemental whole breast US detects mammographically occult cancers, although our rate is much lower than previous studies.

CLINICAL RELEVANCE/APPLICATION

The low PPV of screening US in our study where most women had dense breast tissue and were average risk suggests further studies are necessary to identify the women who may benefit from the exam.

SSA01-05

Whole Breast US after Screening Breast Tomosynthesis: Initial Experience

Vera Lucia Nunes Aguillar MD (Presenter): Nothing to Disclose , Vera Christina Camargo de Siqueira Ferreira MD : Nothing to Disclose , Erica Endo MD : Nothing to Disclose , Carla Basso Dequi MD : Nothing to Disclose , Daniela Gregolin Giannotti MD : Nothing to Disclose , Giovanni Guido Cerri MD, PhD : Nothing to Disclose

PURPOSE

to determine performance of whole breast ultrasonography (US) in women who underwent additional breast US during the first year of implementation of breast tomosynthesis (digital mammography - DM - plus tomosynthesis (BT), in a screening population

METHOD AND MATERIALS

Prospective study, including 1034 consecutive women, age 35-85 year-old, who underwent screening tomosynthesis for the first time: 2 views DM + 2 views BT of each breast, with sequential reading and consensus arbitration and, subsequently, had physician performed handheld whole breast US, from September/2011 through August/2012.

RESULTS

Twenty - six cases were classified as BI-RADS category 4 or 5 by screening BT and 24 were submitted to biopsy with 12 cancers found (4 DCIS and 8 invasive). In subsequent screening US, 09 lesions were classified as BIRADS category 4, all submitted to FNA of biopsy and one cancer was found: lobular invasive carcinoma, HG1, NH 1 , 6 mm, LS negative. Of 13 cancers detected in this screening population, with BT and additional US, 12 could be seen by tomosynthesis (4 DCIS and 8 invasive), while only 7 were detected by US (all invasive). Cancer detection rate was 1,16% (12/1034) with breast tomosynthesis and increased to 1,26% (13/1034), with additional US. Adding US to BT increase the number of biopsies from 26 to 35. PPV3 for US only lesion detection was 1,1 (1/9) compared to 50% for lesions detected by tomosynthesis

CONCLUSION

Adding physician-performed handheld US to breast tomosynthesis had a little impact in cancer detection rate and a low overall PPV. Further clinical studies are needed with a large number of women, especially with dense breasts.

CLINICAL RELEVANCE/APPLICATION

Screening breast ultrasound
SSA01-06  Digital Breast Tomosynthesis (DBT) and Breast Ultrasound (US): Additional Roles in Dense Breasts with Category 0 at Conventional Digital Mammography (DM)

Jin Chung MD (Presenter): Nothing to Disclose, Eun-Suk Cha MD: Nothing to Disclose, Jee Eun Lee MD: Nothing to Disclose, Jeoung Hyun Kim: Nothing to Disclose, Bo Bae Lee: Nothing to Disclose

PURPOSE
To compare the diagnostic performance of DBT and US for the dense breasts with category 0 at conventional DM.

METHOD AND MATERIALS
From December 2012 to March 2013, DBT, breast US and DM were performed in 202 patients. Among them, 156 patients were dense breasts (ACR pattern 3 and 4) and 108 lesions of 108 patients were categorized as BI-RADS 0 (asymmetry, 84; calcifications, 6; asymmetry with calcifications, 18). BI-RADS final assessment for DBT and US were recorded. BI-RADS category 1-3 was considered benign, and BI-RADS category 4 and 5 were considered malignant. Sixty-two lesions underwent biopsy or surgical excision and others had at least 1 year of follow-up data.

RESULTS
Among 108 lesions, 17 (15.7%) were malignant and 91 (84.3%) were benign. Final assessments of US were categorized as follows: category 1 in 5, category 2 in 6, category 3 in 38, category 4a in 34, category 4b in 12, category 4c in 1 and category 5 in 12. For DBT, final assessments were categorized as follows: category 1 in 34, category 2 in 16, category 3 in 24, category 4a in 13, category 4b in 4, category 4c in 3, category 5 in 14. The sensitivity and negative predictive value were 100% for both US and DBT. For US, specificity and positive predictive value were 53.9 and 28.8%. For DBT, specificity and positive predictive value were 81.3 and 50%. Diagnostic accuracy of US and DBT were 61.1 and 84.3%. Benign biopsy rate of DBT (50%, 17/34) was lower than that of US (71.2%, 42/59).

CONCLUSION
For dense breasts, DBT showed better diagnostic performance than breast US. DBT may reduce the benign biopsy rate and short term follow-up.

CLINICAL RELEVANCE/APPLICATION
DBT is a beneficial method for dense breasts on DM, with reducing unnecessary breast biopsy and short-term follow-up.

SSA01-07  Comparison of Breast Digital Tomosynthesis and Full-field Digital Mammography: Ultrasonography Detected Breast Cancer

Kyung Jin Nam MD (Presenter): Nothing to Disclose, Boo-Kyung Han MD, PhD: Nothing to Disclose, Eun Sook Ko MD: Nothing to Disclose, Ji Soo Choi MD, PhD: Nothing to Disclose

PURPOSE
To compare the diagnostic performance of digital breast tomosynthesis (DBT) with that of conventional full-field digital mammography (FFDM) in a population of screening US-detected breast cancers.

METHOD AND MATERIALS
From January 2013 to June 2013, 865 women underwent both conventional FFDM and DBT imaging. Among them, 84 patients were classified as having screening US-detected cancers, which were initially detected by screening US in asymptomatic patients with negatively interpreted mammography. The cases with retrospectively seen, overt mammographic findings or incomplete datasets were excluded (n = 43). In the rest 41 women with US-detected mammographically occult cancers (hereafter, UDMOCs), three radiologists independently described the lesion type and location of the most actionable findings in both FFDM and DBT with 4-week interval, without knowledge of US findings. The lesion type was divided into: negative, mass, asymmetry, focal asymmetry, calcifications only, single view mass and mass with calcifications. The visibility score from 0 to 2 was given to each case.

RESULTS
Diagnostic performance when sum of visibility scores of three radiologists was equal to or more than score 4 was significantly different between DBT and FFDM (53.6% vs. 26.8%, P=0.013). Among 41 cases, all three readers detected cancers in 11 cases with DBT and 1 case with FFDM and no reader detected cancers in 6 cases with DBT and 16 cases with FFDM. We found significant difference of diagnostic performance between DBT and FFDM in aspect of the individual visibility in two of three radiologists (63.4% vs. 31.7% for reader 1, p=0.008; 43.9% vs. 9.7% for reader 3, p =0.001). The dominant lesion type was “mass” on DBT (50%) and “focal asymmetry” on FFDM (57.1%).

CONCLUSION
This study has demonstrated improved diagnostic performance of DBT compared to FFDM in patients with UDMOCs and increased accuracy for mass characterization of DBT compared to FFDM.

CLINICAL RELEVANCE/APPLICATION
When DBT is added to FFDM, cancer detection and mass characterization could be improved in the interpretation of mammographic abnormalities in women with mammographically occult breast cancer.
**CONCLUSION**

HHUS lesions not seen on AUS were found retrospectively on transverse but not coronal view. BI-RADS 2 and AUS 4, oval masses <8mm had indistinct margins on the coronal and transverse views. Most many 4's had hypoechoic shadowing artifacts seen on one AUS view, often the lateral. Where HHUS was mismatch resulted in cancer diagnosis. All lesions biopsied were benign. For BI-RADS HHUS 0/1 and AUS 4, HHUS and 4 on AUS in 16/87(18%); and 4 on HHUS with 0,1, or 2 on AUS in 26/87(30%). No BI-RADS Mismatches were HHUS 0 (not seen) or 1 (negative) and AUS 4 (suspicious) in 29/87(33%); BI-RADS 2 on HHUS and 4 on AUS in 16/87(18%); and 4 on HHUS with 0,1, or 2 on AUS in 26/87(30%). No BI-RADS mismatch resulted in cancer diagnosis. 87/505(17%) had different HHUS and AUS lesion BI-RADS. Age range: 19-92y. 505 pts. had 745 lesions. Of the 230 prior US images, 32% (74 of 230) had visible findings (mean size on US, 0.8cm; range, 0.2-2.5 cm) correlated with subsequent cancers and 68% (156 of 230) did not. No differences were found in mammographic density (P=0.966) or background echotexture between visible and non-visible cases (P=0.229). Of the 74 visible findings, reasons for missed diagnoses were misinterpretation (41%, 30/74), benign appearance (30%, 22/74), small lesion size <5mm (9%, 7/74), multiple distracting lesions (8%, 6/74), stability >24 months (7%, 5/74), or missed core biopsy (5%, 4/74). Fifty-three percent (39/74) of them were classified as actionable and 47% (35/74) as underthreshold. Actionable findings showed more irregular shape (P <0.001); non-circumscribed margin (P=0.004), non-parallel orientation (P =0.046), and larger lesion size (P =0.049) than underthreshold findings.

**RESULTS**

Breast cancer findings on prior screening US are mainly missed due to misinterpretation (41%), benign appearance (30%), small size <5mm (9%), or multiple distracting lesions (8%).

**CLINICAL RELEVANCE/APPLICATION**

To avoid missing early cancers on screening breast US, close attention should be paid to subtle suspicious findings as well as separate assessment of multiple findings.

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**METHOD AND MATERIALS**

Between 2003 and 2011, 230 pairs of US examinations including prior images with negative or benign findings and subsequent images with developed cancers (mean interval, 11.2 months; range, 2-24 months) were found. Mean size of detected cancers was 2.3 cm (range, 0.1 - 8.2 cm) for invasive cancers (n=182) and 2.4 cm (range, 0.3 - 7 cm) for DCIS (n=48). Mammographic density, background echotexture, lesion visibility, features on prior US, and reasons for missed diagnoses as well as their actionability were classified by two experienced radiologists in consensus. Differences between visible versus non-visible cases and actionable versus underthreshold findings were compared.

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**RESULTS**

Of the 230 prior US images, 32% (74 of 230) had visible findings (mean size on US, 0.8cm; range, 0.2-2.5 cm) correlated with subsequent cancers and 68% (156 of 230) did not. No differences were found in mammographic density (P=0.966) or background echotexture between visible and non-visible cases (P=0.229). Of the 74 visible findings, reasons for missed diagnoses were misinterpretation (41%, 30/74), benign appearance (30%, 22/74), small lesion size <5mm (9%, 7/74), multiple distracting lesions (8%, 6/74), stability >24 months (7%, 5/74), or missed core biopsy (5%, 4/74). Fifty-three percent (39/74) of them were classified as actionable and 47% (35/74) as underthreshold. Actionable findings showed more irregular shape (P <0.001); non-circumscribed margin (P=0.004), non-parallel orientation (P =0.046), and larger lesion size (P =0.049) than underthreshold findings.

**CONCLUSION**

Breast cancer findings on prior screening US are mainly missed due to misinterpretation (41%), benign appearance (30%), small size <5mm (9%), or multiple distracting lesions (8%).

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**BI-RADS Differences in Lesion Assessment between Handheld Physician-Performed Whole Breast Ultrasound (HHUS) and Supine Automated Ultrasound (AUS)**

**PURPOSE**

To retrospectively investigate the presumptive reasons for a missed diagnosis on prior screening ultrasonography (US) examinations in women subsequently diagnosed with breast cancers.

**METHOD AND MATERIALS**

From 4/2012 to 2/2014, 505 pts. referred for breast US exams at 2 sites participated in this IRB-approved, HIPAA-compliant prospective study. Physicians performed HHUS with a 18-6 MHz linear transducer using ACRIN 6666 documentation & assigning BI-RADS per lesion of 2 to 6, 1 (normal), or 0 (not seen) when HHUS and AUS were compared. For AUS, a sonographer positioned a wide 14-5MHz transducer for AP, lateral, and medial views. Transverse, coronal, and sagittal views were reviewed at a workstation by a 2nd breast imager blinded to HHUS. AUS and HHUS exams were integrated with clinical, mammography & MRI data. Where AUS and HHUS BI-RADS were different, clinical significance was determined and explanation sought.

**RESULTS**

Age range: 19-92y. 505 pts. had 745 lesions. 87/505(17 %) had different HHUS and AUS lesion BI-RADS. Mismatches were HHUS 0 (not seen) or 1 (negative) and AUS 4 (suspicious) in 29/87(33%); BI-RADS 2 on HHUS and 4 on AUS in 16/87(18%); and 4 on HHUS with 0,1, or 2 on AUS in 26/87(30%). No BI-RADS mismatch resulted in cancer diagnosis. All lesions biopsied were benign. For BI-RADS HHUS 0/1 and AUS 4, many 4's had hypoechoic shadowing artifacts seen on one AUS view, often the lateral. Where HHUS was BI-RADS 2 and AUS 4, oval masses <8mm had indistinct margins on the coronal and transverse views. Most HHUS lesions not seen on AUS were found retrospectively on transverse but not coronal view.
HHUS and AUS lesion BI-RADS assessments differed in 18%, but no cancers were miscast as benign. For AUS success in breast imaging workflow, interpreters may benefit from knowing the AUS appearance of artifacts as well as lesions studied with HHUS.

**CLINICAL RELEVANCE/APPLICATION**

With concern for masking of cancers by dense breast tissue on mammography, a supine automated breast US scanner has been approved by the FDA for supplemental screening, only one of many indications for breast ultrasound. With experience in the similarities and differences between small FOV HHUS and AUS, automated scanners can be useful for diagnostic applications such as detection and follow-up of multiple benign-appearing masses.

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**SSA02**

**Cardiac (Anatomy and Function)**

*Scientific Papers*

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**Sun, Nov 30 10:45 AM - 12:15 PM  Location: S502AB**

**Participants**

**Moderator**
- Seth Jay Kligerman MD: Author, Reed Elsevier
- Jill E. Jacobs MD: Nothing to Disclose
- Leena Mammen MD: Nothing to Disclose

**Sub-Events**

**SSA02-01**

*A Comparative Study of Methods for Cardiac Ventricular Volume Estimation*

Xiantong Zhen PhD (Presenter): Nothing to Disclose, Zhijie Wang: Nothing to Disclose, Ali Islam MD: Nothing to Disclose, Mousumi Bhaduri MD: Nothing to Disclose, Ian Chan MD: Nothing to Disclose, Shuo Li PhD: Employee, General Electric Company

**PURPOSE**

Accurate and automatic estimation of cardiac ventricular volumes, e.g., left ventricle (LV) and right ventricle (RV), is of great significance for clinical assessment of cardiac functions. Existing estimation methods can be categorized into conventional contouring-based methods and emerging direct estimation without contouring. This study comparatively investigates representative methods from each category to find out the more suitable one for cardiac ventricular volume estimation in clinical use.

**METHOD AND MATERIALS**

3360 2D short-axis cine MR images from 56 clinical subjects were used. Each contains 20 frames in a cardiac cycle. These images were acquired on a 1.5T scanner with fast imaging employing steady-state acquisition (FIESTA) image sequence mode, using these acquisition parameters: TR=2.98 ms, TE=1.2 ms, flip angle=30 degrees, and slice thickness=10 mm. We investigate two categories of methods: contouring-based methods including level set (LS) and graph cut (GC) and direct estimation methods without contouring including Bayesian estimation (BE) and descriptor learning (DL). The performance is evaluated by estimation error of ejection fraction (EF), i.e., absolute difference between those obtained from evaluated methods and manual contouring by human experts.

**RESULTS**

For LV, direct methods produce estimation errors of 0.037 (BE) and 0.085 (DL), and contouring-based methods yield estimation errors of 0.110 (LS) and 0.097 (GC). For RV, contouring-based methods fail to do estimation due to the geometrical complexity of RV, and direct methods can estimate for bi-ventricles, i.e., LV and RV, simultaneously with impressive results of 0.049 (BE) and 0.110 (DL) for RV. Direct estimation methods outperform contouring-based methods in terms of estimation errors and yield comparable performance with baselines (i.e., inter-observer variability) which are 0.012 and 0.018 for LV and RV, respectively.

**CONCLUSION**

Direct estimation methods provide more accurate estimation of cardiac ventricular volumes than contouring-based methods. Moreover, they are flexible to be used for either individual or joint volume estimation of LV and RV, while contouring based methods can only apply to a single ventricle.

**CLINICAL RELEVANCE/APPLICATION**

Direct estimation methods have emerged as a convenient and mature clinical tool for cardiac volume estimation which enable diagnosis of cardiac diseases to be conducted in a more efficient and reliable way.
**SSA02-03**

**Hepatic Triglyceride Content is Associated with Left Ventricular Diastolic Dysfunction in Overweight and Obese Individuals: The NEO Study**

Ralph L. Widya MD (Presenter): Nothing to Disclose, Renee De Mutsert : Nothing to Disclose, Martin den Heijer : Nothing to Disclose, Saskia le Cessie PhD : Nothing to Disclose, Frits R. Rosendaal MD : Nothing to Disclose, Wouter J. Jukema MD : Research Grant, Astellas Group Research Grant, AstraZeneca PLC Research Grant, B I O T R O N I K G m b H & Co KG Research Grant, Boston Scientific Corporation Research Grant, DAIICHI SANKYO Group Research Grant, Eli Lilly and Company Research Grant, sanofi-aventis Group Research Grant, Medtronic, Inc Research Grant, Merck & Co, Inc Research Grant, Pfizer Inc Research Grant, OrbusNeich Research Grant, Novartis AG Research Grant, F. Hoffmann-La Roche Ltd Research Grant, SERVIER Research Grant, The Medicine Company Speaker, Astellas Group Speaker, AstraZeneca PLC Speaker, B I O T R O N I K G m b H & Co KG Speaker, Boston Scientific Corporation Speaker, DAIICHI SANKYO Group Speaker, Eli Lilly and Company Speaker, sanofi-aventis Group Speaker, Medtronic, Inc Speaker, Merck & Co, Inc Speaker, Pfizer Inc Speaker, OrbusNeich Speaker, Novartis AG Speaker, F. Hoffmann-La Roche Ltd Speaker, SERVIER Speaker, The Medicines Company, Jan W. A. Smit MD, PhD : Nothing to Disclose, Albert De Roos MD : Nothing to Disclose, Hildø J. Lamb MD, PhD : Nothing to Disclose

**PURPOSE**

To investigate the relationship between nonalcoholic fatty liver disease (NAFLD) and left ventricular (LV) diastolic function, and to what extent this association was explained by the metabolic syndrome.

**METHOD AND MATERIALS**

MR spectroscopy and imaging were performed to measure hepatic triglyceride content and LV diastolic heart function (E/A). Linear regression analyses were performed to study their association while adjusting for age, sex, heart rate, alcohol consumption, pack years of smoking, all components of the metabolic syndrome, abdominal visceral adipose tissue (VAT), body fat, and stratified by BMI < or ≥27 kg/m².

**RESULTS**

In 747 participants aged 45-65 years, median (interquartile range) hepatic triglyceride content was 2.55 (1.30-6.06)%%. A 10-fold increase in hepatic triglyceride content decreased mean E/A with -0.191 (95%CI: -0.268, -0.115) in participants with a BMI ≥27 kg/m², but not in participants with a BMI<27 kg/m² (β -0.065, 95%CI: -0.256, 0.125). After adjustments for components of the metabolic syndrome, VAT and body fat this association slightly attenuated (β-0.094, 95%CI: -0.164, -0.023).

**CONCLUSION**

Hepatic triglyceride content was associated with LV diastolic dysfunction in participants with a BMI ≥27 kg/m² while adjusting for confounding factors including the components of the metabolic syndrome and VAT. These observations suggest that NAFLD may pose an independent risk of myocardial dysfunction above and beyond known cardiovascular risk factors which are clustered within the metabolic syndrome.

**CLINICAL RELEVANCE/APPLICATION**

Our finding that nonalcoholic fatty liver disease is associated with diastolic heart function may be of importance for the understanding of the development of cardiovascular disease in the growing obesity epidemic.

**SSA02-02**

**Left Atrial Appendage Morphology Differs in Patients with Suspected Cardiogenic Stroke without Chronic Atrial Fibrillation**

Miika Korhonen BMBS, MSc (Presenter): Nothing to Disclose, Antti Tapani Muuronen BMEdSc : Nothing to Disclose, Mika Haataja MD : Nothing to Disclose, Otso Arponen : Nothing to Disclose, Marja Hedman : Nothing to Disclose, Pekka Jakala : Nothing to Disclose, Petri J. Sipola MD : Nothing to Disclose, Pirjo Mustonen : Nothing to Disclose, Ritva Liisa Vanninen MD : Nothing to Disclose, Mikko Tapani Taina : Nothing to Disclose

**PURPOSE**

Left atrial appendage (LAA) is the most typical origin for intracardiac thrombus formation when associated with atrial fibrillation (AF). There is controversy whether LAA morphology associates with increased stroke/TIA risk and, if it does, which morphological type increases the risk most. We used cardiac computed tomography (cCT) to examine LAA morphology and volume in suspected cardiogenic stroke/TIA patients without persistent AF.

**METHOD AND MATERIALS**

The prospective study included 111 patients (74 males; mean age, 60 years) with suspected cardioembolic stroke/TIA without AF and 40 (21 males; mean age, 54 years) age and gender matched healthy control subjects. LAA volumes were quantified. Three observers in consensus classified LAAs into four morphology types (Cactus; ChickenWing; WindSock; CauliFlower) modified with a quantitative qualifier.

**RESULTS**

The proportions of LAA morphology types Cactus, ChickenWing, WindSock and CauliFlower were 5.0%, 37.5%, 35.0% and 22.5% in age and gender matched stroke/TIA patients and 20.0%, 10.0%, 67.5%, and 2.5% in controls, respectively. Distribution of morphology types differed significantly (P<0.01). Stroke patients also had decreased number of LAA lobes (P<0.01). In the whole stroke/TIA population the proportions of LAA morphology types Cactus, ChickenWing, WindSock and CauliFlower were 9.0%, 23.4%, 47.7%, and 19.8%.
Patients with WindSock morphology had larger LAAs (P<0.01) and over half of patients with WindSock morphology had an enlarged LAA of >5.6 mL/m2.

CONCLUSION

LAA morphology differed significantly between stroke/TIA patients and healthy control subjects. ChickenWing LAA and fewer lobes were more common in stroke/TIA patients without chronic AF.

CLINICAL RELEVANCE/APPLICATION

LAA morphologies associating with elevated stroke risk may suggest existence of paroxysmal atrial fibrillation and thus help targeting prolonged rhythm monitoring.

SSA02-04

Left Ventricular Strain Gradient Is Abnormal in Hypertrophic Cardiomyopathy: Assessment by CMR Feature Tracking

Davis M. Vigneault BS (Presenter): Nothing to Disclose, Eunice Yang MD: Nothing to Disclose, Linda Chi Hang Chu MD: Nothing to Disclose, Carolyn Ho: Nothing to Disclose, David A. Bluemke MD, PhD: Research support, Siemens AG

PURPOSE

Circumferential strain (ε_{cc}) increases from epicardium to endocardium in normal patients. However, evaluation of strain at the myocardial surfaces is difficult with tagged CMR, which is better suited to midwall strain analysis. CMR feature tracking is a novel technique which directly tracks motion at the myocardial borders. The purpose of this study was to test the feasibility of using feature tracking to evaluate circumferential transmural strain gradient (cTSG, the difference endocardial and epicardial ε_{cc}) in patients with hypertrophic cardiomyopathy (HCM).

METHOD AND MATERIALS

Subjects with a clinical diagnosis of overt HCM and their family members were invited to participate in this multi-center, prospective, cross-sectional study. Genetic testing was performed, and left ventricular hypertrophy (LVH) was assessed by echocardiography or CMR. Patients were categorized as control (mutation-/LVH-, n=30), preclinical (mutation+/LVH-, n=37), or overt (mutation+/LVH+, n=48) HCM. Mid ventricular short axis cine images were analyzed at using Multimodality Tissue Tracking software (MTT Version 6.0.4725, Toshiba Medical Systems Corporation, Tokyo, Japan).

RESULTS

Global endocardial ε_{cc} was significantly increased in overt patients (-29.8% ± 6.6%) relative to preclinical (-26.6% ± 4.8%, p = 0.011) and control (-24.6% ± 4.3%, p < 0.0001). Global epicardial ε_{cc} showed a decreasing trend from control to preclinical to overt, cTSG increased significantly from control (-13.7% ± 3.6%) to preclinical (-17.0% ± 4.0%) to overt (-19.2% ± 7.8%, p < 0.01). Significant differences were observed between preclinical and control in the septum (p < 0.01), overt and preclinical anteriorly (p < 0.001), and overt and control in all segments (p < 0.0001).

CONCLUSION

CMR feature tracking is feasible in HCM, and detected an increased strain gradient between the endocardial and epicardial surfaces.

CLINICAL RELEVANCE/APPLICATION

Patients with gene positive HCM but without wall thickening (LVH-) may have subtle abnormalities in myocardial strain in early disease detected by CMR feature tracking, relative to control and overt HCM patients.

SSA02-05

Semi-automatic Cardiac Longitudinal Strain Analysis Using Four-chamber Cine MR Imaging: Correlation with Left Ventricular Dysfunction

Masateru Kawakubo RT (Presenter): Nothing to Disclose, Michinobu Nagao MD: Research Grant, Bayer AG Research Grant, Koninklijke Philips NV, Seiji Kumazawa PhD: Nothing to Disclose, Masato Yonezawa: Nothing to Disclose, Yuzo Yamasaki MD: Nothing to Disclose, Hiroshi Honda MD: Nothing to Disclose, Akiko Suyama Chishaki MD: Nothing to Disclose, Yasuhiro Nakamura RT: Nothing to Disclose, Junji Morishita PhD: Nothing to Disclose

PURPOSE

Assessment of ventricular function with cardiac magnetic resonance (MR) imaging requires ventricular volumetry for a cardiac cycle. To reduce the time and effort, we developed a semi-automatic method that can detect the biventricular margin for four-chamber (4CH) cine MR imaging, and we performed longitudinal strain (ε) analysis to predict left ventricular (LV) dysfunction.

METHOD AND MATERIALS

In 20 patients with heart failure [mean age, 55 years; mean LV ejection fraction (LVEF), 39%], 4CH cine images were obtained using a 3-Tesla MR system. The ε_L was defined as the percentage of the longitudinal length at end-diastole with respect to the difference between the longitudinal length at each phase and end-diastole on 4CH cine images. The LV and right ventricular (RV) ε values were calculated semi-automatically (ε\_L\_auto) and manually (ε\_L\_manu) for a cardiac cycle. The correlation between ε\_L\_auto and ε\_L\_manu between minimum ε\_L\_auto and LVEF were analyzed using Pearson correlation coefficients. The ε\_L\_auto values were
compared by the Wilcoxon rank-sum test between patients with LVEF > 40% (n = 10) and LVEF ≤ 40% (n = 10). Receiver operating characteristic (ROC) analysis was performed to determine the optimal cutoff of the minimum $\varepsilon_{L\_auto}$ for detection of patients with LVEF ≤ 40%.

RESULTS

Excellent correlations were observed between $\varepsilon_{L\_auto}$ and $\varepsilon_{L\_manu}$ (Pearson r = 0.85, 0.92 for LV, RV; p < 0.0001). Significant negative correlations between the minimum $\varepsilon_{L\_auto}$ and LVEF were observed (Pearson r = -0.75, -0.89 for LV, RV; p < 0.0001). Significant differences were found in the $\varepsilon_{L\_auto}$ between two patient groups (LV: -15.8 ± 3.0 vs. -7.2 ± 3.2%, RV: -31.9 ± 5.5 vs. -15.0 ± 3.8%; p < 0.0001). ROC analysis revealed the optimal cutoff for identifying patients with LVEF ≤ 40% (LV $\varepsilon_{L\_auto}$ = -12.0%; area under the curve, 0.96; sensitivity, 100%; specificity, 90%; RV $\varepsilon_{L\_auto}$ = -24.0%; area under the curve, 1.00; sensitivity and specificity, 100%).

CONCLUSION

The $\varepsilon_{L}$ from our semi-automated method showed excellent agreement with that from the manual tracing and significantly correlated with LVEF. Our method predicted LV dysfunction with simple and easy measurements.

CLINICAL RELEVANCE/APPLICATION

Our proposed semi-automatic method is easy and accurate for longitudinal strain analysis, and it enables the prediction of LV dysfunction by using only one slice of 4CH cine MR imaging.

SSA02-06

Comparison of End-diastolic versus End-systolic Cardiac-computed Tomography Reconstruction Interval in Patients prior PVI

Wieland Staab MD (Presenter): Nothing to Disclose, Jan Martin Sohns MD: Nothing to Disclose, Martin Fasshauer MD: Nothing to Disclose, Christian Sohns: Nothing to Disclose, Christina Unterberg-Buchwald: Nothing to Disclose, Joachim Lotz MD: Research Cooperation, Siemens AG

PURPOSE

Using a split-bolus single phase cardiac-CT angiography (CCTA) in patients prior PVI, CT Datasets were evaluated in left ventricular end-systolic (LVES) (39±4 % RR-interval) and left ventricular end-diastolic (LVED) (77±5 % RR-interval) cardiac cycle. Aim of the study was to investigate diagnostic accuracy of CCTA between cardiac cycles, intra/-interobserver variability’s as well as comparing acquired volumetric and diametric datasets.

METHOD AND MATERIALS

182 consecutive Patients with drug refractory AF scheduled for PVI (62.6 % male, mean age 64.1±10.2 years) underwent routine pre-procedural evaluation including TEE and CCTA for evaluation of LA/LAA anatomy and thrombus formation. Here, qualitative and quantitative analysis (using LA/LAA ratio) was performed. Volumetric measurements in LVES and LVED were carried out according to the Simpson’s method. Intra- and interobserver variability was observed in all acquired datasets and both reconstruction intervals.

RESULTS

14 out of 182 patients (7.7%) showed filling defects of the LAA in CCTA. End-systolic volumes (LA/LAA) measured in 30 patients without filling defects and all 14 with filling defects were significantly larger ( p < 0.01) than in end-diastolic phase. Patients with filling defects showed significantly larger LA volumes than in patients without ( 193.07 ± 9.77 ml/m² vs 171.87 ± 26.85 ml/m² ; p< 0.01). Qualitative analysis was inferior to quantitative analysis using LA/LAA Ratio (< 0.5; accuracy : 100%,88%,100%,99% vs 100%). Intra/-interobserver variability was lower in end-systolic vs end-diastolic reconstruction interval ( = 0.942 vs 0.891).

CONCLUSION

For evaluating CCTA datasets in patients prior PVI, the LVES (39±4 % RR-interval) reconstruction interval is recommended due to significantly larger LA/LAA volumes and lower intra/-interobserver variability’s.

CLINICAL RELEVANCE/APPLICATION

The LVES interval is recommended for reconstructing CCTA Datasets in patients referred for pulmonary vein intervention due to significantly larger LA/LAA diameters / volumes (p< 0.01) and lower intra/-interobserver variability’s.

SSA02-07

Right Ventricular Strain Abnormalities in Arrhythmogenic Right Ventricular Cardiomyopathy: Analysis of CMR by Feature Tracking

Davis M. Vigneault BS (Presenter): Nothing to Disclose, Anneline S. J. M. Te Riele MD: Nothing to Disclose, Cynthia James PhD: Nothing to Disclose, Stefan L. Zimmerman MD: Nothing to Disclose, Hugh Calkins: Nothing to Disclose, Harikrishna Tandri: Nothing to Disclose, David A. Bluemke MD, PhD: Research support, Siemens AG

PURPOSE

Arrhythmogenic right ventricular cardiomyopathy (ARVC) is an inherited cardiomyopathy characterized by regional wall motion abnormalities of the right ventricle (RV) that are often subtle and difficult to quantify. RV Myocardial strain is poorly assessed with tagged cardiac magnetic resonance (CMR) due to the thin RV wall. We sought to determine the feasibility of RV myocardial strain analysis in ARVC patients using a novel feature tracking method.
**METHOD AND MATERIALS**

Patients with suspected ARVC and control subjects underwent horizontal long axis (HLA) and short axis (SA) cine imaging using SSFP sequences. In the HLA view, the RV was divided into subtricuspid (ST), anterior wall (AW), and apical (Ap) regions. In the SA view, the RV was divided into outflow tract (OT), free wall (FW), angle (Ang), and inferior (Inf) regions. Each region was analyzed to determine peak longitudinal and circumferential strain and strain-rate using Multimodality Tissue Tracking (MTT) software (MTT Version 6.0.4725, Toshiba Medical Systems Corporation, Tokyo, Japan).

**RESULTS**

58 subjects (19 controls, 20 preclinical ARVC [mutation+], and 19 overt ARVC [mutation+, Task Force+] patients) who had undergone cine CMR examination were enrolled in the study. The average age was 34.6 ± 16.2 years (40% women). Regional longitudinal strain and strain rate decreased in magnitude from control to preclinical to overt ARVC, though significance was only reached between overt and control (p < 0.01 for all strains / strain rates, with the exception of the apex). Strain was most abnormal in the subtricuspid region. Compared to longitudinal strain, circumferential strain and strain rate showed similar differences between groups, although more pronounced in the inferior region of the RV.

**CONCLUSION**

CMR feature tracking of the RV is feasible and may allow for quantification of regional wall motion abnormalities in ARVC.

**CLINICAL RELEVANCE/APPLICATION**

Qualitative assessment of regional wall motion abnormalities is unreliable and subject to inter-observer variation. CMR feature tracking has the potential to improve the reliability of ARVC diagnosis and detection of regional wall motion abnormalities.

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**SSA02-08**

**Merged Multidetector-Computed Tomography (MDCT) with Late-Enhancement and Electroanatomic Mapping (EAM) in Patients Affected by Recurrent Episodes of Ventricular Tachycardia (VT): A Point-by-Point Correlation**

Caterina Colantoni (Presenter): Nothing to Disclose, Antonio Esposito MD : Nothing to Disclose, Anna Palmisano MD : Nothing to Disclose, Sofia Auntunes : Nothing to Disclose, Francesco Aldo De Cobelli MD : Nothing to Disclose, Alessandro Del Maschio MD : Nothing to Disclose

**PURPOSE**

Most of recurrent VT recognizes a myocardial scar substrate; an ICD-compatible imaging able to assess cardiac scars and anatomy may help to plan and guide EAM and VT ablation. Our purpose was to evaluate the feasibility and usefulness of integrating MDCT data with EAMs for VT substrate assessment and guidance of VT mapping and ablation.

**METHOD AND MATERIALS**

20 patients suffering from recurrent episodes of VT underwent MDCT before VT ablation, including an angiographic-scan and a low-energy (80kV) delayed-scan (10 minutes after high concentration contrast media). For each patient, a 3D-model of the heart (CT-3D-MODEL), representing the cardiac cavities, aortic root, left ventricular wall and myocardial scar in different colours, was obtained by the fusion of angiographic and delayed scan, separately segmented. The CT-3D-MODELs were uploaded on CARTO® system and co-registered with high-density Bipolar maps using CARTO-merge. A point-by-point correlation was performed between low-voltage areas at bipolar EAM (≤1.5mV, corresponding to scar) and scars on CT-3D-MODEL, using a homemade software. 20 mm was considered the cut-off for registration-error.

**RESULTS**

The analysis included 24 scars, counting 15 scars in ischemic cardiomyopathy, 7 scar in non-ischemic cardiomyopathy, and 2 scar of myocardial origin. The bipolar EAMs were mapped with an overall number of 18095 points (min 71; max 2601); 11737 out of 18095 points at EAMs corresponded to scar areas on CT-3D-MODEL with 68% of overall correspondence. Analysis for patient showed a range of correlation between CT-3D-MODEL and EAM varying from 0% to 99%. A correlation between CT-3D-MODEL and EAM > 75% was found in 15 out of 20 patients, in 3 patients the correlation resulted between 50% and 75% and in 2 was < 50%. In these 2 patients the poor correlation was linked to the absence of low voltages at EAM, in one patient, and to the low quality of delayed MDCT scan, in the second case.

**CONCLUSION**

Cardiac MDCT with delayed scan allows an accurate assessment of scar substrate of VT in most of patient. The optimized protocol of acquisition and post-processing set-up in this study allows to obtain high resolution CT-3D-MODELS suitable for integration with EAMs on CARTO.

**CLINICAL RELEVANCE/APPLICATION**

The integration of CT-3D-MODELS with EAM could be useful for identification of VT substrate, potentially improving VT ablation success.
Doppler Ultrasound as an Alternative Gating Method in Cardiac Cine MRI

Fabian Kording (Presenter): Nothing to Disclose, Bjoern Schoennagel MD: Nothing to Disclose, Friedrich Uberle: Nothing to Disclose, Gerhard B. Adam MD: Nothing to Disclose, Jin Yamamura MD: Nothing to Disclose

PURPOSE

Accurate synchronization of the cardiac cycle is one of the main challenges in cardiac magnetic resonance imaging. Ultrasound is not objected to magneto-hydro-dynamic effects, does not interact with the electromagnetic field of the MRI and measures the physiological motion of the heart rather than electrical activation. The purpose of this work was to evaluate Doppler ultrasound (DUS) as an alternative gating method in cardiac MRI.

METHOD AND MATERIALS

Steady-state free precession (SSFP) 2D CINE MRI in 12 healthy subjects (8 male, 4 female) was performed at 1.5 T with DUS, electrocardiogram (ECG) and pulse oximetry (POX) gating signals. Trigger reliability and variance of detected trigger time points during acquisition were computed from signals stored by the internal log function of the physiologic unit of the MRI. Quantitative analysis of image quality was assessed by calculating endocardial border sharpness (EBS), signal-to-noise (left ventricular blood) and contrast-to-noise (blood-myocardium) ratios and left ventricular (LV) function parameters.

RESULTS

No interference with the MRI electromagnetic field was observed for DUS and POX signals whereas ECG showed small T-wave elevations due to magneto-hydro-dynamic effects. Trigger variances, displaying trigger accuracy, were 48 ± 11 ms (ECG), 41 ± 12 ms (DUS) and 81 ± 35 ms (POX). Mean stroke volume for ECG, DUS and POX was 82 ± 24 ml, 83 ± 22 ml and 81 ± 27 ml yielding an ejection fraction of 59 ± 6 %, 61 ± 7 % and 59 ± 6 %, respectively. EBS for systole, diastole and as temporal mean over the cardiac cycle was 3.1 ± 0.2 / 2.6 ± 0.1 / 2.9 ± 0.2 pixel (ECG), 3.1 ± 0.2 / 2.6 ± 0.2 / 2.9 ± 0.2 pixel (DUS) and for POX gated images 3.3 ± 0.1 / 2.9 ± 0.1 / 3.1 ± 0.2 pixel. Signal-to-noise ratios for ECG and DUS were 52 ±13 and 45 ± 16 with a contrast-to-noise ratio of 39 ±10 and 34 ±12.

CONCLUSION

Synchronization of 2D CINE SSFP cardiac MRI was successfully demonstrated using DUS at 1.5 T. Quantitative analysis revealed high agreement between ECG and DUS whereas trigger accuracy and EBS were smaller for POX gating. In conclusion, DUS gating is a promising alternative gating method for cardiac MRI.

CLINICAL RELEVANCE/APPLICATION

Doppler ultrasound measures physiological motion of the heart rather than electrical activation and, hence, enables a more accurate gating, especially for higher field strength.

Predictive Value of Coronary Artery Lumen Area Quantification for Prediction of Hemodynamically Relevant Coronary Stenosis by Computed Tomography (CT) Angiography

Fabian Plank (Presenter): Nothing to Disclose, Tobias De Zordo MD: Nothing to Disclose, Moritz Kummann: Nothing to Disclose, Andrea Klauser MD: Nothing to Disclose, Werner R. Jaschke MD, PhD: Nothing to Disclose, Gudrun Feuchtner MD: Nothing to Disclose

PURPOSE

Coronary CTA is validated to rule out coronary artery disease (CAD), however, false positive high-grade lesions result in lower sensitivity. Additional mean lumen area (MLA) measurements may increase accuracy by identifying hemodynamic relevance of a stenosis. Therefore the purpose was to evaluate the added value of MLA quantification by CTA to predict hemodynamic significance of coronary stenosis by invasive angiography (ICA) requiring coronary revascularization procedure.
METHOD AND MATERIALS

45 patients (mean age 63.9) who underwent 128- or 64-slice CTA presented with at least one high-grade stenosis (> 50%) in a proximal coronary vessel (right coronary artery (RCA), left main (LM), left anterior descending (LAD) or circumflex artery (CX)) and subsequently underwent invasive angiography (ICA). The minimal lumen area (MLA) was quantified by CT. Results were evaluated for hemodynamic relevance in ICA (defined as fractional flow reserve <0.8) and followed by percutaneous intervention or coronary bypass grafting. ROC-Analysis with stepwise testing (0.1 mm² MLA increments) was performed.

RESULTS

Overall, 50 high-grade stenosis (6 RCA, 7 LM, 37 LAD) in 156 proximal segments were evaluated. Mean lumen diameter was 4.7 mm² ±3.05. Mean MLA was 2.75 mm² (range 2.18-3.27) for high grade stenosis and 5.51 mm² (range 4.93-6.09) for no or mild stenosis. The MLA for LM was 7.13 mm², LAD 2.90 mm², CX 3.84 mm², RCA 5.13 mm². A threshold of 1.9 mm² MLA was identified as optimal cut-off, area under the curve (AUC) was 0.90 (p<0.0001). Sensitivity: 81.8% (59.7 - 94.8) and specificity: 91.04% (84.9 - 95.3). Twenty seven high-grade stenosis (>50%) in CT had no hemodynamic relevance. Of those, 24 (88.9%) lesions had MLA >1.9 mm².

CONCLUSION

A minimal lumen area cut-off of 1.9 mm² or less showed highest accuracy for prediction of significantly increased hemodynamic relevance and may add important value to CTA.

CLINICAL RELEVANCE/APPLICATION

The added value of MLA measurements may help identify hemodynamically relevant coronary stenosis.

SSA03-02

Increased Epicardial Fat Volume Is Independently Associated with Atrial Fibrillation, Atrial Fibrillation Severity and Radiofrequency Ablation Outcome

Jadranka Stojanovska MD, MS (Presenter): Nothing to Disclose, Ella A. Kazerooni MD: Nothing to Disclose, Barry Howard Gross MD: Nothing to Disclose, Hakan Oral MD: Nothing to Disclose

PURPOSE

To determine whether intrathoracic fat volumes are independently associated with the presence of atrial fibrillation (AF), severity of AF and outcome of radiofrequency ablation (RFA) using logistic regression analysis.

METHOD AND MATERIALS

Institutional Review Board approval was obtained and patient consent was waived for this HIPPA-compliant retrospective study. A total of 231 patients, 169 with AF (75 with non-paroxysmal and 94 with paroxysmal) and 62 control patients, formed the study population. AF patients underwent computed tomography (CT) of the pulmonary veins and left atrium, and control patients underwent coronary CT. Intrathoracic fat volumes (extrapericardial and epicardial) were measured for both groups. Associations between presence and severity of AF and intrathoracic fat volumes were assessed using logistic regression analysis.

RESULTS

The epicardial fat volume remained statistically associated with the prevalence of AF [1.01 (1.003-1.03), p=0.01], AF severity [1.008 (1.001-1.02), p=0.03], and recurrence of AF after RFA [1.009 (1.001-1.01), p=0.02] after adjustment for age, gender, and body mass index. Time to recurrence after ablation was shorter in patients who had larger epicardial fat volume than patients who did not (14± 15 days versus 22± 16 days, p=0.017). The epicardial fat volume was larger in the 78/169 AF patients (46%) who had AF recurrence after RFA compared to the 91/169 or (54%) who did not have recurrence (81 ± 47 mL versus 105 ± 56 mL, p=0.002).

CONCLUSION

Increased epicardial fat volume is associated with the presence of AF, AF severity, and higher probability of recurrence of AF after radiofrequency ablation.

CLINICAL RELEVANCE/APPLICATION

Extensive epicardial fat is associated with earlier recurrences of AF after radiofrequency ablation that potentially may reduce the transmurality of radiofrequency ablation by affecting current and impedance dynamics. Quantification of epicardial fat on pre-procedural CT scan may identify patients with AF who will benefit from catheter ablation as a definitive treatment for AF.

SSA03-03

Left Atrial Appendage (LAA) Thrombosis Exclusion with Two-phase Cardiac Computed Tomography (CT) in Patients with Atrial Fibrillation (AF): A Prospective Comparison Study with Transesophageal Echocardiography (TEE)

Daniela Di Marco MD (Presenter): Nothing to Disclose, Manuela Giglio MD: Nothing to Disclose, Francesca Besana MD: Nothing to Disclose, Sandro Sironi MD: Nothing to Disclose, Pietro Spagnolo MD: Nothing to Disclose

PURPOSE

to evaluate the diagnostic accuracy of two-phase cardiac CT in detecting left atrial appendage (LAA) thrombosis
in patients with chronic atrial fibrillation referred for radiofrequency ablation using the CARTO 3 and NavX system.

**METHOD AND MATERIALS**

260 consecutive patients undergoing CARTO-guided radiofrequency ablation for atrial fibrillation were prospectively enrolled. All patients underwent both cardiac CT and TEE within a 3-hour period or less. Diagnostic accuracy of cardiac CT for detection of LAA thrombosis was computed using TEE as reference standard. CT scanning protocol included a standard early phase imaging to evaluate coronary arteries, pulmonary vein and LAA anatomy and a late phase imaging using prospective electrocardiographic gating 6 minutes after contrast media injection. To reduce the radiation dose, late phase imaging was limited to the left atrium and performed only when a LAA filling defect was found on early-arterial phase. Filling defects seen on added late-phase imaging as well as on early-phase imaging were categorized as thrombus.

**RESULTS**

TEE demonstrated spontaneous echo contrast in 48 patients and thrombus in 6 patients. In 57 patients CT demonstrated LAA early filling defects and a late-phase imaging was performed. All the 6 thrombi diagnosed on TEE were correctly identified on cardiac CT. The overall sensitivity and specificity were both 100%. The calculated radiation dose of CT examination was 3.31 mSv for early-phase imaging and 0.16 mSv for late phase imaging.

**CONCLUSION**

two-phase cardiac CT is a noninvasive and accurate modality for detecting LAA thrombosis and differentiating thrombus from circulatory stasis. Cardiac CT may obviate routine TEE before radiofrequency ablation.

**CLINICAL RELEVANCE/APPLICATION**

two-phase cardiac-CT could be a one-stop-shop examination in patients with AF before RF-ablation allowing to obtain accurate imaging of heart, pulmonary veins and exclude LAA thrombosis, avoiding TEE.

**Corrected Coronary Opacification Difference Measured with Computed Tomography Angiography Predict Coronary In-stent Restenosis**


**PURPOSE**

To determine whether changes in corrected coronary opacification (CCO) across stents can identify in-stent restenosis (ISR) severity compared with invasive coronary angiography (ICA) as a reference standard.

**METHOD AND MATERIALS**

Between September 2009 and December 2012, patients with previous stents implantation who underwent ICA for recurrent typical or atypical chest pain after coronary CT angiography (CTA) within three months were enrolled. Attenuation values of coronary lumen were measured at proximal and distal of stents and normalized to the descending aorta. Changes in CCO were calculated and CCO difference across the stent was compared with severity of ISR.

**RESULTS**

A total of 141 stents were assessed. 76 stents were normal, 18 stents had ISR < 50%, 28 stents had with ISR 50% to 99%, and 19 stents were occluded. The median of CCO difference in group of no ISR, ISR < 50%, ISR 50% to 99%, and ISR 100% were 0.078, 0.163, 0.346 and 0.606, respectively (all $P < 0.01$). For stents <3mm, CCO difference of no ISR and non-obstructive ISR were significantly lower than obstructive ISR and occluded (all $P < 0.001$). To all the stents with any ISR and stents with ISR equal or more than 50%, the accuracy of ISR diagnosed by CCO ($c$ statistic 0.934 ± 0.023 and 0.994 ± 0.004, respectively) were significant better than that of CTA alone ($c$ statistic 0.794 ± 0.004 and 0.692 ± 0.047, respectively) (all $P < 0.01$).

**CONCLUSION**

CCO difference across coronary stents could predict ISR severity especially obstructive ISR in stents less than 3mm diameter. The performance of ISR diagnosed by CTA improved significantly when CCO difference was taken into account.

**CLINICAL RELEVANCE/APPLICATION**

In patients with coronary in-stent restenosis, coronary CT angiography is able to help identify the difference of coronary attenuation and predict the severity of restenosis.
SSA03-05

Evaluation of Dynamic Features of Aortic Annulus in Patients with Bicuspid Aortic Stenosis (BAS) throughout Cardiac Cycle by Dual Source Computed Tomography (DSCT): Implications for Transcatheter Aortic Valve Implantation (TAVI)

Liqing Peng (Presenter): Nothing to Disclose, Xiao-Yi Chen: Nothing to Disclose, Jian-Qun Yu MD: Nothing to Disclose, Zhi-Gang Yang: Nothing to Disclose

PURPOSE

Bicuspid aortic stenosis (BAS) has been a relative contraindication to transcatheter aortic valve implantation (TAVI), but small series of patients with severe BAS successfully treated with TAVI were reported recently. We sought to assess the dynamic features of aortic annulus of BAS throughout cardiac cycle by dual source computed tomography (DSCT).

METHOD AND MATERIALS

Thirty-one patients (15 males and 16 females; mean age: 69.1±5.3 years, range: 60-82 years) with severe BAS who underwent retrospectively ECG-gated DSCT angiography were included. The images were reconstructed into 10 phases at 10% step of R-R interval. The image quality was evaluated with a 3-points scoring method (3 points: good image quality free of artifact; 2 points: adequate image quality for evaluation with mild artifact; 1 point: inadequate image quality due to severe artifact). Minor aortic annular diameter (AAD-min), major aortic diameter (AAD-maj), aortic annular perimeter (AAP) and aortic annular area (AAA) were measured in each phase. AAP derived AAD (AAD-PD) and AAA derived AAD (AAD-AD) were calculated using formula C = πD and s = π(D/2), respectively. The absolute and relative difference of all parameters throughout the cardiac cycle were calculated with (maximum-minimum) and [(maximum-minimum)/minimum] multiplied by 100%.

RESULTS

Best image quality was in 20%, 30%, 60% and 70% R-R intervals in the majority of patients (96.8%, 30/31) during cardiac cycle. In all patients, AAD-min, AAD-maj, AAP and AAA varied during cardiac cycle, and AAD-maj was greater than AAD-min throughout the cardiac cycle (p < 0.0001). The relative differences of AAD-min, AAD-maj, AAD-PD and AAD-AD were 19.6±12.9%, 15.7±8.0%, 9.6±6.2% and 9.6±3.1%, respectively; while the absolute difference of which were 4.0±2.5mm, 3.7±1.5mm, 2.3±0.9mm and 2.6±1.2 mm, respectively (p=0.001).

CONCLUSION

In patients with BAS, aortic annulus is oval and its shape changes during cardiac cycle. The difference of AAP-PD throughout cardiac cycle is relative smaller. Thus, AAP might be the most proper parameter for estimating aortic annulus size before TAVI. Considering image quality, mid-late systole and mid-diastole were more reliable for evaluation.

CLINICAL RELEVANCE/APPLICATION

Finding out dynamic features of aortic annulus of BAS may help precisely estimate aortic annulus size, and decrease TAVI procedure related complications.

SSA03-06

Relationship of Breast Arterial Calcification with Coronary Calcium Score and Coronary CT Angiography

Mariana Diaz-Zamudio MD (Presenter): Nothing to Disclose, Peter Jay Julien: Nothing to Disclose, Damini Dey PhD: Research support, Siemens AG, Heidi Gransar: Nothing to Disclose, Louise J. Thomson MBChB: Nothing to Disclose, John D. Friedman MD: Nothing to Disclose, Sean Hayes MD: Nothing to Disclose, Daniel S. Berman MD: Research Grant, Lantheus Medical Imaging, Inc Research Grant, Astellas Group Research Grant, Siemens AG Speaker, Bristol-Myers Squibb Company Speaker, Covidien AG Speaker, Astellas Group Stockholder, Spectrum Dynamics Ltd Consultant, Bracco Group Consultant, FlouroPharma, Inc

PURPOSE

To determine whether breast arterial calcification (BAC) on mammography are predictive for high risk coronary calcium score (CAC) and coronary artery disease (CAD) identified by coronary CTA.

METHOD AND MATERIALS

Consecutive female patients age >45 undergoing coronary CTA and CAC scanning for clinical purposes and screening mammography within 24 months from CTA were identified. Mammography studies were reviewed by an experienced reader blinded to CT results. BAC was assessed using a semi-quantitative scale (none/mild/moderate/severe). CAC was categorized as 0, 1-99, 100-399, and ≥400 and CTA as 0, <50%, 50-69%, and ≥70% stenosis grade. All clinical and risk-factor data were collected prospectively.

RESULTS

In 204 patients included, median time between mammography and CTA was 7 months (range 0-24). Median age was 63.2 years (range 45-88). BAC was present in 43 (21%). The BAC group was older (69.6 vs 61.5, p<0.001). By CAC category, CAC 100-399 and ≥400 were more common in the BAC group (CAC 100-399: 23.2 vs 16.1%; CAC≥400: 21 vs 6.2%, p=0.01) and CAC 0 and CAC 1-99 were more common in the no BAC group (CAC 0: 47 vs 37.2%; CAC 1-99: 30.4 vs 18.6%, p=0.01). By multivariable analysis (including age, BMI, hypertension, diabetes mellitus, smoking history, family history) moderate/severe BAS predicted CAC≥400 (OR 4.2, p=0.03). By CTA category, 50-69% and ≥70% stenosis were more common in the BAC group (50-69%: 11.6 vs 3.2%; ≥70%: 20.9 vs 7.8%, p=0.008). CAD 0 and stenosis <50% were more common in the no BAC group (CAD 0: 47 vs 34.8%; <50%: 42 vs 32.5%; p=0.008). On multivariable analysis BAS was a predictor of 50-69% stenosis (OR 3.5, p=0.01). To assess age interaction, a sub-analysis of patients >65 (n=91) was performed. In this subgroup, age was not different between BAC and no BAC groups (73.6 vs 72.4, p=0.32);
however, the presence of CAC≥400 (41.6 vs 14%, p=0.019) and ≥50% stenosis (39.4 vs 17.2%, p=0.019) remained higher in the group with moderate/severe BAC. Moderate/severe BAC persisted as a multivariable predictor of CAC≥400 (OR 8.7, p=0.007) and ≥50% stenosis (OR 4.7, p=0.012).

CONCLUSION
BAC predicts high coronary calcium scores and CAD in coronary CTA independently of age and risk factors.

CLINICAL RELEVANCE/APPLICATION
BAC identified in routinely performed mammographies could potentially be used to direct further testing to detect CAD in women.

SSA03-07

Fast Cardiac 1H-MR Spectroscopy at 3T: High Permittivity Materials Increase SNR and Reduce Data Acquisition Time

Paul de Heer MSc (Presenter): Nothing to Disclose, Maurice B Bizino: Nothing to Disclose, Andrew Webb DPHIL: Nothing to Disclose, Hildo J. Lamb MD, PhD: Nothing to Disclose

PURPOSE
Cardiac 1H magnetic resonance spectroscopy (1H-MRS) is the gold standard for non-invasive quantification of myocardial triglyceride content (MTGC) which is a key feature of cardiomyopathy in metabolic syndrome and type 2 diabetes mellitus. 1H-MRS is a challenging technique due to a low signal-to-noise ratio (SNR), and the purpose of this study was to investigate whether high permittivity pads can increase the SNR, thereby also reducing the scanning time required.

METHOD AND MATERIALS
All experiments were approved by the institutional Ethics Committee and written informed consent from all volunteers was obtained prior to the study. Twenty healthy volunteers were scanned, 8 female and 12 male, average age 30 yr. (range 19-53), average BMI of 23 kg/m2 (range 20-34). Scans were performed on a 3T Philips Ingenia. Two high permittivity pads, 2 cm thick (anterior) and 1cm thick (posterior), with dimensions 20x20cm2 were used. The spectroscopic volume-of-interest (40x15x25mm3) was planned in the interventricular septum. ECG-triggered respiratory navigated PRESS spectra were acquired without water suppression (TE 35ms, TR 8.5s, 16 averages) and with water suppression (TE 35ms, TR 3.5s, 48 averages) with and without dielectric pads. Data were phase and DC corrected, and fitted using the AMARES algorithm in jMRUI. The SNR of the TG spectra was defined as the integrated area under the (CH2)n and (CH3) peak divided by the SD of the noise taken from the last 100 points of the FID. Statistical significance of the data was tested using a double sided paired Student's t-test and was considered significant at p-values < 0.05.

RESULTS
In Fig. 1 spectra from two different volunteers and a summary Bland-Altman plot is shown. The mean lipid SNR for all volunteers show an increase from 28±16 (mean±SD) to 42±24 (p<0.0001), a gain factor in SNR of 1.6±0.5 when the pads are used. The average MTGC is 0.39% without pads and 0.38% with pads, showing no significant difference.

CONCLUSION
High permittivity materials improve cardiac 1H-MR spectroscopy at 3T by increasing SNR by a factor of 1.6, resulting in better quantification and/or a reduction in acquisition time by a factor of ~2.6 (gain_SNR*gain_SNR).

CLINICAL RELEVANCE/APPLICATION
Cardiac 1H MR spectroscopy is a unique non-invasive method to assess cardiac energy metabolism. The innovation of using high permittivity materials increases the accuracy and speed of the technique.

SSA03-08

Computed Tomography Angiography of the Lower Extremity and Coronary Arteries by Using 256-Slice CT Prospective ECG-gated Protocol

DE XUAN XIE (Presenter): Nothing to Disclose, Zhang Jinling : Nothing to Disclose, Xiao Xigang MD : Nothing to Disclose

PURPOSE
To investigate the possible use of a 256-slice computed tomography (CT) prospective electrocardiography (ECG)-gated wide volume scanning protocol in combined angiography of the lower extremity and coronary arteries after single contrast medium injection for patients with lower extremity peripheral arterial disease (PAD).

METHOD AND MATERIALS
A total of 34 patients with PAD underwent CT angiography (CTA) with a prospective ECG gated protocol that covered the level of the tracheal bifurcation to the foot sole. A low-dose scanning protocol was used, the tube voltage and effective tube current were manually adjusted according to each patient’s body mass index. Image quality of coronary arteries was assessed using a four-point ranking scale, a score ≥ 2 was considered to reflect adequate diagnostic acceptability. A three-point ranking scale was used to assess the image quality of lower extremity arteries, a score ≥ 2 was considered to reflect diagnostic acceptability. Digital subtraction angiography (DSA) of the lower extremity arteries was performed on patients requiring therapeutic intervention.
RESULTS
A total of 93.07% of the coronary segments were adequate for diagnosis. 17 (50%) patients showed coronary artery stenosis ≥ 50%. A total of 95.8% of the lower extremity arterial segments were adequate for diagnosis. Twenty-eight patients underwent DSA examination, the sensitivity, specificity, PPV, NPV, and accuracy of CTA for the detection of significant lower arterial stenosis (≥50%) was 94.8%, 97.2%, 95.3%, 96.9% and 96.3% respectively. The mean effective dose was 8.93± 3.42 mSv, which was not significantly higher than the average patient dose of 7.47 mSv reported in the literature.

CONCLUSION
Using the prospective ECG-gated wide volume CTA protocol, images of the coronary and lower extremity arteries suitable for diagnosis can be acquired simultaneously after a single injection of contrast agent. In addition to accurately diagnose PAD, the combined angiography might be used to screen for coronary heart disease in patients with PAD.

CLINICAL RELEVANCE/APPLICATION
In addition to accurately diagnose PAD, the combined angiography might be used to screen for coronary heart disease in patients with PAD.

SSA03-09 When Is Optimal Scan Timing in Static Myocardial CT Perfusion Imaging-by Whole Heart Dynamic Scan
Yuki Tanabe (Presenter): Nothing to Disclose, Teruhito Kido MD, PhD : Nothing to Disclose, Takahiro Yokoi : Nothing to Disclose, Shintaro Tsuruoka : Nothing to Disclose, Naoki Fukuyama : Nothing to Disclose, Takuya Matsuda : Nothing to Disclose, Rami Yokoyama : Nothing to Disclose, Masashi Nakamura : Nothing to Disclose, Yoshiko Nishiyama MD : Nothing to Disclose, Masao Miyagawa MD, PhD : Nothing to Disclose, Teruhito Mochizuki MD : Nothing to Disclose

PURPOSE
The purpose of this study is to investigate the optimal timing of single-phase CT perfusion (CTP) scan for differentiation of ischemic and normal myocardium.

METHOD AND MATERIALS
The study group comprised 21 patients (mean age 68.7±7.5 years) who underwent ATP-stress dynamic myocardial CTP scan and invasive coronary angiography (ICA) and stress myocardial perfusion imaging (MPI) (SPECT or cardiac MRI). All patients in this study had one or two vessels disease. Dynamic CTP (whole heart datasets over 30 consecutive heart beats in systole without spatial and temporal gaps) was acquired with prospective ECG gating. Coronary stenosis >=50% was defined as positive findings in ICA, and perfusion abnormalities were defined as positive findings in MPI. In this study, the areas with ICA (-) and MPI (-) are defined as normal, the areas with ICA (+) and MPI (+) as ischemia and the areas with ICA (+) and MPI (-) as non-ischemia. Results of ICA and MPI are analyzed according to 3 vessel areas (LAD, LCX, RCA). 2 experienced radiologists visually analyzed the dynamic CTP images in reference to the results of ICA and MPI and consulted together about the optimal scan timing for differentiation of ischemic and normal myocardium. Then, "static image" at the optimal scan timing was compared with "dynamic image" in the diagnostic performance for detecting myocardial ischemia by other 2 experienced radiologists visually analyzing.

RESULTS
Normal, ischemic and non-ischemic areas were 22/63, 29/63 and 12/63 areas. As a result of qualitative assessment, the optimal scan timing could be 1.8-2.5 seconds after peak enhance time of the aorta (mean ΔCT value (normal-ishcemia): 26.0±18.9 HU). 95% of all cases were included in this range. In "static CTP image" at the optimal scan timing was compared with "dynamic image" in the diagnostic performance for detecting myocardial ischemia by other 2 experienced radiologists visually analyzing.

CONCLUSION
In myocardial CTP imaging, the optimal timing of single-phase scan is 1.8-2.5 seconds after peak enhance time of the aorta, which will be helpful to optimize single-phase CTP scans.

CLINICAL RELEVANCE/APPLICATION
Static CTP image by scanning at the optimal timing can decrease radiation exposure with keeping the diagnostic performance almost the same level of the dynamic CTP image.
Lung Cancer Screening in a Predominantly Poor, Overweight, Inner-city Minority Population: Initial Experience

**SUB-EVENTS**

**SSA04-01**

**Participants**

Mark L. Schiebler MD: Shareholder, Cellectar Biosciences, Inc

Caroline Chiles MD: Nothing to Disclose

**Lung Cancer Screening in a Predominantly Poor, Overweight, Inner-city Minority Population: Initial Experience**

Alia Godelman MD: Nothing to Disclose, Hannah Milch MD (Presenter): Nothing to Disclose, Mark Kaminetzky: Nothing to Disclose, Anna Shmukler MD: Nothing to Disclose, Tova C. Koenigsberg MD: Nothing to Disclose, Linda Brody Haramati MD, MS: Investor, OrthoSpace Ltd, Investor, Kryon Systems Ltd, Board Member, Bio Protect Ltd, Spouse, Board Member, OrthoSpace Ltd, Spouse, Board Member, Kryon Systems Ltd

**PURPOSE**

To evaluate the applicability of the National Lung Screening Trial (NLST) results to a predominantly poor, overweight, inner-city minority population.

**METHOD AND MATERIALS**

We examined the data for all 198 patients who underwent low dose chest CT as part of our inner-city academic medical center's lung cancer screening program from its inception in 12/2012 till 2/2014. All met NLST eligibility criteria. A screening coordinator worked closely with patients and tracked follow-up. CTs were interpreted clinically by 1 of 4 cardiothoracic radiologists. Results were reported as 5 standardized categories: 1. No evidence of lung cancer, normal chest; 2. No evidence of lung cancer, benign pulmonary findings; 3. Small nonspecific pulmonary nodules; 4. Small spiculated nodule (4a) or ground glass nodule (4b); 5. Pulmonary mass (5a) or metastatic disease (5b). Routine screening in 1-year was recommended for categories 1 and 2. Shorter follow up (Fleischner criteria) was advised for categories 3 and 4. Tissue correlation was advised for category 5. Calcium score (Shemesh et al. range 0-12) was reported. Additional data included demographics, smoking history, BMI, dose length product (DLP), and lung biopsy/resection pathology.

**RESULTS**

Of 198 patients, 54% were men, 72% current smokers, 69% non-white (35% black, 31% Hispanic, 3% other). Mean age was 64 yrs, mean BMI 31 (range 20-39). Mean calcium score was 3/12 (range 0-12), mean DLP 107 (range 71-223). 73% results were categories 1 and 2, 22% category 3, 2% category 4 and 3% category 5. Of 5 category 5 patients had resections confirming the diagnosis of lung carcinoma, ranging from stage IA to IIIA. One category 5 patient awaits biopsy. One category 4 had ongoing suspicion for cancer on follow up CT but biopsy results were benign.

**CONCLUSION**

Low dose CT lung cancer screening using NLST criteria is feasible in a predominantly poor, overweight, inner-city minority population. The screening coordinator plays a crucial role. In the first 15 months, lung cancer was diagnosed in 2%. Interpretation yielded a high specificity with sensitivity to be determined with ongoing follow-up.

**CLINICAL RELEVANCE/APPLICATION**

Successful initiation of a lung cancer screening program is feasible in a predominantly poor, overweight, inner-city minority population. NLST results require validation in understudied populations.

**SSA04-02**

**Invited Speaker: Demographic Characteristics and Results of National Comprehensive Cancer Network High-risk Group 2 in a Clinical CT Lung Screening Program**

Brady John McKee MD (Presenter): Nothing to Disclose, Jeffrey Alexander Hashim MD: Nothing to Disclose, Robert James French MD: Nothing to Disclose, Andrea Bertram McKee MD: Nothing to Disclose, Christoph Wald, MD, PhD: Radiology Advisory Committee, Koninklijke Philips NV, Sebastian Flacke MD: Research Consultant, Pluromed, Inc Speaker, Nordion, Inc

**PURPOSE**

To compare the demographic characteristics and screening results of NCCN high-risk Group 2 (>50y, >20 pack-years, 1 additional risk factor) to NCCN high-risk Group 1 (55-74y, current or former smoker quit 30 pack-years) in a clinical CT lung screening program.

**METHOD AND MATERIALS**

We retrospectively reviewed results of all CT lung screening exams performed from 1/2012 through 12/2013. Those screened had to fulfill the NCCN high-risk criteria and have an MD order for screening. All exams were performed on 64+ MDCT scanners at 100 kV and 30-70 mA. Image interpretation was performed by credentialed radiologists using the structured reporting system, "LungRADS". A positive exam was defined as a solid nodule > 4mm, a groundglass nodule > 5mm, or a chest lymph node > 1 cm not stable for more than two years. Clinically significant incidental findings including findings suspicious for pulmonary infection were recorded.

**RESULTS**
458 Group 2 and 1302 Group 1 individuals underwent prevalence CT lung screening exams during the study interval. Group 2 qualifying risk factors: 44% personal history of smoking related cancer, 28% chronic lung disease, 24% carcinoma exposure, < 5% primary relative w/lung cancer. Male/female ratio, average age, and average pack-years was 50/50, 61, and 40 for Group 2 and 53/47, 63, and 50 for Group 1. 36% of Group 2 and 50% of Group 1 were active smokers. Average duration of smoking cessation was 18.5y in Group 2, 6.7y in Group 1. 25% in Group 2 and 28% in Group 1 had positive exams. 6.1% in Group 2 and Group 1 had at least one clinically significant incidental finding. 6.1% in Group 2 and 6.6 % in Group 1 had findings suspicious for pulmonary infection. 23 cases of lung cancer were diagnosed in 1328/1760 (75%) with clinical followup after screening: 6 in Group 2 and 17 in Group 1 with an annualized rate of malignancy of 1.6% for Group 1 and 1.8% for Group 2.

CONCLUSION
Screening results for NCCN Group 2 are similar to NCCN Group 1 and those reported in the National Lung Screening Trial. The prevalence rate of lung cancer in NCCN Group 2 suggests thousand of additional lives could be saved each year if screening eligibility is expanded to include this high-risk group.

CLINICAL RELEVANCE/APPLICATION
Expanding CT lung screening eligibility to include NCCN high-risk Group 2 could increase the number of qualified Americans by two to three million and offers the potential to save thousands of additional lives each year.

Trends in CT Screening for Lung Cancer at Leading Academic Medical Centers

PURPOSE
To determine trends in CT lung cancer screening at leading academic medical centers.

METHOD AND MATERIALS
An electronic survey was emailed in March 2014 to thoracic radiologists at 21 leading academic medical centers, identified from the 2012-2013 US News and World Report listings of top hospitals, cancer centers, and pulmonary medicine centers. Radiologists who reported that they currently offer lung cancer screening were asked additional questions which ranged from patient selection policies to the likelihood of implementing forthcoming LUNG-RADS in their practice. March 2014 survey results were compared to March 2013 survey results for select questions that overlapped between the 2 surveys.

RESULTS
Of the 20 survey respondents (95% response rate), 19 (95%) currently have an active CT screening program, an increase from 79% in 2013. Five or fewer patients are scanned per week at most sites (14 of 19, 74%), and only 1 site (5%) reported >20 patients per week. Regarding charges, all exams were self-pay at 9 of 19 (47%) screening sites and a majority was self-pay at the remaining sites. Similar to 2013, most programs (12 of 19, 63%) require physician referral for screening. NLST entry criteria remained the most common patient selection criteria in 2014, but 5 sites (26%) recently expanded their age criteria in response to new USPSTF recommendations. Regarding solid nodule size thresholds for defining a positive screen, 13 of 19 (68%) sites use ≥4 mm, 3 sites (16%) use ≥ 5mm, 2 sites (11%) use ≥6 mm, and 1 site (5%) does not use a size criterion. Less than half of the screening sites (9 of 19, 47%) definitely plan to incorporate LUNG-RADS. Almost all programs (18 of 19, 95%) routinely report coronary artery calcifications and most report this qualitatively (89%) rather than quantitatively (11%).

CONCLUSION
Most leading academic medical centers have CT screening programs, but relatively few patients are being screened. Only a minority of sites has modified its selection criteria in response to new USPSTF guidelines and fewer than half definitely plan to incorporate forthcoming LUNG-RADS in their practice.

CLINICAL RELEVANCE/APPLICATION
Screening programs should be encouraged to standardize their lung cancer screening practices. Forthcoming ACR-STR practice guidelines and LUNG-RADS can facilitate this process.

Unenhanced Chest CT at 100kV with Spectral Shaping: A Potential New Sub-millisievert Lung Cancer Screening Protocol

PURPOSE
To prospectively investigate image quality and radiation dose of 100 kV spectral shaping chest CT using a dedicated tin filter on a 3rd generation DSCT in comparison to standard 100 kV chest CT.

METHOD AND MATERIALS
Sixty patients that were referred for a non-contrast chest CT were prospectively included in this study and examined at 100kV with a dedicated tin filter behind the x-ray tube for spectral shaping. These patients were retrospectively matched with patients that were examined on a 2nd generation DSCT at 100kV without tin filter. All images were reconstructed using iterative reconstruction techniques (ADMIRE, SAFIRE; Siemens). Objective and subjective image quality was assessed in various anatomic regions and radiation dose was compared.
RESULTS

Radiation dose was decreased by 90% using the 100 kV tin protocol when compared to 100 kV without tin filtration (mean dose 3.0±1.2 vs. 0.32±0.12 mSv). Soft tissue attenuation and soft tissue image noise was not statistically different for both examination techniques (p>0.05). Attenuation of air was lower for examinations performed with spectral shaping, while image noise was higher (p<0.05).

CONCLUSION

100 kV spectral shaping chest CT by means of a tube based tin filter allows 90% dose reduction when compared to 100 kV chest CT without spectral shaping. Thus, this CT protocol may be ideal for lung cancer screening.

CLINICAL RELEVANCE/APPLICATION

Our study demonstrates the feasibility and dose reduction of spectral shaping at a tube voltage of 100kV for non-contrast enhanced chest CT, allowing this protocol to be used for lung cancer screening.

Feasibility of Rapid Reading of CT Lung Cancer Screening with Computer-aided Detection Support

Bram Van Ginneken PhD (Presenter): Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Canon Inc Research Grant, Toshiba Corporation Research Grant, Riverain Technologies, LLC, Colin Jacobs MSc: Research Grant, MeVis Medical Solutions AG, Ernst T. Scholten MD: Nothing to Disclose, Mathias Prokop MD, PhD: Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group Speakers Bureau, Toshiba Corporation Speakers Bureau, Koninklijke Philips NV Research Grant, Toshiba Corporation, Pim A. de Jong MD, PhD: Nothing to Disclose

PURPOSE

The reading effort associated with CT lung cancer screening programs is substantial. We investigated the performance of rapid reading of chest CT scans with integrated CAD support, with the goal of quickly assigning a subject to either regular one-year follow-up, short-term follow-up or immediate work-up.

METHOD AND MATERIALS

From the baseline round of a large randomized controlled low-dose CT lung cancer screening trial, randomly 23 cases were selected from each of the three categories used in the trial: 1) no significant nodules, 1 year follow-up CT; 2) nodule 50-500 mm³, 3 month follow-up CT; 3) nodule >500 mm³, referral to pulmonologist. All 69 cases were pre-processed with three different CAD systems aimed at detecting both solid and subsolid lesions and set to operate at high sensitivity. CAD marks were merged and presented in a prototype software environment optimized for rapid reading that includes one-click immediate volumetric segmentation and study preloading to navigate to the next case in the worklist without delay. Seven blinded readers read all cases in random order in a single session as follows. First, CAD marks were inspected and accepted or rejected. Next, readers quickly inspected the scan and added relevant nodules if CAD had not identified these. Finally, readers assigned the scan to one of the three categories of the screening protocol.

RESULTS

Cases had 5.1 CAD marks on average. 73±7% of cases (range 58-80%) were assigned to the correct category. 94% of discordances were between category 1 versus 2, or category 2 versus 3. In most cases the reason was that the volume of the most suspicious nodule was very close to the cutoffs used in the screening protocol. Of the 23 cases in category 3, 14 contained lung cancer. None of these were put in category 1 by any reader; only two of these were placed in category 2, each by only 1/7 readers. 2/9 of the benign category 3 cases were put in category 1: one case by 4/7 readers (a relatively large pleural lesion missed by CAD), and one by 1/7 readers. Total median reading time per case was 67±17 seconds.

CONCLUSION

With the support of highly effective CAD systems, nodule volumetry, and an optimized reading environment, it is possible to accurately read lung cancer CT scans in around one minute per case.

CLINICAL RELEVANCE/APPLICATION

An optimized reading environment is presented that can be used for large scale implementation of lung CT screening.

Nodule Risk Calculator: A New Tool to Reduce Low Dose CT Scans in Lung Cancer Screening

Collette Louise English BMBS, FRCR (Presenter): Nothing to Disclose, Mark Teh MBBS: Nothing to Disclose, Rebecca E. Hall MBChB: Nothing to Disclose, Ana-Maria Bilawich MD: Nothing to Disclose, Stephen Lam: Nothing to Disclose, John R. Mayo MD: Speaker, Siemens AG

PURPOSE

We studied the utility of a nodule follow up algorithm based on malignancy risk assessed using a published Nodule risk calculator applied to lung cancer screening low dose CT (LDCT) scans. Using this approach, we hypothesized more appropriate CT follow up could be performed, reducing cost and radiation dose.

METHOD AND MATERIALS

We performed a retrospective study of a cross sectional sample of 200 consecutive LDCT scans (February to
May 2003) obtained in a lung cancer screening program. Entry criteria for screening included; 30 pack year current or former smoker, 50-74, no previous lung cancer. Baseline CT was assessed and dominant nodule malignant risk assessed using the nodule calculator based on; nodule diameter, nodule density (solid, part solid, ground glass), age, spiculation, lobar location, gender, family history of lung cancer, emphysema and total nodule count. Up to 12 year follow up (FU) was evaluated for; number of follow up LDCT, diagnosis of lung cancer, total radiation dose and fatality from lung cancer. Comparison was made to proposed follow up based on nodule calculator; <1.5% 2 year FU (minimal risk), 1.5-6% 1 year FU (low risk), >6% FU as clinically indicated (high risk).

**RESULTS**

Percentage of subjects stratified by dominant nodule risk: 82% with minimal risk; 12% low risk; 6% high risk. Lung cancer developed in 5 participants (3%) in the minimal and low risk group, only one of which arose from the dominant nodule on baseline LDCT. The total number of follow up LDCTs performed in the minimal and low risk group using conventional FU was 932. Using the risk calculator FU protocol 608 (65%) fewer LDCT scans (average 3 per subject) would have been performed with potential saving of ~$150,000. Using this FU protocol all cancers in the minimal and low risk group would have been detected at T1A size (<20 mm diameter).

**CONCLUSION**

The Nodule Calculator accurately identified minimal and low risk subjects in a lung cancer screening cohort with up to 12 year FU. A modified FU protocol based on the nodule calculator risk would have detected all cancers at T1A stage, saving 65% of LDCT scans, reducing program costs and subject radiation dose.

**CLINICAL RELEVANCE/APPLICATION**

Utilization of the nodule risk calculator can greatly reduce the number of follow up CTs in a lung cancer screening program.

**Nodule Detection in Lung Cancer Screening: When, Where, and Why are Non-calcified Lung Nodules Missed?**

**PURPOSE**

To assess the variation in lung nodule detection in low dose chest CT based on location, attenuation characteristics and reader experience.

**METHOD AND MATERIALS**

In an IRB approved study, we selected and extracted 18 non-calcified lung nodules with solid (n=7 nodules), ground glass (7) and mixed (4) attenuation from 12 chest examinations from patients with known malignant lung disease. All nodules had similar size and shape (mean size 7mm, size range, 6-8 mm). These nodules were randomly inserted in to 34 normal low dose chest CT examinations belonging to 34 patients (mean age 57.5 years, 15M;19F) at the following lung sites, apices, bases, peripheral 2 cm, close to heart and major vascular structures, branching points of bronchi and vessels and in the common regions of image artifacts such as behind the 1st rib. A total of 47 lung nodules (some nodules were inserted multiple times in each scan) were inserted. Two residents (Resident 1 with 2 weeks of CT training and resident 2 with at least one complete chest CT rotation) and two radiologists at the end of one year thoracic fellowship training, all blinded to the details of the study, interpreted the CT examinations in a routine fashion. Variation of nodule detection was assessed based on location, attenuation characteristics and reader experience; statistical significance was assessed by chi-square test.

**RESULTS**

Resident 2 and the two fellows identified significantly more nodules in all categories (p=0.01). There is significantly decreased detection of nodules at branching points, adjacent to heart and major vessels compared to those at apices, bases and at periphery of the lungs (p=0.004). Identification of mixed density nodules was significantly higher for fellows (p=0.008).

**CONCLUSION**

Dedicated chest CT training improves detection of lung nodules, particularly that of mixed attenuation nodules (which are more likely to be malignant). The detection of nodules adjacent to heart and major vessels and at branching points is difficult even for fellowship-trained radiologists.

**CLINICAL RELEVANCE/APPLICATION**

Dedicated training is required for improved lung nodule detection. Nodules in certain locations may be difficult to detect, which may be improved with our dedicated training program. Review of MIP images and use of CAD program for lung nodule detection may also help.
SSA04-08
Agreement of Diameter- and Volume-based Pulmonary Nodule Management in Lung Cancer Screening

Marjolein Anne Heuvelmans BSc (Presenter): Nothing to Disclose, Rozemarijn Vliegenthart MD, PhD: Nothing to Disclose, Pim A. De Jong MD, PhD: Nothing to Disclose, Willem P. Mali MD, PhD: Nothing to Disclose, Gonda Jasmijn de Jonge MD, PhD: Nothing to Disclose, Geertruida H. De Bock: Nothing to Disclose, Matthijs Oudkerk MD, PhD: Nothing to Disclose

PURPOSE
To determine the agreement of diameter and volume measurements for different types of nodules found in low-dose computed tomography lung cancer screening, using data of the NELSON trial.

METHOD AND MATERIALS
The study was institutional review board approved. Data of 2,240 solid nodules with volume of 50-500mm^3 (intermediate-sized) detected at baseline in 1,498 participants were used. Volume based on semi-automatically (SA) derived maximal transversal (MT) diameter and mean of MT and perpendicular diameter were compared to SA-derived volumes by Bland-Altman plots; both for the total group of nodules, per margin (smooth, lobulated, spiculated and irregular) and per shape (spherical or non-spherical). Diameters in a random sample of 100 nodules were measured manually by two independent radiologists, and compared to the SA-derived diameters in a prospective validation study. Moreover, the implications for referral rates were evaluated for the use of a diameter-based or a volume-based protocol.

RESULTS
Median participant age was 59 years (interquartile range:8), and 212/1,498 (14.2%) were women. Using SA-derived mean or MT diameter to assess nodule volume lead to a mean volume overestimation of 47.2% (95%-confidence interval (CI):40.7%-54.7%) and 85.1% (95%-CI:81.2-89.0%), respectively, compared to SA-derived volume. For irregular and non-spherical nodules, the mean overestimation was even 161.7% (95%-CI:131.7%-191.8%) and 168.9% (95%-CI:155.2%-182.5%), respectively. Manual diameter measurement overestimated SA-derived MT diameter by ≥10% in 44% (44/100) and underestimated in 18% (18/100) of the nodules. Compared to a 10-mm criterion for referral, using SA-derived MT diameter, 7.9% (177/2240) of the volume-based indeterminate nodules would have led to direct referral. Manual measurements would even have led to 31% (31/100) referrals.

CONCLUSION
The agreement between manual and SA-derived diameter, as well as between SA-derived diameter-based volume and SA-derived volume is poor. Applying manual and SA-derived diameter measurement in CT lung cancer screening leads to a substantial shift in nodule classification compared to SA volume measurements.

CLINICAL RELEVANCE/APPLICATION
Applying manual and SA-derived diameter measurement in CT lung cancer screening leads to a substantial shift in nodule classification compared to SA volume measurements.

SSA04-09
CT Screening for Lung Cancer: The Frequency of Nonsolid Nodules, Rate of Malignancy, and Long-term Survival in a Large, Long-term Database

Claudia I. Henschke MD, PhD (Presenter): Nothing to Disclose, Rowena Yip MPH: Nothing to Disclose, James Smith MD: Nothing to Disclose, Mingzhu Liang MD: Nothing to Disclose, Dongming Xu MD, PhD: Nothing to Disclose, David F. Yankelevitz MD: Research Grant, AstraZeneca PLC Royalties, General Electric Company

PURPOSE
The diagnostic workup of nonsolid pulmonary nodules remains controversial. We address the frequency of identifying such nodules, the frequency of resolution or growth, the frequency and stage of lung cancer diagnoses, and long-term survival of those diagnosed with lung cancer.

METHOD AND MATERIALS
Using the screenings in the database, we identified participants with one or more nonsolid nodules identified in the first, baseline round to determine whether the nodule resolved, decreased in size, remained unchanged, or increased in size or CT attenuation. Nodule size was based on the average nodule diameter. Follow-up time for the diagnosed cases of lung cancer was from the date of diagnosis to April 1, 2014 or death, whichever came first.

RESULTS
Among the 58,062 participants who underwent baseline CT screening, the prevalence of at least one nonsolid nodule was 4% (2,383). The frequency was: 1060 (45%) for those largest nodule < 5 mm in diameter, 956 (40%) for 5-9 mm, 231 (8%) for 10-14 mm, and 136 (7%) for 15+ mm. The nonsolid nodule resolved in 20% (N = 466), decreased in size in 7% (N = 174), was unchanged in 54% (N = 1,281), or increased in size or HU attenuation in 19% (N =462) on annual repeat scans. A diagnosis of lung cancer was made in 65 (3%) of the 2,383 participants; 3 (0.3%) for those < 5 mm, 26 (2.7%) for those 5-9 mm, 22 (9.5%) for those 10-14 mm, and 14 (10%) for those 15+ mm. Median time to diagnosis was 34 months (range: 1-123). No malignancy was diagnosed in those whose nodule resolved or decreased, 2% (N = 27) in those whose nodule did not change and 8% (N = 20) among the 462 whose nodule increased in size. All were adenocarcinoma, clinical and pathologic Stage I. There were no lung cancer deaths in the 62 who underwent resection, regardless of whether resection was lobar (N = 37) or sublobar (N = 25). None of the 3 unresected patients with a cytologic diagnosis of malignancy died of lung cancer. Median follow-up time from diagnosis was 80 months (range: 4-161 months).
CONCLUSION
Nonsolid nodules, regardless of size, can be followed annually as survival is 100% even when resected years later.

CLINICAL RELEVANCE/APPLICATION
Nonsolid nodules of any size can be followed by annual scans to assess growth.

SSA05
Emergency Radiology (Practice and Protocols)

Participants
Moderator
Aaron D. Sodickson MD, PhD: Research Grant, Siemens AG

Ferco H. Berger MD: Nothing to Disclose

Sub-Events
SSA05-01 Emergency Department Imaging Utilization: What Factors are Associated with High Imaging Volume?

Meir Hillel Scheinfeld MD, PhD: Nothing to Disclose, Kevin Burns MD (Presenter): Nothing to Disclose, Victoria Chernyak MD: Nothing to Disclose

PURPOSE
Predicting ED imaging volume would be helpful in scheduling radiologists and technologists. Our goal was to determine the relationship of triage volume, season, weather and day of the week on imaging volume.

METHOD AND MATERIALS
IRB approval was obtained. The hospital database was queried for daily ED triage volume and imaging studies performed from 2011 through 2013 at a large tertiary care urban medical center. Daily weather conditions (temperature, amount and type of precipitation) were obtained from National Oceanic and Atmospheric Administration records. 'Extreme weather' was defined as temperature <32ºF or >90ºF. Day of the week and season were recorded. Pearson correlations were first used to compare daily triage volume to imaging volume by modality. Logistic regression was used to arrive at parsimonious models with dichotomous outcomes of having high imaging volume, defined as days above the 90th percentile for a given modality. All models were adjusted for day of the week.

RESULTS
There were 485,295 ED triages and 305,493 imaging studies performed during the study period. Pearson correlations between triage volume and imaging modality yielded r=0.73 (p<0.0001) for XR, >37 US or >73 CT exams. For every additional 50 triaged patients, the odds of having high XR volume increased by 4.3 times (95% CI 2.9-6.3, p<0.0001).

CONCLUSION
Higher ED triage volume is strongly associated with high XR volume and, to a lesser extent, with high CT and US volume. Extreme weather is associated with increased odds of having high CT volume but not US or XR. Amount or type of precipitation were not associated with high imaging volume.

CLINICAL RELEVANCE/APPLICATION
ED triage volume is the primary association of imaging volume, most prominently for radiography; therefore, factors which influence ED triages should be considered when determining radiology and technologist staffing.

SSA05-02 Imaging Utilization Trends in Emergency Departments in the Medicare Population

Santosh Kumar Selvarajan MD (Presenter): Nothing to Disclose, David C. Levin MD: Consultant, HealthHelp, LLC Board of Directors, Outpatient Imaging Affiliates, LLC, Laurence Parker PhD: Nothing to Disclose, Vijay Madan Rao MD: Nothing to Disclose

PURPOSE
Policymakers and payers have been concerned with the rapid growth in imaging utilization. But recent studies have shown that outpatient advanced imaging use has leveled off and begun to drop. Our purpose was to see if this trend has manifested itself in Emergency Departments (EDs).

METHOD AND MATERIALS
The nationwide Medicare Part B Physician/Supplier Procedure Summary Master Files for 2002-2012 were the data source. CPT codes for plain radiography (XR), noncardiac ultrasound (US), CT, MRI, and nuclear medicine (NM) were aggregated by modality. Medicare's place-of-service codes were used to identify those exams done during ED visits, and its specialty codes were used to determine which specialties did the interpretations. Utilization rates per 1000 Medicare beneficiaries were calculated. Trends from 2002 to 2012 were assessed.

RESULTS

Between 2002 and 2012, the ED utilization rate per 1000 of XR increased from 248.8 to 320.0 (+29%). Noncardiac US increased from 9.5 to 21.0 (+121%). CT increased from 57.2 to 147.9 (+159%). MRI increased from 1.4 to 5.1 (+264%). Only NM showed a slight numerical decline, from 2.8 to 2.1 (-25%), but this was largely due to code bundling that occurred in myocardial perfusion imaging in 2010. In each of the first 4 modalities, growth was steady and progressive with no evidence of slowing. Raw numbers per 1000 beneficiaries of accrued new exams between 2002 and 2012 were: XR 71.3, US 11.5, CT 90.7, MRI 3.7, NM -0.7. Radiologists' share of the interpretations in 2012 were: XR 97%, US 89%, CT 99%, MRI 99%, NM 93%.

CONCLUSION

In contradistinction to the trends among outpatients, utilization rates of imaging in EDs grew continuously and substantially from 2002 to 2012. The largest numerical increases were seen in CT and XR. Radiologists strongly predominate in interpreting in all modalities. The degree of growth is of some concern and suggests that more attention needs to be directed to imaging appropriateness criteria in EDs.

CLINICAL RELEVANCE/APPLICATION

n/a

SSA05-03

ED CT of the Abdomen and Pelvis Utilization has Continued to Increase, Despite what Appears to be a Reduction in Procedures caused by Code Bundling

Santosh Kumar Selvarajan MD (Presenter): Nothing to Disclose, David C. Levin MD: Consultant, HealthHelp, LLC Board of Directors, Outpatient Imaging Affiliates, LLC, Vjay Madan Rao MD: Nothing to Disclose, Laurence Parker PhD: Nothing to Disclose

PURPOSE

Previous studies have shown that the all imaging utilization rates have been stable since 2006 except CT which has continued to grow (overall annual growth of 3.4% from 2007-2009). From 2011, CPT codes for CT scans of the abdomen and pelvis were bundled into a single new code. Our purpose was to determine what effect this policy had on recent trends in CT utilization in ED.

METHOD AND MATERIALS

The nationwide Medicare Part B databases for 2000-2012 were used. The codes for CT of the abdomen and CT of the pelvis were selected for all years of the study, and the bundled codes for CT abdomen/pelvis were selected for 2011 and 2012. Procedure volumes in ED and non-Ed (inpatient, office, and outpatient) settings were calculated. To understand the trends through the bundling years (2011 and 2012), we doubled the number of bundled codes, since these would have counted as 2 exams in 2010 and before.

RESULTS

The nationwide Medicare utilization rates of both CT abdomen and CT pelvis grew from 2000 to 2007 (4.8 M. to 9.7 M.) Thereafter, from 2008 to 2010, growth had stabilized except in ED (Non-ED, 8.1 M. to 7.7 M.; ED, 1.7 M. to 2.0 M).

There is a dramatic drop off in 2011 due to bundling: non-ED, 7.7 M. 4.2 M., Ed, 2.0 to 1.2 M When the bundled exams are doubled, 2011 non-Ed is stable at 7.8 M. exams; ED increases substantially from 2010, to 2.3 M. exams. In 2012, again counting the bundled code as 2 exams, non-ED volume is stable, at 7.8 M., while ED volume again increases substantially, to 2.6 M.

CONCLUSION

Medicare volumes of CT of the abdomen and CT pelvis show an apparent decline, but this is an artifact of code bundling. While procedure volume is stable in non-ED settings, volume of CT of the abdomen and pelvis continue to grow strongly in the ED.

CLINICAL RELEVANCE/APPLICATION

New guidelines are probably required to reduce the CT utilization rates in Emergency.

SSA05-04

In-person Communication with a Radiologist in the Emergency Department Results in Improved Two-way Communication of Information, and May Improve Patient Care

Mariam Sofia Aboian MD, PhD (Presenter): Nothing to Disclose, Marcel Brus-Ramer MD, PhD: Nothing to Disclose, Allison Anne Tillack PhD: Nothing to Disclose, Mark Daniel Mamlouk MD: Nothing to Disclose, Peter Andrew Marcovici MD: Nothing to Disclose
PURPOSE
We hypothesized that the physical proximity of a radiologist to the treating providers in the ED would improve communication between radiologists and treating providers, and thus possibly improve care.

METHOD AND MATERIALS
The radiology resident on-call reading room at our university hospital was recently moved to the ED. Approximately 6 months later, the impact of this move was assessed via an IRB approved, HIPPA compliant survey [Figure 1] among ED faculty and residents ("providers") after each in-person encounter with the on-call radiology resident.

RESULTS
27 surveys were completed during the study period. Direct in-person communication with radiology residents on-call was reported as "very important" (14/27) or "important" (11/27) for managing patients in the ED. 48% of providers stated they preferred to consult with a radiologist in-person for only their most difficult patients. In-person interaction was presumed to affect patient care, with 20/27 of the responders reporting that key information was communicated to the radiologist about the patient's clinical history that would otherwise not have been communicated. In addition, 22/27 of the responders felt that they understood the imaging results better after the discussion as opposed to reading a "wet read" written report. Improved patient care due to direct communication was reported by 21/27 of the ED provider responders.

CONCLUSION
In-person communication between radiologists and ED providers was reported to be "important" or "very important" in 92% of cases, and was most often sought out by ED providers in perceived difficult cases. Critical history was provided to the radiologist that would not otherwise be communicated in 74% of surveyed encounters. Imaging findings were better understood by the ED providers in 81% of the encounters and there was improvement in patient care from the perspective of the majority of ED providers.

CLINICAL RELEVANCE/APPLICATION
In-person communication between ED providers and radiologists facilitates information sharing and thus may improve patient care in settings that require rapid communication.

Effect of Patient Primary Spoken Language on CT Utilization in the Emergency Department

Bruce E. Lehnert MD (Presenter): Nothing to Disclose, Daniel S. Hippe MS: Research Grant, Koninklijke Philips NV Research Grant, General Electric Company, E. Sally Lee PhD: Nothing to Disclose, Lauren K. Whiteside MD: Nothing to Disclose, Ken Floris Linnau MD, MS: Speaker, Siemens AG Royalties, Cambridge University Press

PURPOSE
To determine if patient spoken language is associated with utilization of CT and time to CT imaging in the ED for patients who present without a trauma-related complaint.

METHOD AND MATERIALS
In this IRB approved, HIPAA compliant study, we retrospectively reviewed all adult ED visits from 10/1/2012 to 5/30/2013. Patient demographics, reported primary spoken language (PSL), Emergency Severity Index (ESI) score, time of ED admission and discharge, and CT (if performed) order time were recorded. Trauma and psychiatric patients, those with ESI scores 1 and 2, those with missing demographics, PSL or discharge time were excluded. The remaining patients were classified as moderate acuity (ESI=3) and low acuity (ESI=4, 5). Cox regression was used to evaluate the relationship between PSL and rate of CT while adjusting for other confounders. The association between PSL and time to CT order was assessed using generalized estimating equations (GEEs) while adjusting for other factors.

RESULTS
There were 17,651 ED visits by 12,124 patients which met the inclusion/exclusion criteria. 1,907 (16%) reported a non-English as their PSL. Before adjustments, a CT was ordered for 10.2% of patients with English PSL and 15.2% of patients with non-English PSL. In those for whom a CT was ordered, the average time to order was 124 +/- 93 min (English PSL) and 141 +/- 88 min (non-English PSL). After adjusting for sex, age, number of visits and time of admission, moderately acute patients with a non-English PSL had a 44% (CT: 23-68%; p<0.001) higher chance of getting a CT ordered when in the ED >1.5 hrs and had a 13.6 min longer mean time to CT order (CI: 3.0-24.3; p=0.01). Non acute patients with non-English PSL had an 88% (CI: 26-181%; p=0.002) higher chance of getting a CT ordered when in the ED >1.5 hrs and had a 41.6min longer mean time to CT order (CI: 11.2-72.0; p=0.007). CT ordering rates were comparable when done < 1.5 hrs after admission.

CONCLUSION
Patients who report a non-English PSL have a significantly increased likelihood of undergoing CT in the ED and there is a significantly longer time to CT order placement.

CLINICAL RELEVANCE/APPLICATION
In-person communication between ED providers and radiologists facilitates information sharing and thus may improve patient care in settings that require rapid communication.
Patient primary spoken language association with CT use in the Emergency Departments represents a potential source for disparity in health care between English and non-English speaking patients.

SSA05-06

**Dual Energy Post-processing of Incidental Renal Lesions Encountered in the Emergency Department: Reducing the Need for Follow-up Imaging**

Jeremy Robert Wortman MD (Presenter): Nothing to Disclose, Urvi Pravin Fulwadhva MD: Nothing to Disclose, Jeffrey Y. Shyu MD: Nothing to Disclose, Aaron D. Sodickson MD, PhD: Research Grant, Siemens AG

**PURPOSE**

To quantify the incidence of indeterminate renal lesions during routine dual energy CT (DECT) in an Emergency Department (ED) setting, and to assess the potential of DECT post-processing to characterize lesions and eliminate the need for further follow-up evaluation.

**METHOD AND MATERIALS**

1,400 consecutive contrast enhanced abdominal CT scans were included in the study cohort, obtained in the ED using a DE CT protocol (Siemens SOMATOM Definition Flash). All scans were reviewed by a radiologist to assess for the presence of an indeterminate renal lesion defined for potentially solid lesions as size > 5 mm, attenuation > 20 HU, and lack of macroscopic fat, or for a cystic lesion as presence of thick septations or calcifications, thickened wall, or mural nodules. DE post-processing was performed on all lesions, which were considered enhancing if there was greater than 15 HU from iodine in contained DE regions of interest. All lesions were subsequently re-classified as benign or indeterminate.

**RESULTS**

At least one indeterminate renal lesion was identified in 57 (4.1%) patients, with mean lesion size of 1.7 cm. 36/57 (63%) were classified as benign (non-enhancing) after review of the iodine overlay images (36/36 Bosniak II cysts). The remaining 21 lesions (37%) could not be classified as benign (14 enhancing masses; 12/14 < 20 mm, 2/14 > 20 mm; 6 Bosniak IIF cysts, 1 Bosniak III cyst). Of the 57 indeterminate lesions, 9 had correlative imaging obtained with MR, CT, or US, with concordant results in all cases (1 enhancing mass, 8 Bosniak II/IIF cysts).

**CONCLUSION**

4.1% of ED patients undergoing abdominal CT had an incidentally detected indeterminate renal lesion. DE CT exonerated 63% of these lesions as benign, potentially averting the need for further workup in 2.6% of ER patients imaged by abdominal CT.

**CLINICAL RELEVANCE/APPLICATION**

If performed routinely, dual energy CT has the potential to substantially reduce the need for follow-up imaging to further characterize indeterminate renal lesions incidentally detected on Emergency Department abdominal CT scans.

SSA05-07

**Non-trauma-associated Incidental Findings in Whole-body CT Examinations in Patients with Suspected Multiple Trauma**

Martin Helmut Maurer MD (Presenter): Nothing to Disclose, Eduard Kroczek: Nothing to Disclose

**PURPOSE**

In patients with suspected multiple trauma whole-body computed tomography (wbCT) is the gold standard in the initial diagnostic work-up. As wbCT gives not only a rapid and precise overview on traumatic lesions it may also reveal associated non-traumatic findings of variable clinical importance. The aim of this study was to evaluate the number and quality of such incidental findings in patients that underwent whole-body CT examination due to suspected multiple trauma in a Level 1 trauma center.

**METHOD AND MATERIALS**

In a retrospective study between 2009 and 2013 a total of 2,909 patients (1,909 male, 800 female) with suspected multiple trauma were retrospectively analyzed with regard to non-trauma-associated incidental findings obtained in whole-body CT examination at initial admission. Findings were categorized by two readers in consensus according to the body region (head, neck, thorax, abdomen/pelvis, musculoskeletal system) and their clinical importance (category 1 = further diagnostic work-up or therapeutic intervention urgently needed within initial hospitalization; 2 = further work-up needed within less than 3 months; 3 = findings that may result in health problems in the future; 4 = benign incidental finding, no further work-up needed, variants).

**RESULTS**

Overall, 5,997 incidental findings were documented in 2,074 patients, thereof 1,135 in the head, 262 at the neck, 1,280 in the thorax, 2,541 in the abdomen and 779 findings of the musculoskeletal system. There were 294 patients (9.9%) with a category 1 finding where further work-up or therapy was urgently needed, 673 patients (24.8%) with a category 2 finding, 775 patients (28.6%) with a category 3 finding and 332 patients (12.2%) with a category 4 finding.

**CONCLUSION**
Whole-body CT scans of patients with a suspected multiple trauma show a considerable number of non-trauma-associated incidental findings. There was at least one incidental finding in one out of two patients and a finding requiring urgent follow-up or therapy in one out of ten patients.

CLINICAL RELEVANCE/APPLICATION

In patients initially imaged with wbCT for suspected multiple trauma, radiologists and trauma surgeons must be aware of a high number of non-traumatic incidental findings with clinical relevance.

Incidence of Acute Myocardial Infarction in Patients with Suspected Acute Pulmonary Embolism: Rationale for Low Dose Triple Rule out CT in the Acute Setting

Shamir Rai BSC: Nothing to Disclose, David Tso MD (Presenter): Nothing to Disclose, Patrick McLaughlin FFR(RCSI): Nothing to Disclose, Savvas Nicolaou MD: Nothing to Disclose

PURPOSE

The purpose of our study was to retrospectively determine the incidence of acute myocardial infarction (MI) in emergency patients with suspected pulmonary embolism (PE) who underwent chest computed tomography pulmonary angiography (CTPE). Given the advent of low dose Triple-Rule-Out (TRO) CT examination with advanced detector and reconstruction technology, reduced contrast medium volumes and improved image quality at low tube kilovoltage, and the continued morbidity, mortality, costs, and catastrophic consequences associated with missed acute MIs it would seem feasible to perform TRO CT examinations over CT chest (CTPE) when looking for a suspected PE in the acute setting in high-risk patient populations.

METHOD AND MATERIALS

The reports of 4596 consecutive patients who underwent CTPE between January 2011 and March 2014 at a single institution were retrospectively reviewed. The total number of patients that displayed CT signs of an acute MI were recorded and compared to the total number of CTPE that were conducted in the given time period.

RESULTS

Seventeen patients, of which 12 were male and 5 were female, ranging in age from 47 to 90, (mean age, 68.82 +/- 13.87 [SD] years) were identified as having an acute MI when being worked up for a PE via CTPE out of a total of 4596 chest CTs (PE protocol) conducted (0.37%). A total of 13 out of 17 patients (76%) were over the age of 60 with identified MI on the CTPE protocol.

CONCLUSION

This investigation establishes a baseline of 0.37% for the incidence of MI in patients being worked up for PE via chest CTPE protocol. Determination of the number of patients with aortic dissection, valvular, myocardial and other coronary artery disease (CAD) has not been explored in this study, but would further support a TRO CT over a chest CT (CTPE). As it stands TRO CT examination techniques, especially in patients over the age of 60, have the potential to reduce the number of hospitalized patients and reduce total health care costs.

CLINICAL RELEVANCE/APPLICATION

Full TRO CT protocol should be considered over chest CT (CTPE) protocol for suspected acute PE in patients over the age of 60. This reduces the chances of missing significant findings such as a MI in a high-risk population.

Maximizing the Golden Hour: Assessing the Novel Prototype Polytrauma Viewer in the Setting of Unstable Acute Polytrauma Patients

Shamir Rai BSC: Nothing to Disclose, David Tso MD (Presenter): Nothing to Disclose, Patrick McLaughlin FFR(RCSI): Nothing to Disclose, Chesnal Dey Arepalli MD: Nothing to Disclose, Luck Jan-Luck Louis MD: Nothing to Disclose, Savvas Nicolaou MD: Nothing to Disclose

PURPOSE

The purpose of this study is to evaluate the clinical utility of the novel prototype Polytrauma Viewer (Siemens Healthcare, Forchheim, Germany) in the setting of unstable acute polytrauma patients.

METHOD AND MATERIALS

32 unstable blunt acute trauma patients, between Nov. 2009 and Mar. 2014, meeting the criteria of SBP = 16, at a level 1 trauma center who underwent a whole-body CT (WBCT) scan were identified. Time to conduct the WBCT and time to final reconstruction was recorded. Two trauma radiologists (combined experience of 24 years) were blinded and interpreted the scans for life-threatening injuries [defined as non-contained vascular injury, unstable fractures, aortic dissection, tension pneumothorax, and intra/extra axial hemorrhage with significant mass effect] using the PACS workstation as the gold standard and the novel Polytrauma Viewer. Qualitative and quantitative measurements were used for image assessment. Time to load and process images, time to interpret and reach a final diagnosis, confidence of exclusion of life-threatening injuries (on a scale of 1-10, with 1 representing no confidence and 10 representing high confidence) and missed diagnosis were recorded when compared to the final report.

RESULTS

The mean total time to scan, perform the WBCT and complete the last reconstruction was 458s±258, 18.47s±11.89 and 3454s±1610 respectively. A significant reduction (p

CONCLUSION

The novel Polytrauma Viewer (Siemens Healthcare, Forchheim, Germany) is a promising prototype that can
reduce the time to identification of life-threatening injuries in the acute traumatic setting through automatic reconstruction techniques and autosplitting the WBCT.

**CLINICAL RELEVANCE/APPLICATION**

The novel Polytrauma Viewer can reduce the time to identification of life-threatening injuries in the acute traumatic setting without diagnostic compromise, thereby potentially improving patient outcome and increasing the likelihood of patient survival.

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**SSA06**

**Gastrointestinal (Dual Energy CT)**

**Scientific Papers**

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

**ARRT Category A+ Credits:** 1.50

**Sun, Nov 30 10:45 AM - 12:15 PM**

**Location:** E353A

**Participants**

- **Moderator**
  - Laura R. Carucci MD : Nothing to Disclose
- **Moderator**
  - Dushyant V. Sahani MD : Research Grant, General Electric Company

**Sub-Events**

**SSA06-01**

**Impact of a Second-Generation Virtual Monochromatic Algorithm on the Conspicuity of Hypervascular Liver Tumors Using Dual-Source Dual-Energy MDCT**

- **Daniele Marin** MD (Presenter) : Nothing to Disclose, Achille Mileto MD : Nothing to Disclose, Juan Carlos Ramirez Giraldo PhD : Employee, Siemens AG

**PURPOSE**

To investigate the impact of a second-generation virtual monochromatic algorithm on the conspicuity of hypervascular liver tumors and image noise, using dual-source dual-energy MDCT.

**METHOD AND MATERIALS**

A custom anthropomorphic liver phantom simulating different levels of enhancement of hypervascular lesions in three adult body sizes was imaged with a second-generation dual-source MDCT using both dual-energy (100/Sn140 kVp) and single-energy acquisitions, at various energy levels (80,100,120, 140 kVp). For each phantom size, the radiation output was kept constant for all scans. Virtual monochromatic images from the dual-energy dataset were reconstructed at energy levels ranging from 40 to 140 keV, using both first-generation (Syngo DE Monoenergetic) and second-generation (Syngo DE Monoenergetic PLUS) virtual monochromatic algorithms. Noise and tumor-to-liver contrast-to-noise ratio (CNR) were calculated and compared among different reconstructed datasets, for all phantom body sizes.

**RESULTS**

On single-energy imaging, the minimum noise level was observed at 120 kVp for the small and at 140 kVp for the medium and large phantom sizes; 80 kVp yielded the highest tumor-to-liver CNR for all phantom sizes. For the first-generation virtual monochromatic algorithm, noise was lowest at 70 keV in the small and medium phantom sizes, and 80 keV in the large phantom size; an energy level of 60 keV yielded the highest tumor-to-liver CNR for all phantom sizes. For the second-generation virtual monochromatic algorithm, noise was lowest at 80 keV for the small and the medium phantom sizes, and 90 keV for the large phantom size; an energy level of 40 keV yielded the highest tumor-to-liver CNR for all phantom sizes. In the large phantom, second-generation virtual monochromatic images at an optimal energy yielded significantly higher tumor-to-liver CNR, compared to either single-energy or first-generation virtual monochromatic images (P<0.01).

**CONCLUSION**

Second-generation virtual monochromatic algorithm may improves the conspicuity of hypervascular liver tumors compared to single-energy and first-generation virtual monochromatic images, in larger body sizes.

**CLINICAL RELEVANCE/APPLICATION**

Second-generation optimal energy virtual monochromatic images may substantially improve the conspicuity of hypervascular liver tumors in larger patients.

**SSA06-02**

**Dual Energy MDCT in Hypervascular Liver Tumors: Effect of Patient Body Size on Selection of the Optimal Monochromatic Energy Level**
PURPOSE

To investigate the effect of body size on selection of the optimal monochromatic energy level for maximizing conspicuity of hypervascular liver tumors during late hepatic arterial phase with dual-energy MDCT.

METHOD AND MATERIALS

An anthropomorphic liver phantom having three different body sizes and iodine-containing inserts simulating low- and high-contrast hypervascular liver lesions was imaged with dual-energy MDCT and single-energy MDCT at various polyenergetic energy levels (80, 100, 120 and 140 kVp). Dual energy MDCT was also performed in 48 patients with 114 hypervascular liver tumors; virtual monochromatic images were reconstructed at energy levels ranging from 40 to 140 keV at 10 keV increments. The effect of body size and lesion iodine concentration on image noise and tumor-to-liver contrast-to-noise ratio (CNR) was compared among the different datasets for both phantoms and patients.

RESULTS

The highest tumor-to-liver CNR was noted at 80 kVp for all phantom sizes. On virtual monochromatic images, the minimum noise was noted at 70 keV, for small and medium phantom sizes, and at 80 keV, for the large phantom. CNR was highest at 50 keV, for the small and medium phantoms, and at 60 keV, for the large phantom (P<0.0001). Compared with 80 kVp images, optimized monochromatic energy images yielded significantly higher CNR for low-contrast lesions, in all phantom sizes (P<0.0001). The optimal monochromatic energy level for maximizing tumor-to-liver CNR in patients increased proportionally to body size (P<0.0001).

CONCLUSION

Selection of the optimal monochromatic energy level for maximizing the conspicuity of hypervascular liver tumors is significantly affected by patient's body size.

CLINICAL RELEVANCE/APPLICATION

Optimized monochromatic energy images may improve the conspicuity of hypervascular liver tumors in patients having a variety of sizes, which may be particularly beneficial for detecting subtle lesions in patients with cirrhosis.

Feasibility of Dual-energy CT for Iodine Contrast Media Reduction: An Animal Study

Yong Eun Chung MD, PhD (Presenter): Nothing to Disclose, Hye-Jeong Lee MD: Nothing to Disclose, Myeong-Jin Kim MD, PhD: Nothing to Disclose

PURPOSE

To investigate the feasibility of dual energy CT (DECT) for iodine contrast media reduction in the diagnosis of hypervascular and hypovascular focal liver lesions.

METHOD AND MATERIALS

A VX2 tumor was implanted in two different segments of the liver in 13 rabbits. After 2-4 weeks, two phase contrast enhanced CT scans including the late arterial phase (LAP) and hepatic venous phase (HVP) were performed three times with 24 hour intervals. Contrast media of 1 ml/kg was injected via the ear vein during a 7 second period, with three different concentrations of iodine, i.e. 300 (I\textsubscript{300}), 150 (I\textsubscript{150}) and 75 mgI/mL (I\textsubscript{75}).

The mean HU and standard deviation (SD) was measured in the liver, the hypervascular portion of the VX2 tumor which represented hypervascular tumors, and the central necrotic area of the VX2 tumor, which represented hypovascular tumors in 140 kVp images with I\textsubscript{300} as a reference standard. The mean HU and SD were also measured in monochromatic images (between 40keV and 140 keV with 10 keV intervals) at the same locations with I\textsubscript{150} and I\textsubscript{75}. Contrast-to-noise ratio (CNR) for hypervascular lesions in LAP and hypovascular lesions in HVP were calculated and the ratio of CNR (CNR\text{ratio}) between monochromatic image sets with I\textsubscript{150} and I\textsubscript{75} and the reference standard was calculated.

RESULTS

A total of 23 VX2 tumors in 25 rabbits were evaluated. For hypervascular lesions, CNR\text{ratio} was higher than 1 in 40 keV (1.23), 50 keV (1.28) and 60 keV (1.17) images with I\textsubscript{150}, whereas CNR\text{ratio} wasn't higher than 1 in any keV images with I\textsubscript{75}. In terms of hypovascular lesions, CNR\text{ratio} was higher in 40 keV (2.19), 50 keV (1.55) and 60 keV (1.16) with I\textsubscript{150}, and 50 keV (1.24) and 70 keV (1.14) with I\textsubscript{75}.

CONCLUSION

With dual energy CT, the total amount of iodine contrast media might be halved in the diagnosis of hypervascular liver lesions and reduced to one fourth in the diagnosis of hypovascular liver lesions, while preserving CNRs of the focal liver lesion.
CLINICAL RELEVANCE/APPLICATION

In patients with impaired renal function, the total amount of iodine contrast media can be reduced by using DECT without deteriorating diagnostic performance for focal liver lesions.

SSA06-04

Elucidation of the Perfusion Characteristics of Dual-energy Iodine-related Attenuation in Hepatocellular Carcinoma Using Volume Perfusion CT

Wolfgang M. Thaiss (Presenter): Nothing to Disclose, Ulrike Haberland : Employee, Siemens AG, Konstantin Nikolaou MD : Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG, Marius Horger MD : Nothing to Disclose, Alexander Sauter : Nothing to Disclose

PURPOSE

Iodine-related attenuation (IRA) acquired with dual energy CT is regarded as a perfusion surrogate marker. The purpose of the study was to compare this technique with Volume Perfusion CT (VPCT) in HCC patients.

METHOD AND MATERIALS

After approval, 20 patients (mean age 69.2) with untreated HCC were enrolled in a liver perfusion at 80 kV, using a Siemens Somatom Definition AS+. VPCT evaluation and ROI measurements - encompassing the maximum tumor outline - were carried out using a dedicated postprocessing software (syngo Volume Perfusion CT Body, Siemens). 20 lesion were evaluated. Next, the time-resolved perfusion scans were split in single time points. IRA maps were calculated for the time points in 3.5 sec steps starting at the peak enhancement of the abdominal aorta. Finally, the same VPCT-tumor-ROI was drawn and iodine concentration (IC) values were calculated for the 80 kV scans.

RESULTS

VPCT perfusion parameters were as follows: (tumor): blood flow (BF) 51.7 ± 17.0 (mL/100 mL/min), blood volume (BV) 12.6 ± 4.3 (mL/100 mL); (liver): arterial liver perfusion (ALP) 42.4 ± 15.0 (mL/100 mL/min), portal-venous perfusion (PVP) 10.3 ± 9.1 (mL/100 mL/min), hepatic arterial perfusion index (HPI) 84.4 ± 12.6. Peak enhancement in the lumen of the aorta was reached at 17.6 ± 4.4 sec. Tumor IC (mg/DL) for the different time-points: 65.9 ± 41.7 (at peak enh. aorta), 110.6 ± 65.3 (p. enh. a. + 3.5 sec), 129.1 ± 61.7 (+ 7 sec), 131.6 ± 56.0 (+ 10.5 sec), 126.9 ± 46.6 (+ 14 sec), 115.6 ± 44.1 (+ 17.5 sec). Highest time-point correlations between perfusion parameters and IC: BF and IC r = 0.683 at peak enh. ao. + 7 sec (P = 0.001), BV and IC r = 0.640 peak enh. ao. (P = 0.003), ALP and IC r = 0.802 (+ 7 sec) (P < 0.001), PVP and IC no correlation, HPI and IC r = 0.477 peak enh. ao. (P = 0.003).

CONCLUSION

In HCC, the evaluated tumor IC are not as robust as VPCT measurements, reflected by higher standard deviations. Good correlations between IC values and BF, BV, ALP could be found. If dual-energy iodine maps should reflect BV or HPI, a scan 7 seconds after the aortic peak enhancement is recommended. However, VPCT with kinetic modeling allows for the differentiation of various perfusion parameters.

CLINICAL RELEVANCE/APPLICATION

The significance of IRA as a perfusion surrogate from dual-energy is unclear. Therefore we've performed a comparison with VPCT in HCC, showing a good correlation but lack of robustness of IRA as compared to quantitative VPCT.

SSA06-05

Comparison of Image Quality and CT Numbers between True-noncontrast and Virtual Noncontrast Images of the Abdomen from Second-generation Dual-source CT Scanner


PURPOSE

To compare image quality and CT numbers between true-noncontrast (TNC) and virtual noncontrast (VNC) images of the abdomen from second-generation dual-source dual-energy CT (DSCT) scanner

METHOD AND MATERIALS

IRB-approved, HIPPA-compliant retrospective study of 42 subjects (mean age 59.7 yrs. [SD=9.1]) who underwent 3-phase CT of the liver on a DSCT scanner (Flash, Siemens Healthcare) using single energy (SE) (120kVp) and dual energy (DE) protocol (100/Sn140kVp), on different occasions. Four sets of images (TNC-SE, TNC-DE and VNC reconstructed from the arterial [VNCa] and portal-venous [VNCp] phases from DE exams) of the abdomen from each patient were randomly reviewed by 5 readers, who graded the image quality (1. Very good; 2. Good; 3. Fair; 4. Poor; 5. Very poor) and the presence of artifacts (1. None; 2. Do not affect interpretation; 3. Affect interpretation but diagnosis still possible; 4. Inadequate for use). Acceptable image quality was defined as a score ≤3, and acceptable artifact as a score ≤3. Regression analysis was used to assess differences in scores for image quality and artifacts, and differences in CT numbers obtained in the liver,
kidneys, spleen, inferior vena cava, aorta and retroperitoneal (RP) fat.

RESULTS

Compared to TNC-DE, the mean proportion of acceptable image quality was 0.114 lower for VNCa (95% CI: 0.077, 0.152) and 0.119 lower for VNCp (95% CI: 0.073, 0.165). The difference between the VNCa and VNCp was small and not statistically significant (0.005, 95% CI: -0.031, 0.041). VNC sets had high frequencies of acceptable artifacts (VNCa: 0.995, VNCp: 0.986), and the differences among them were not statistically significant. For the liver, the mean difference in CT number between TNC-DE and VNCa was -0.7 (95% CI: -1.7, 0.3), and between TNC-DE and VNCp was -0.7 (95% CI: -1.7, -0.3). The largest differences in the mean CT numbers between VNCa and TNC-DE was in the aorta (50.2 vs. 40.8, 95% CI: 6.8, 11.9), and the largest difference between VNCp and TNC-DE was in the RP fat (-87.2 vs. -92.4, 95% CI: 4.0, 6.8). In the liver, spleen and RP fat both VNC sets showed a better agreement with TNC-DE than with TNC-SE.

CONCLUSION

VNC images had high frequency of acceptable image quality and artifacts, with small differences in CT numbers compared to TNC-DE.

CLINICAL RELEVANCE/APPLICATION

VNC is an alternative to TNC images of the abdomen, which helps decrease patients' exposure to radiation.

SSA06-06

Virtual Unenhanced Images of the Abdomen with Third-generation Dual-source Dual-energy CT and Third-generation Iterative Reconstruction: Image Quality, Attenuation and Radiation Dose


PURPOSE

To compare image quality, attenuation and radiation dose between virtual unenhanced (VU) and conventional unenhanced (CU) datasets of the abdomen obtained with a 3rd generation dual-source dual-energy CT system (DECT). The impact of a 3rd generation iterative reconstruction algorithm (ADMIRE) was also assessed in comparison to filtered back projection (FBP).

METHOD AND MATERIALS

Eight patients underwent triphasic abdominal CT examinations including single-energy CU (120kV, 147 ref.mAs) and dual-energy arterial and portal venous phase acquisitions (100/Sn150kV, 180/90 ref.mAs). VU images were generated from arterial (AVU) and portal venous (PVU) phases. CU, AVU and PVU data-sets were reconstructed using FBP and ADMIRE (strength 3). Two abdominal radiologists analyzed the image quality using a five-point scale. Radiation dose, attenuation and noise of the abdominal organs and aortic calcifications were recorded for both FBP and ADMIRE in CU, AVU and PVU datasets.

RESULTS

Mean image quality scores of DECT VU images with ADMIRE was not significantly different than the mean image quality of CU images (4.830.12) for both AVU (4.790.9) and PVU (4.750.14), (p>.05). The mean attenuation values of liver, spleen, pancreas, renal cortex, aorta, and retroperitoneal fat did not differ significantly among CU, AVU, and PVU images (p>.05). There was however a significant difference in mean attenuation for small calcified aortic plaques, with a reduction in density for VU images (37939, 21756, 33478 HU for CU, AVU and PVU, respectively, p<.01). The radiation dose of the single-energy and dual-energy acquisitions did not differ significantly (3.221.25, 3.251.26, 3.231.27 mSv for CU, AVU and PVU, respectively, p>.05). The potential dose reduction that would have been achieved by omitting the unenhanced acquisition was 33.2% (p<.01).

CONCLUSION

3rd generation DECT VU images with the ADMIRE iterative reconstruction algorithm showed comparable image quality as single energy CU images with complete iodine subtraction, albeit with a reduction in the density of calcifications on VU images. There was no significant difference in radiation dose between dual-energy and single energy acquisitions.

CLINICAL RELEVANCE/APPLICATION

Despite an imperfect calcium subtraction, a 3rd generation DECT VU imaging technique using the ADMIRE algorithm has the potential to replace CU images in clinical practice.

SSA06-07

Comparison of Radiation Dose and Noise Levels From Single Energy and Dual Energy Computed Tomography Examinations of the Abdomen In Vivo and in Phantom Experiments

PURPOSE
To compare the radiation dose and noise levels between single energy (SE) and dual energy (DE) computed tomography (CT) examinations of the abdomen performed in the same dual-source CT (DSCT) scanner.

METHOD AND MATERIALS
IRB-approved, HIPPA-compliant prospective study of 45 adult subjects (mean age: 60.3 yrs. [SD=9.0] and mean effective diameter: 35.5 cm [SD=4.4]), who on different occasions had 3-phase exam of the liver in the same DSCT scanners (Flash, Siemens Healthcare) using SE protocol (120kVp; weight-based mAs) and DE protocol (100/Sn140kVp; mAs adjusted to match the CTDIvol of a weight-based mAs SE scan). The dose metrics (volume computed tomography dose index [CTDIvol], dose-length product [DLP], size-specific dose estimate [SSDE] and effective dose) from each phase were recorded. Image noise was obtained in the liver, retroperitoneal (RP) fat, IVC, and aorta. Distributions of outcome variables (dose and noise) were examined using Q-Q plots and Shapiro tests. A semi-anthropomorphic abdominal phantom (QRM GmbH, Germany) with two “fat” rings simulating patients with 30, 35 and 40-cm lateral dimensions was scanned with DECT and SECT at multiple dose levels to obtain the noise vs. dose curves.

RESULTS
All the dose metrics were significantly higher with SECT than with DECT (p < 0.001). The mean total DLP and effective dose on SECT were 1339 mGy-cm (SD, 544.63) and 20.09 mSv (SD, 8.17), and the mean total DLP and effective dose in DECT were 853.22 mGy-cm (SD, 281.84) and 12.8 mSv (SD, 4.23), respectively. The differences between SECT and DECT increased as the patient’s effective diameter increased (p < 0.001). Noise levels in the liver (20 vs 18.5), IVC (22.2 vs 19.5), RP fat (21 vs 18.9) and aorta (24.3 vs 22.5) were greater on DE compared to SE exams (p<0.05). In the phantom study, the CTDIvol at equal image noise was less for DECT vs. SECT by 11-15% depending on the phantom size. These results are consistent with the clinical study, especially after accounting for the difference in noise between DECT and SECT.

CONCLUSION
Abdominal DECT had a significantly lower radiation dose at similar or equal noise levels compared to SECT in both clinical and phantom studies.

CLINICAL RELEVANCE/APPLICATION
These results are critical for implementation of DECT of the abdomen in clinical practice, as they show that this technique does not necessarily come at the expense of higher radiation doses.
**Impact of Nonlinear Image Blending Techniques for Contrast Medium Dose Reduction during Abdominal Dual Energy MDCT**

**Achille Mileto MD (Presenter):** Nothing to Disclose  
**Daniele Marin MD:** Nothing to Disclose  
**Juan Carlos Ramirez Giraldo PhD:** Employee, Siemens AG  
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**Emanuele Scribano:** Nothing to Disclose  
**Giorgio Ascenti MD:** Nothing to Disclose

**PURPOSE**

To compare the image quality of a dual-energy nonlinear image blending technique, at reduced load of contrast medium, with a full-dose simulated 120 kVp linear blending technique during the portal venous phase of the abdomen.

**METHOD AND MATERIALS**

Forty-five patients (25 men, 20 women; mean age, 65.6±9.7 years; mean body weight, 74.9±12.4 kg) underwent contrast-enhanced single-phase dual energy CT of the abdomen by a random assignment to one of three different contrast medium dose injection protocols using iomeprol 400 mgI/mL: (a) 1.3 mL of per kilogram of body weight (full dose, 100%), (b) 1.0 mL per kilogram of body weight (75%), and (c) 0.65 mL per kilogram of body weight (50%). Simulated 120 kVp linear blended images at full contrast dose, and nonlinear blended images at 75% and 50% contrast medium doses were reconstructed. Contrast-to-noise ratio and noise (at portal vein, liver, aorta, and kidney) were compared between the different datasets, using the analysis of variance. Three readers qualitatively assessed image quality for all data sets in a blinded and independent fashion.

**RESULTS**

Nonlinear blended images at 75% contrast medium dose allows for a significant improvement in contrast-to-noise ratio (P < .05 for all comparisons) compared with simulated 120 kVp linear blended images at full dose. No statistically significant difference existed in contrast-to-noise ratio and noise between nonlinear blended images at 50% contrast medium dose and simulated 120 kVp linear blended images at full dose. Nonlinear blended images at 50% contrast medium dose were considered acceptable, by all readers.

**CONCLUSION**

Dual energy nonlinear image blending allows for reducing the dose of contrast medium up to 50% during portal venous phase, while preserving image quality.

**CLINICAL RELEVANCE/APPLICATION**

The possibility of obtaining clinically adequate image quality with a 50% reduction of the contrast medium dose may be clinically exploited to minimize patient risks while containing costs.
PURPOSE
To assess the accuracy of current generation multidetector-row CT scanner by using multiplanar reconstructions (MPR) in identifying the mesorectal fascia (MRF) invasion, in rectal cancer patients, in comparison with conventional MRI.

METHOD AND MATERIALS
A total of 79 patients with biopsy proven primary adenocarcinoma of the rectum who were referred for thoracic and abdominal CT staging were enrolled in this study. The contrast-enhanced MDCT scans were performed both on a 256 row scanner (ICT, Philips) and on 16 row scanner (Brilliance 16P, Philips) with the following acquisition parameters: tube voltage 120 KV and tube current 150-300 mAs (depending on patient’s weight). Multplanar CT reconstructions were performed and the imaging data were reviewed as axial images and then as MPR images: coronal, sagittal, perpendicular and parallel along with rectal tumour axis. The MRF was readily identified in all patients as a thin, isodense to muscle, curvilinear envelope adjacent to the rectum and the mesorectal fat. The MR study, performed on 1.5 T with a dedicated phased array multicoil, included multplanar T2 weighted sequences and axial T1 weighted sequences. Axial and MPR CT images were then compared to MRI imaging in order to assess the involvement of MRF. Diagnostic accuracy of both modalities was compared and statistically analyzed.

RESULTS
All the CT scan studies were diagnostic in terms of detection of rectal cancer; among the 79 patients, the tumor characteristics suggested by multidetector-row CT agreed with those of MRI. All the patients underwent to surgical rectal excision. Considering the row CT axial images, the overall sensitivity and specificity were respectively 82.6% and 70%, PPV was 79%, NPV 74% and accuracy of 77%; while performing multplanar reconstructions the sensitivity increased to 87% and specificity to 85%, PPV was 89%, NPV 82% and accuracy of 86%.

CONCLUSION
CT technique with new generation of scanner, by producing high resolution images, represents a useful and reliable diagnostic tool in the assessment of loco-regional and whole body staging of patient with locally advanced rectal cancer.

CLINICAL RELEVANCE/APPLICATION
MDCT, producing higher resolution and multi-planar reformation of the images, should be considered as alternative technique in rectal cancer staging, especially in patient with MRI contraindications.

PURPOSE
To compare reformatted images from three-dimensional (3D) CUBE T2-weighted fast spin-echo MR sequence with tri-planar images acquired two-dimensional (2D) T2-weighted fast spin-echo sequence in terms of image quality and accuracy of T staging of rectal cancer.

METHOD AND MATERIALS
58 patients (mean age, 58.4 years; range, 26-80 years) with rectal cancer conformed by colonoscopy and biopsy were enrolled in this study. All patients underwent pelvic MRI examination at 1.5 T. MRI sequences included a single coronal 3D CUBE T2-weighted fast spin-echo MR sequence with 1.4-mm-thinkness and a 2D T2-weighted fast spin-echo sequence in the sagittal, coronal, and axial planes with 5-mm-thickness. The other two planar images of 3D CUBE sequence were reconstructed at GE AW4.5 workstation with 5 mm thickness and no interslice gap. The total acquisition times of two sequences were calculated. Qualitative analyses of image quality and conspicuity between tumor and normal tissue were performed. Two radiologists experienced in colorectal cancer independently assessed the T-stage of local tumor in CUBE and T2-weighted image according to the depth of tumor invasion, circumference and length of intestine involved and the results were compared with histological results respectively. Quantitative values, qualitative scores were analyzed by using the paired t test, Wilcoxon signed rank test, respectively.

RESULTS
Mean acquisition time of 3D sequence (384s) was significantly shorter than the acquisition time of 2D sequences in three planes (718s) (p <0.05). Although both readers reached a consensus that 3D CUBE yielded significantly lower image quality than 2D MRI(p < 0.05), tumor conspicuity was superior with the 3D sequence (2.78±0.85 vs 2.21±0.73, t=8.24, P < 0.05), and 3D sequence offered similar accuracy in T stage of rectal cancer compared to 2D sequence(35/58 vs 33/58; t=1.76, P=0.08).

CONCLUSION
Despite a lower overall image quality, but because of time savings and the versatility of reconstructing images in any orientation without compromise of diagnostic accuracy in T stage of rectal cancer, the 3D CUBE T2-weighted fast spin-echo sequence showed certain advantages compared to 2D T2-weighted fast spin-echo sequences.
Compared with 2D T2-weighted FSE sequence, 3D CUBE T2-weighted FSE sequence produces a great savings of time and offers a greater tumor conspicuity and the ability to perform multiplanar reformation.

**SSA07-03**

**Magnetic Resonance Imaging-detected Extramural Venous Invasion: Significant Prognostic Factor in Rectal Carcinoma**

Min-Ju Kim MD : Nothing to Disclose, Na Yeon Han (Presenter): Nothing to Disclose, Beom Jin Park MD : Nothing to Disclose, Deuk Jae Sung MD : Nothing to Disclose, Sun Hye Lee : Nothing to Disclose, Jun Seong Kim : Nothing to Disclose

**PURPOSE**

To compare the incidence of disease relapse between rectal cancer patients with positive MRI-detected extramural venous invasion (mrEMVI) and those with negative mrEMVI and evaluate the relapse-free survival rates between the two groups.

**METHOD AND MATERIALS**

A total of 263 patients (166 men, 97 women; mean age: 61 years, range: 20-85 years) with biopsy proven rectal carcinoma without metastasis at initial staging were enrolled in this study. All patients were staged using preoperative 3T rectal MRI, chest/abdomen CT and PET/CT scan and underwent follow-up imaging studies after operation at least for 3 years. Two radiologists reviewed all MR images and gave a consensus regarding MRI-EMVI score (five-point scale; 0-2: negative, 3-4: positive). All follow-up images were evaluated for local recurrence or metastasis. The incidences of disease relapse were compared between the two groups (mrEMVI-positive or negative) using Chi-square test. The relapse-free survival rate was analyzed using the Kaplan-Meier method and the differences between the groups were compared using the log rank test.

**RESULTS**

Of 263 patients, there were 69 (26.2%) patients with mrEMVI-positive rectal carcinoma. Of these patients, 42% (29/69) developed local recurrence or metastases during follow-up period, which were compared to 9.8% (19/194) of those with negative mrEMVI. There was significant difference in the incidence of relapse between two groups (p< .001). The patients were followed for a median of 52 (range, 3-76) months. The 5-year relapse-free survival rate was 89.4% in patients with mrEMVI-negative rectal cancer which was significantly higher than 56.4% in patients with mrEMVI-positive rectal cancer (p < .001).

**CONCLUSION**

The patients with mrEMVI-positive rectal cancer demonstrated higher disease-relapse rate and lower relapse-free survival rate than those with negative mrEMVI-negative rectal cancer.

**CLINICAL RELEVANCE/APPLICATION**

Preoperative evaluation of mrEMVI may predict the prognosis of patients with rectal carcinoma.

**SSA07-04**

**MRI Tumor Heterogeneity as a Potential Prognostic Imaging Biomarker in Patients with Rectal Cancer Treated with Neoadjuvant Chemoradiotherapy**


**PURPOSE**

To assess the prognostic significance of heterogeneity of rectal tumours on MRI, quantified by texture analysis in patients treated with neoadjuvant chemoradiation.

**METHOD AND MATERIALS**

Retrospective analysis of 29 consecutive patients with rectal cancer with 1.5T rectal MRI pretreatment and 6 weeks post neoadjuvant chemoradiation Tumor heterogeneity was quantified on the T2 axial small field of view image with the largest tumour diameter, using TexRAD, a commercially available software. This used filtration-histogram based texture analysis technique to extract pixel size based (fine, medium, coarse) features and quantified histogram parameters including Kurtosis (K), skewness (S) and normalized standard-deviation (SDn). Kaplan-Meier analysis compared texture parameters with overall (OS) and disease-free survival (DFS). Mean follow-up was 39.4 months.

**RESULTS**

4 patients showed complete pathological response. Median OS and DFS was 52.3 (95% CI: 40.5-64.0) and 37.3 (95% CI: 15.3-59.2) months respectively. On pre-treatment MR, lower SDn and higher K/S were significantly associated with reduced OS for different texture scales (medium scale: SDn <0.52, p=0.0007; K>1.58, p=0.017; S>0.9, p=0.018) and lower SDn and K were significantly associated with reduced DFS for different texture scales (medium texture scale: SDn <0.52, p=0.0068; K<-0.27, p=0.0195). At 6 weeks post treatment, an increase in SDn and decrease in K/S were associated with poor prognosis (medium texture scale: SDn >8.1%, p=0.0431; K<50.8%, p=0.018; S<0.12, p=0.041). Pathological response, tumor stage, nodal stage and circumferential resection margin status) were not significant predictors of OS and DFS.

**CONCLUSION**
Pre-treatment and 6 weeks post chemoradiation rectal tumor MRI texture parameters were associated with reduced OS and DFS. Changes in biological parameters such as tissue hypoxia may be reflected by changes in tumour heterogeneity.

**CLINICAL RELEVANCE/APPLICATION**

Tumour heterogeneity on pretreatment and 6 weeks post chemoradiation rectal MRI may be useful in predicting poorer clinical outcome and provide opportunity to target those patients suited for intensive management.

**SSA07-05**

**Diagnostic Efficacy of Diffusion-weighted MR Imaging in the Evaluation of Tumor Response to Neoadjuvant Chemoradiation Therapy, in Patients with Locally Advanced Rectal Cancer, Correlated with Tumor Regression Grade at Histology**

Maria Concetta Mumoli MD (Presenter): Nothing to Disclose, Davide Ippolito MD: Nothing to Disclose, Pietro Andrea Bonaffini MD: Nothing to Disclose, Orazio Minutolo MD: Nothing to Disclose, Cammillo Roberto Giovanni Leopoldo Talei Franzesi: Nothing to Disclose, Sandro Sironi MD: Nothing to Disclose

**PURPOSE**

To assess the diagnostic value of quantitative apparent diffusion coefficient (ADC), as a predictor of tumor response to neoadjuvant chemo-radiation therapy (CRT) in patients with locally advanced rectal cancer (LARC), by analysing pre and post CRT values of ADC, correlated to tumor regression grade (TRG) obtained by histopathological analysis.

**METHOD AND MATERIALS**

A total of 70 patients with locally advanced rectal cancer (≥T3 or lymphnode positive) were evaluated before and after CRT treatment. Each patient scan consists of multiplanar T2 and T1 combined with diffusion-weighted sequences using a 1.5T MRI system (Achieva, Philips). For each patient dedicated workstation was used to evaluate the quantitative apparent diffusion coefficient (ADC) pre- and post-CRT MR images, by outlining freehand region of interest (ROIs) on the site of the lesion. Diagnostic accuracy of ADC values for predicting treatment response correlated with histopathological tumor regression grade (TRG) was evaluated, according to Mandard’s classification [responders (TRG1-2) and non-responders (TRG 3-5)].

**RESULTS**

Patients were assigned to the tumor responders group (n = 48) or the tumor non-responders group (n = 22) on the basis of histopathologic examination results following surgery. Before CRT, there wasn’t significant difference in ADC value between responders vs non-responders: the mean tumor ADC values in the responders group was minimally lower than those in non-responders group (862.67 × 10−3 mm²/sec ± 206.66 vs 877.46 mm²/sec ± 168.40). After CRT, the mean tumor ADC increased significantly in the responders group, 1444.46 × 10−3 mm²/sec ± 231.49 than in the nondownstaged group 1.267.47 × 10−3 s/mm². The post-CRT ADC values were correlated to histopathologic tumor regression grade (TRG), and ROC analysis demonstrated the best cut-off value of 1,298 × 10−3 mm²/sec, in determing responders patients yielding a sensitivity of 86% and specificity of 72%.

**CONCLUSION**

The quantitative assessment of post-CRT in ADC map, represents a non-invasive feasible tool, useful in the re-staging of patients with locally advanced rectal cancer (LARC), having good relationship with histology.

**CLINICAL RELEVANCE/APPLICATION**

The post-CRT ADC values showed comparable relative accuracy as a predictor of tumor response to neoadjuvant chemo-radiation therapy (CRT) to tumor regression grade (TRG) obtained by histopathologic analysis.

**SSA07-06**

**Performance of Texture Analysis, Diffusion Weighted Imaging and Perfusion Imaging in Predicting Tumoral Response to Neoadjuvant Chemoradiotherapy in Rectal Cancer Patients Studied with 3T MR**

Carlo Nicola de Cecco MD (Presenter): Nothing to Disclose, Maria Ciolina MD: Nothing to Disclose, Balaji Ganeshan PhD: Scientific Director, TexRAD Limited, Marco Rengo MD: Nothing to Disclose, Luca Saba MD: Nothing to Disclose, Andrea Laghi MD: Speaker, Bracco Group Speaker, Bayer AG Speaker, General Electric Company Speaker, Koninklijke Philips NV

**PURPOSE**

To determine the performance of texture analysis (TA), diffusion weighted imaging (DWI), and perfusion MR (pMR) in predicting tumoral response in patients treated with neoadjuvant chemoradiotherapy (CRT).

**METHOD AND MATERIALS**

The patient population consisted of 12 patients with rectal cancer, who underwent pre-treatment 3T MRI. Texture analysis (kurtosis), apparent diffusion coefficient (ADC) and pMR parameters (IAUGC, Ktrans, Ve, Kep) were quantified using commercial research software algorithms. After CRT, all patients underwent complete surgical resection and the surgical specimen served as the gold standard. Receiver operating characteristic (ROC) curve analysis was performed to assess the discriminatory power of texture parameters to predict complete response.
RESULTS
Pathological complete response (pCR), partial response (PR) and no response (NR) were found in 6, 3 and 3 patients, respectively. Baseline kurtosis was significantly lower in pCR in comparison with PR+NR (p=.01). Among ADC and pMR parameters, only Ve was significantly lower in the pCR compared to PR/NR (p=.01). A significant negative correlation between kurtosis and ADC (r=-0.650, p=0.022) was observed. The areas under the curve (AUC) to discriminate patients with pCR from patients with PR/NR were 0.861 for kurtosis, 0.694 for IAUGC, 0.569 for Ktrans, 0.861 for Ve, 0.668 for Kep and 0.556 for ADC. The discriminatory power was significant for kurtosis (p=0.001) and Ve (p=0.003). The optimal cutoff for the identification of pCR was

CONCLUSION
Baseline TA and pMRI parameters have the potential to act as imaging biomarkers of tumoral response to neoadjuvant chemoradiotherapy.

CLINICAL RELEVANCE/APPLICATION
The identification of new imaging biomarkers for early assessment of neoadjuvant treatment response could be helpful in refining rectal cancer patient management, providing a better targeting of preoperative therapy.

SSA07-07
Clinical Impact of the Tumor Volume Reduction Ratio in the Rectal Cancer Patients Following Preoperative Chemoradiation; A Comparison Study of Volumetric Measurement, Down-staging, and Tumor Response Grade
Yoo bee Han MD (Presenter): Nothing to Disclose, Soon Nam Oh MD: Nothing to Disclose, Dong Myung Yeo: Nothing to Disclose, Hong Seok Jang: Nothing to Disclose, Sung Eun Rha MD: Nothing to Disclose, Seung Eun Jung MD: Nothing to Disclose, Moon Hyung Choi MD: Nothing to Disclose, Jae Young Byun MD: Nothing to Disclose

PURPOSE
To evaluate whether MR volumetric analysis in rectal cancer can predict the clinical outcome, tumor recurrence and disease-free survival (DFS), and to determine the most reliable method for predicting clinical outcome among tumor volume reduction ratio (TVRR), tumor down-staging (TDS), and tumor response grade (TRG).

METHOD AND MATERIALS
Seventy four patients who underwent preoperative concurrent chemoradiation therapy (CCRT) and following curative rectal surgery, between January 2007 and December 2010, were included in this study. Two radiologists being blind to clinical outcome measured tumor volume in consensus before and after CCRT on MRI. Tumor volume was manually traced on each T2 weighted axial image and was calculated by multiplying cross-sectional areas by section thickness. TVRR, TDS of T stage were assessed on MRI. The pathologic TRG, recurrence and DFS were assessed with medical record. We divided patients into two groups according to episode of recurrence. Difference of TVRR between two groups were assessed with student t-test, and the cut-off value of TVRR for predicting recurrence were evaluated with maximal chi-square method. Difference of TDS and TRG between two groups were estimated with chi-square test. The most reliable predicting parameter among TVRR, TDS, and TRG was evaluated with Cox regression analysis.

RESULTS
TVRR (p=0.002) and TRG (p=0.006) was significantly different between recurrent and non-recurrent groups, whereas TDS of T stage (p=0.448) was not. Mean follow up time for DFS was 36.98 ± 18.51 months. The cut-off value of TVRR was estimated as 61.38%. Between higher TVRR (>61.38%) and lower TVRR groups, DFS (p=0.00) and TRG (p < 0.01) were significantly different. TVRR was the most reliable predicting parameter.

CONCLUSION
After CCRT, TVRR assessment on MRI can be a prognostic parameter for predicting tumor recurrence and DFS, as well as TRG. The cut-off value of TVRR was 61.38% in our study.

CLINICAL RELEVANCE/APPLICATION
MR volumetry of rectal cancer can be a helpful predicting factor for clinical outcome in patients with CCRT.

SSA07-08
The MRI Features of Rectal Cancer Which Achieved Pathological Complete Remission after Neoadjuvant Concurrent Chemoradiation Therapy
Honsoul Kim MD, PhD : Nothing to Disclose, Jieun Koh MD (Presenter): Nothing to Disclose, Hyuk Hur : Nothing to Disclose, Woong Sub Koom : Nothing to Disclose, Myeong-Jin Kim MD, PhD : Nothing to Disclose, Joonseok Lim MD : Nothing to Disclose

PURPOSE
To depict the MRI characteristics of rectal cancer of which pathological complete remission (PCR: Mandard grade 1) has been achieved by neoadjuvant concurrent chemoradiation therapy (CRT).

METHOD AND MATERIALS
We retrospectively analyzed 88 (Male/female=55/33, age of 58.62±11.24 years) rectal cancer patients who underwent pre-/post-CRT MRI, CRT and surgery between January 1998 and December 2012 and were found to have achieved PCR. Post-CRT MR was obtained 8~54 (23.4±9.9) days before surgery. Tumor distal margin reached lower, middle and upper rectum (n=49/38/1, 6.0±2.3cm to anal verge). We analyzed pre-/post-CRT
RESULTS

Pre-CRT (24.3±4.27 cm³) and post-CRT (7.67±3.99 cm³) MR revealed a tendency of marked volume decrease (P<0.001, reduction rate: 70.6±19.3%). MR TRG G1 (PCR)/G2/G3/G4/G5 (marked progression) were 3/23/61/1/0. MR T stage (T1/2/3a/T3b/T3c/T4) were 14/6/26/35/7/pre-CRT and 19/13/28/21/7/post-CRT. CRM results (negative/threatening/invasion) were 37/34/17/pre-CRT and 44/33/11/post-CRT. SI grade (not visible/lower-than-muscle/iso-to-muscle/intermediate/high/edema-SI) were 0/0/8/80/0/pre-CRT and 3/14/50/15/6/post-CRT. Morphologic grade of post-CRT MR (not visible/scanty/remaining/subtle soft tissue/gross nodule) were (3/13/25/47). DWI was performed in 68 post-CRT MRIs, of which 10 showed diffusion restriction. The post-CRT MR LN grade were (negative/borderline/suspicious=39/44/5), but pathology review identified metastatic LNs in only 2 negative and 2 borderline graded cases. Six patients (6.8%) later developed tumor recurrence.

CONCLUSION

MRI of rectal cancer which achieved PCR after CRT demonstrates highly variable and confusing imaging characteristics. A tendency of marked volume reduction and decreased T2 SI after CRT does exist, but remaining mass and/or enlarged LNs of soft tissue SI are not infrequently encountered.

CLINICAL RELEVANCE/APPLICATION

Post-CRT rectal cancer can show highly variable MRI features. Striking remnant mass and/or LNs with bulk showing soft tissue SI does not necessarily neglect the possibility of having achieved PCR.

SSA07-09

CT-quantified Obesity a Risk or Protective Factor for Complications after Rectal Cancer Surgery?

Johanna Nattenmueller MD (Presenter): Nothing to Disclose, Jurgen Staffa : Nothing to Disclose, Astrik Bagdassarjan : Nothing to Disclose, Yakup Kulu : Nothing to Disclose, Biljana Gigic : Nothing to Disclose, Hans-Ulrich Kauczor MD : Research Grant, Boehringer Ingelheim GmbH Research Grant, Siemens AG Research Grant, Bayer AG Speakers Bureau, Boehringer Ingelheim GmbH Speakers Bureau, Siemens AG Speakers Bureau, Novartis AG, Martin A. Schneider : Nothing to Disclose, Cornelia Ulrich PhD : Nothing to Disclose

PURPOSE

Obesity is associated with an increased incidence and mortality in rectal cancer (RC). However, an obesity paradox in the sense of a protective effect of adipose tissue is described in many chronic diseases. We evaluated whether there is an impact of total adipose tissue (TAT), visceral adipose tissue (VAT), subcutaneous adipose tissue (SAT) and BMI on morbidity including medical and surgical complications after RC surgery.

METHOD AND MATERIALS

In 329 patients with RC (98 female, 231 male; mean age 63.0 (SD 12), mean BMI 26.0 kg/m² (SD 5) with 218 obese patients BMI >25 kg/m²) who underwent multi-detector-CT, area-based quantification of TAT, VAT, SAT and Ratio VAT/SAT was performed on levels L3/4 and L4/5, and volume-based quantification from T11/12 to L5/S1 (abd) and L5/S1 to symphysis (pelv), between -190 to -30 HU. Logistic regressions of TAT, VAT, SAT and Ratio VAT/SAT on surgical complications [total n=107, anastomotic leakage (AL, n=27), wound infection (WI, n=57), bleeding (n=12), abscess (n=26), bladder dysfunction (BD, n=25), burst abdomen (BA, n=9)] and medical complications [total n=47, cardiac (n=18), pulmonary (n=22)] were performed.

RESULTS

A significant increase was seen in overall medical complications for TAT (Pabd=0.03; ppelv=0.003) and SAT (Pabd=0.02; ppelv=0.002); in cardiac complications for TAT (Pabd=0.02, ppelv=0.01), VAT (Pabd=0.03) and SAT (ppelv=0.02); in AL for VAT (ppelv=0.02) and SAT (P14/5=0.04); in WI for TAT (Pabd=0.02, pnelv=0.02) and SAT (Pabd=0.04, pnelv=0.01); in BD for TAT (Pabd=0.03) and VAT (Pabd=0.02, P13/4=0.02); in BA for TAT (Pabd=0.003, pnelv=0.002, P13/4=0.007, P14/5=0.004), VAT (Pabd=0.005, P13/4=0.01, P14/5=0.03), SAT (Pabd=0.006, pnelv=0.002, P13/4=0.05, P14/5=0.007) and Ratio/VAT/SAT (P14/5=0.01). No association was seen with pulmonary or overall surgical complications, bleeding and abscess. BMI showed no association with any complication.

CONCLUSION

In contrast to BMI, an increase in adipose tissue compartments measured in CT is able to predict complications after RC surgery. No obesity paradox was observed in the sense of a protective effect of adipose tissue.
Sub-Events

SSA08-01  
Imaging and Biological Characteristics of Hepatocellular Carcinoma with β-catenin Mutation


PURPOSE

Wnt/β-catenin signaling pathway activation expressed by β-catenin mutation is frequently observed in hepatocellular carcinoma (HCC) at about 30-40%. HCC with β-catenin mutation and expression of its transcriptional product glutamine synthetase (GS) is supposed to be classified into a particular subtype. The purpose of this study is to clarify the imaging and pathological characteristics of this subtype of HCC.

METHOD AND MATERIALS

Surgically resected 138 HCCs were subjected. The grade of immunohistochemical expression of β-catenin and GS was evaluated, and then classified into three groups: β-catenin(+)/GS(+) group as HCC with β-catenin mutation, β-catenin(-)/GS(+) group as intermediate type HCC and β-catenin(-)/GS(-) group as HCC without β-catenin mutation. We compared three groups regarding following imaging and pathological findings of HCCs.

1. Precontrast CT value. 2. Enhancement ratio on arterial phase of dynamic CT. 3. Contrast noise ratio (CNR) on T1 weighted image. 4. CNR on T2 weighted image. 5. CNR and ADC value on diffusion weighted image (DWI). 6. CNR and enhancement ratio on hepatobiliary phase of gadoxetic acid enhanced MR imaging. 7. Pathological findings (macroscopic appearance, differentiation grade, proliferation pattern, vessel invasion and bile production). We also evaluated the correlations between immunohistochemical expression of β-catenin, GS and OATP1B3 (uptake transporter of gadoxetic acid).

RESULTS

HCC with β-catenin mutation (n=27) showed low CNR on DWI, high ADC value, high CNR and high enhancement ratio on gadoxetic acid enhanced MR imaging than those of intermediate type HCC (n=23) and HCC without β-catenin mutation (n=84) (P

CONCLUSION

HCCs with β-catenin mutation, which was supposed to be a biologically less aggressive subtype, showed high ADC value and high enhancement ratio on gadoxetic acid enhanced MR imaging.

CLINICAL RELEVANCE/APPLICATION

DWI and gadoxetic acid enhanced MR imaging are useful to diagnose HCCs with β-catenin mutation. Imaging diagnosis of this subtype of HCC will be important for future personalized medicine.

SSA08-02  
Subcentimeter Hypervascular Nodule at High-risk for Hepatocellular Carcinoma in Patients with Chronic Liver Disease: Natural Course on Serial Gadoxetic Acid-enhanced MRI and Diffusion-weighted Imaging

Kyoung Doo Song MD: Nothing to Disclose, Seong Hyun Kim: Nothing to Disclose, Hye Keun Lim MD: Nothing to Disclose, Jisun Lee (Presenter): Nothing to Disclose, Seong-Yoon Ryu MD: Nothing to Disclose

PURPOSE

To evaluate the natural course of subcentimeter hypervascular nodule at high-risk for developing to hepatocellular carcinoma (HCC) (SHNHR) by using a serial follow-up with gadoxetic acid-enhanced magnetic resonance imaging (MRI) and diffusion-weighted imaging (DWI) in patients with chronic liver disease.

METHOD AND MATERIALS

Institutional review board approval was obtained, and informed consent was waived. A SHNHR was defined as a subcentimeter hypervascular nodule having typical imaging findings of HCC on gadoxetic acid-enhanced MRI and DWI. We included 43 patients who had newly detected 50 SHNHRs. The progression rate to overt HCC was calculated by the Kaplan-Meier method. Cox proportional hazard model was used to evaluate the independent prognostic significance of baseline covariates for progression to overt HCC.

RESULTS

The median follow-up period was 139 days (range, 58 - 394 days). The cumulative progression rate to overt
HCC at 3, 6, 9, and 12 months were 16.8%, 62.8%, 82.1%, and 88.1%. The initial size of SHNHR at baseline MRI was the significant predictor of increased risk of progression to overt HCC in univariate (hazard ratio [HR] = 1.399; 95% confidence interval [CI]: 1.132, 1.728; p = 0.002) and multivariate analysis (HR = 1.647; 95% CI: 1.223, 2.206; p = 0.001), and its optimal cut-off value was 5 mm based on the time-dependent receiver operating characteristic curve at 12 months.

CONCLUSION

The progression rate of SHNHR to overt HCC within 12 months was very high (88.1%). The initial size of SHNHR at baseline MRI was a significant risk factor for progression to overt HCC.

CLINICAL RELEVANCE/APPLICATION

1. Prompt treatment of SHNHRs may be justified, given the very high (88.1%) progression rate of SHNHR to overt HCC within 12 months. 2. If SHNHRs are followed up without any treatment, MRI follow-up at 3-month intervals seems to be reasonable. 3. If management strategy is determined by the risk for progression to overt HCC, 5 mm or less SHNHRs can be followed up without any treatment and prompt treatment may be considered for SHNHRs greater than 5 mm in the greatest dimension.

SSA08-03

Gadoxetic-acid MR Imaging in the Characterization of the "Grey Zone " of the Hepatocarcinogenesis

Michele Di Martino MD, PhD (Presenter): Nothing to Disclose , Michele Anzidei MD : Nothing to Disclose , Fulvio Zaccagna MD : Nothing to Disclose , Luca Saba MD : Nothing to Disclose , Carlo Catalano MD : Nothing to Disclose

PURPOSE

To evaluate radiological findings and diagnostic accuracy of gadoxetic acid magnetic resonance imaging (MRI) in the evaluation of small (≤2 cm) regenerative nodules (RN), dysplastic nodules (DN) and well-differentiated hepatocellular carcinomas (HCCs).

METHODOLOGY AND MATERIALS

Sixty-two cirrhotic patients, with 107 focal liver lesions were prospectively recruited. MR examinations were performed with a 3T magnet (Discovery MR750; General Electric Systems). The MRI study protocol included T1-weighted and T2-weighted pre-contrast sequences and 3D spoiled gradient-echo T1-weighted post-contrast sequences Gd-EOB-DTPA-enhanced obtained during the arterial, portal-venous and equilibrium phases 25 s, 70 s, 180 s and after 20 m. All lesions (33 RN, 29 DN and 45 HCCs) were pathologically confirmed. One radiologist not involved in the datasets analysis reported the signal intensity characteristics of each lesion. Two radiologists blinded to clinical and pathological information evaluate radiological dataset images. Sensitivity, specificity and diagnostic accuracy were considered for statistical analysis.

RESULTS

Regenerative nodules usually show enhancement during the arterial phase without wash-out sign during portal-venous and delayed phase. Dysplastic nodules tend to do not show enhancement during the arterial phase and present wash-out on delayed phase. Well-differentiated HCCs very often show typical vascular pattern (wash-in and wash-out) and low signal intensity during the hepatobiliary phase. According to the AASLD radiological diagnosis the mean sensitivity, specificity and diagnostic accuracy in the diagnosis of HCC were, respectively (76.4%, 80%, 0.84).

CONCLUSION

Gadoxetic acid MR imaging is a reliable tool in the characterization of well-differentiated HCC from dysplastic and regenerative nodules.

CLINICAL RELEVANCE/APPLICATION

Characterization of small nodules in cirrhotic liver is still of challenge. Basically overlap between dysplastic nodules and hypovascular HCCs may be the most common cause of misinterpretation.

SSA08-04

Imaging Diagnosis and Prognosis of Hepatocellular Carcinoma (HCC) in HIV-HCV Co-infected Cirrhotic Patients: Arguments for a New Screening Policy

Maite Lewin MD, PhD (Presenter): Nothing to Disclose , Moana Gelu-Simeon : Nothing to Disclose , Marita Ostos : Nothing to Disclose , Faroudy Boufassa : Nothing to Disclose , Rodolphe Sobesky : Nothing to Disclose , Elina Teicher : Nothing to Disclose , Laurence Meyer : Nothing to Disclose , Helene Fontaine : Nothing to Disclose , Didier Samuel : Nothing to Disclose , Olivier Seror : Nothing to Disclose , Jean-Claude Trinchet : Nothing to Disclose , Jean-Charles Duclos-Vallee : Nothing to Disclose

PURPOSE

To characterize the diagnosis and prognosis imaging features of HCC using computed tomography (CT) or magnetic resonance imaging (MRI) in cirrhotic patients co-infected with human immunodeficiency virus (HIV) and hepatitis C virus (HCV) compared to HCV mono-infected cirrhotic patients.

METHODOLOGY AND MATERIALS
Thirty-five HCC cases from two multicenter prospective cohorts of HIV-HCV cirrhotic patients (32 males; median age: 50 years [40-65]), and 35 mono-infected HCV cirrhotic patients from a control group (29 males; median age: 56 years [41-83]) were included. The CT or MRI analysis of HCCs focused on: (a) the detection of infiltrative or nodular types, (b) the evaluation of nodule size, and (c) evidence for portal obstructing tumors. Survival analysis used the Kaplan-Meier and Cox models. Our institutional review board approved the study and subjects provided written informed consent.

RESULTS

An infiltrative type was found in 8/35 HIV-HCV patients (23%) but was never found in HCV patients (p=0.002). Other HCCs were of a nodular type. The largest nodules had a median diameter that did not differ significantly between HIV-HCV and HCV patients (24 mm [12-70] and 23 mm [13-90], respectively). A portal obstructing tumor was found in 10/35 HIV-HCV patients (28.5%) (including the 8 infiltrative types) but was never found in HCV patients (p=0.001). Survival was significantly shorter among HIV-HCV patients (p=0.004). The principal factors for a fatal outcome were an infiltrative type (adjusted HR:7.12 [2.59-19.60]) and portal obstructing tumor (aHR:4.82 [1.86-12.46]).

CONCLUSION

Compared to HCV mono-infected cirrhotic patients, HCCs in HIV-HCV co-infected cirrhotic patients were diagnosed at a more advanced stage, with a significantly higher rate of infiltrative types and of portal obstructing tumors, consistent with a shorter survival.

CLINICAL RELEVANCE/APPLICATION

An earlier HCC detection using MR imaging rather than ultrasound is required in order to improve the access to curative treatment of HIV-HCV co-infected cirrhotic patients.

SSA08-05

Can We Differentiate Hepatocellular Carcinoma (HCC) with Paradoxical Uptake on Hepatobiliary Phase(HBP) from Focal Nodular Hyperplasia (FNH) or FNH-like Nodule in Gd-EOB-DTPA-enhanced MR Imaging?

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

PURPOSE

To identify imaging features that can reliably differentiate hepatocellular carcinoma(HCC) with paradoxical uptake on hepatobiliary phase(HBP) from focal nodular hyperplasia(FNH) or FNH-like nodule in Gd-EOB-DTPA-enhanced MR imaging

METHOD AND MATERIALS

This study was approved by our institutional review board and the requirement for informed consent was waived. 19 pathologically confirmed HCC with paradoxical uptake on HBP, 28 FNHs, and 21 FNH-like nodules from 61 patients who had undergone Gd-EOB-DTPA-enhanced liver MRI were included. Two radiologists reviewed independently and in consensus all MR images and evaluated the following image features: signal intensities on T1WI, T2WI, and DWI, appearances on T2WI(T2 scar) and HBP(EOB scar), arterial enhancement pattern, washout pattern on venous phase(2 minutes), uptake pattern on HBP, and chemical shifting on in- and out-of-phases. ADC values were also measured. Image features that were statistically significant by univariate analysis were entered into multivariate logistic regression analysis.

RESULTS

Interobserver agreement was excellent(κ>0.85). Among imaging features analyzed, signal intensities on T1WI and DWI, appearances on T2WI and HBP, arterial enhancement pattern, washout pattern on venous phase, uptake pattern on HBP were significantly different among the three groups. (p = <0.001, 0.010, 0.008, <0.001, <0.001, <0.001, and <0.001 respectively) In multivariate analysis, heterogeneous washout pattern on venous phase, heterogeneous uptake pattern on HBP, and heterogeneous arterial enhancement pattern were independent significant variables in the differentiation of HCC with paradoxical uptake from FNH or FNH-like nodule. (p = <0.001, <0.001, and <0.001, respectively)

CONCLUSION

HCC showing paradoxical uptake on HBP in Gd-EOB-DTPA-enhanced liver MRI may be difficult to differentiate from FNH or FNH-like nodule. HCC with paradoxical uptake can be differentiated from FNH or FNH-like nodule on the basis of heterogeneous washout pattern on venous phase, heterogeneous uptake pattern on HBP, and heterogeneous arterial enhancement pattern in Gd-EOB-DTPA-enhanced MRI.

CLINICAL RELEVANCE/APPLICATION

Heterogeneous washout pattern on venous phase, heterogeneous uptake pattern on HBP, and heterogeneous arterial enhancement pattern in Gd-EOB-DTPA-enhanced liver MR imaging can be helpful in differentiating HCC with paradoxical uptake on HBP from FNH or FNH-like nodule.

SSA08-06

Prospective, Multicenter, Intra-individual Comparison of Multidetector CT and Contrast-enhanced MR Imaging in the Detection of Small Hepatocellular Carcinoma in Patients with Cirrhosis Induced by HBV Infection

Ke Wang MD (Presenter): Nothing to Disclose, Ze Peng: Nothing to Disclose, Xuedong Yang: Nothing to Disclose, Xiaoying Wang MD: Nothing to Disclose

PURPOSE

HCC showing paradoxical uptake on HBP in Gd-EOB-DTPA-enhanced liver MRI may be difficult to differentiate from FNH or FNH-like nodule. HCC with paradoxical uptake can be differentiated from FNH or FNH-like nodule on the basis of heterogeneous washout pattern on venous phase, heterogeneous uptake pattern on HBP, and heterogeneous arterial enhancement pattern in Gd-EOB-DTPA-enhanced MRI.

CLINICAL RELEVANCE/APPLICATION

Heterogeneous washout pattern on venous phase, heterogeneous uptake pattern on HBP, and heterogeneous arterial enhancement pattern in Gd-EOB-DTPA-enhanced liver MR imaging can be helpful in differentiating HCC with paradoxical uptake on HBP from FNH or FNH-like nodule.
To prospectively compare the diagnostic performance of multidetector computed tomographic (MDCT) imaging, unenhanced MRI (MR-) and unenhanced combined contrast-enhanced MRI (MR±) in the detection of small hepatocellular carcinoma (SHCC) in patients with cirrhosis induced by HBV infection.

METHOD AND MATERIALS
A total of 150 patients (118M/32F; mean age, 54y; age range, 28-79y) confirmed with cirrhosis induced by HBV infection and suspected of SHCCs (≤3cm) underwent unenhanced combined contrast-enhanced MRI and multiphasic MDCT within 30 days. The images were qualitatively analyzed by 3 independent readers in three separate reading sessions (CT, MR-, MR±). Using strict diagnostic criteria for HCC, readers classified all detected lesions with use of a five-point confidence scale. The reference standard was a combination of pathologic proof, interventional therapy results and substantial tumor growth at follow-up CT or MRI. Interreader variability was assessed. The diagnostic performance of these techniques for the detection of SHCC was assessed by receiver operating characteristic (ROC) analysis, in addition to evaluating the sensitivity, specificity, positive predictive value (PPV) and negative predict value (NPV).

RESULTS
A total of 164 SHCCs (mean size± standard deviation, 1.8cm±0.6; range, 0.7-3.0cm) were detected. For all the lesions, the area under the ROC curve (Az) was significantly higher with MR± (0.947) than either with MR- (0.856) or with MDCT (0.897) (P < 0.05).

CONCLUSION
Unenhanced combined contrast-enhanced MR imaging shows a better diagnostic performance for the detection of small HCCs (both for lesions ≤3cm and lesions ≤2cm) compared with either unenhanced MR or multiphasic MDCT in patients with cirrhosis induced by HBV infection.

CLINICAL RELEVANCE/APPLICATION
Unenhanced combined contrast-enhanced MR imaging is better than either unenhanced MR or multiphasic MDCT in detecting small HCCs, and is recommended in the evaluation of suspected HCC in patients with cirrhosis induced by HBV infection.

SSA08-07 Applicability of Gadoxetic Acid-enhanced MRI for Non-invasive Diagnosis of Hepatocellular Carcinoma (HCC) Using American Association for the Study of Liver Diseases (AASLD) and Liver Imaging Reporting and Data System (LI-RADS) Systems

Min Jung Park (Presenter): Nothing to Disclose, Myeong-Jin Kim MD, PhD: Nothing to Disclose, Yong Eun Chung MD, PhD: Nothing to Disclose, Chansik An MD: Nothing to Disclose, Hyungjin Rhee MD: Nothing to Disclose

PURPOSE
To retrospectively assess whether gadoxetic acid-enhanced MRI can be applicable to the non-invasive diagnosis of HCC using AASLD and LI-RADS systems

METHOD AND MATERIALS
A total of 124 hepatic nodules (≤ 5cm in diameter) in 109 patients at-risk for HCCs who had no history of liver tumor treatment were analyzed. Three observers independently assigned LI-RADS categories (1-5 and M) and AASLD scores (adapted from Bruix et al; 5 as definite HCC), and recorded major (assessment of washout in portal venous phase) and ancillary features (including hypointensity in hepatobiliary phase) of HCC for each lesion. Standard reference for diagnosis was histopathology other than 18 of 26 benign lesions diagnosed based on clinical and imaging features. Scores were compared by using McNemar test. Interobserver agreement was assessed by using multirater Fleiss κ statistics.

RESULTS
On surgery or biopsy, 94 of 124 (75.8%) nodules were confirmed as HCC. Sensitivity and specificity for LI-RADS in three observers were 55.3-67.0% and 83.3-90.0%, respectively, and those for AASLD were 67.0-76.6% and 83.3-86.7%, respectively. AASLD showed significantly higher sensitivity than LI-RADS in two observers (P ≤ 0.003), but no significant difference for specificity. When considering LR-4 and LR-5 as HCC, sensitivity and specificity for LI-RADS were 85.1-87.2% and 70.0-86.7%, respectively, and showed significantly higher sensitivity (P ≤ 0.035) than AASLD in all observers, but no significant difference for specificity. Lesions that were false positive for both systems (when LR-4 and LR-5 as HCC in LI-RADS) in all observers were cholangiocarcinoma (n=1), combined hepatocellular and cholangiocarcinoma (n=1) and dysplastic nodule (n=2). Interobserver agreement for categories consistent with HCC was moderate or good (LR-4 [κ=0.44], LR-5 [κ=0.68], AASLD-5 [κ=0.74]).

CONCLUSION
Gadoxetic acid-enhanced MRI can be applicable to the non-invasive diagnosis of HCC using AASLD and LI-RADS systems, yielding moderate sensitivity and specificity.

CLINICAL RELEVANCE/APPLICATION
Gadoxetic acid-enhanced MRI can be utilized for scoring LI-RADS and AASLD systems with acceptable diagnostic performances.

SSA08-08 Comparison of HCC Conspicuity on Delayed MR Images with Extracellular versus Hepatobiliary Contrast Agent for Patients with Compromised Liver Function

So Yeon Kim MD (Presenter): Nothing to Disclose, Benjamin M. Yeh MD: Research Grant, General Electric Company Consultant, General Electric Company, En-Haw Wu MD: Nothing to Disclose, Zhen Jane Wang SSA08-07 SSA08-08
PURPOSE
To compare the conspicuity of hepatocellular carcinoma (HCC) on the delayed phase images of extracellular contrast (gadodiamide) versus hepatobiliary contrast (gadoxetate disodium)-enhanced MR relative to liver function.

METHOD AND MATERIALS
We retrospectively identified 86 patients with newly diagnosed HCC on liver MR between 2010 and 2013 and recorded the severity of liver disease by Child-Pugh class (CPC). 38 patients had MR enhanced with gadodiamide and 48 with gadoxetate disodium on a 1.5T scanner. The conspicuity of 86 HCCs (mean size, 2.7 cm; range, 1-9.1 cm) was visually graded on a 3-point scale (1=invisible, 2=fair, 3=clear cut) on the delayed phase images (5-minute delay for gadodiamide and 20-minute delay hepatobiliary phase for gadoxetate). Conspicuity was quantitatively by tumor-to-liver contrast ratios (TLC). The relative liver parenchymal enhancement (RPE) was measured on the delayed enhanced versus unenhanced images. For different CPCs, we compared the visual and quantitative conspicuity of and RPE between gadodiamide and gadoxetate.

RESULTS
For the 65 patients with mild liver disease (CPC A), the visual and quantitative conspicuity of the 27 HCCs imaged with gadodiamide was significantly worse than of the 38 HCCs with gadoxetate (P=.01).

CONCLUSION
In patients with moderate to severe liver disease, hypointensity of HCC is more conspicuous on the delayed phase with gadodiamide than with gadoxetate. This may reflect the high extracellular uptake of gadodiamide and poor hepatocyte uptake of gadoxetate in patients with compromised liver function.

CLINICAL RELEVANCE/APPLICATION
Liver function is critical to consider when selecting between an extracellular versus hepatobiliary contrast agent for optimal visualization of HCC at MR imaging.

Determining Optimal Iodine Dose with 80-kVp CT Imaging: Detection of Hypervascular Hepatocellular Carcinoma

SSA08-09

Satoshi Goshima MD, PhD (Presenter): Nothing to Disclose, Yoshifumi Noda MD: Nothing to Disclose, Hirosi Kondo MD: Nothing to Disclose, Haruo Watanabe MD: Nothing to Disclose, Masayuki Kanematsu MD: Nothing to Disclose, Kyongtae Tyler Bae MD, PhD: Patent agreement, Covidien AG Consultant, Otsuka Holdings Co, Ltd

PURPOSE
To determine the optimal iodine mass (IM) required for the detection of hypervascular hepatocellular carcinoma (HCC) based on total body weight (TBW) and body surface area (BSA) at 80kVp CT imaging of the liver.

METHOD AND MATERIALS
IRB approval and written informed consent was obtained. One hundred nine patients with chronic hepatitis (75 men, 34 women; mean age, 67.9 years; range, 41 - 85 years) underwent contrast enhanced CT for screening of HCC. The patients were randomized into three groups according to the following iodine-dose per body-weight protocols: 0.5 gI/kg (0.5 g of iodine per kilogram TBW), 0.4 gI/kg, and 0.3 gI/kg groups. All CT examination were performed with low tube voltage (80kVp), high tube current (with the use of automatic exposure control), and adaptive statistical iterative reconstruction. The three groups were compared in terms of hepatic parenchymal CT enhancement during the portal venous phase (ΔHU) and qualitative score (in a 5-point scale) for the visualization of HCC, if presence, at the hepatic arterial, portal venous, and equilibrium phases. Iodine dose per BSA (gI/m2) was also calculated and compared with ΔHU and visualization of HCC.

RESULTS
Thirty-three HCCs were identified in 30 patients (mean size, 15.2 mm; size range, 5-68 mm). The mean ΔHU for the 0.5 gI/kg group (83.3 HU) was higher than those of the 0.4 gI/kg (63.3 HU) and 0.3 gI/kg (50.0 HU) groups (P < 0.001). The relationship between the enhancement and iodine-dose according to a linear regression analysis was ΔHU = -6.3 + 178.0*IM/TBW (P < 0.001) and ΔHU = 7.4 + 4.1*IM/BSA (P < 0.001). The three groups were comparable in qualitative scores for the visualizations of the detected HCCs in hepatic arterial and portal venous phase.

CONCLUSION
The iodine dose to achieve the hepatic parenchymal enhancement of 50 HU for the detection of hypervascular HCC was estimated to be 0.32 gI/kg of body weight or 10.5 gI/m2 of body surface area at 80-kVp CT imaging. This dose represents substantially less than the traditional dose of 500 mgI/kg used at higher kVp CT imaging.

CLINICAL RELEVANCE/APPLICATION
Our study estimated the optimal amount of iodine-dose for the detection of hypervascular HCC and confirmed that the iodine-dose could be required significantly less in 80-kVp than in higher kVp CT imaging. This information is useful for designing clinical protocols for hepatic CT imaging.
Usefulness of Contrast-enhanced Ultrasound in the Characterization of Renal Nodules Indeterminate on Computed Tomography

Carlos Nicolau MD (Presenter): Nothing to Disclose, Laura Bunesch Villalba MD: Nothing to Disclose, Blanca Pano Brufau MD: Nothing to Disclose, Rafael Salvador Izquierdo MD: Nothing to Disclose, Carmen Sebastia Cerqueda MD: Nothing to Disclose, Laura Oleaga: Nothing to Disclose

PURPOSE

The aim of this study was to assess the accuracy of contrast-enhanced ultrasound (CEUS) in the characterization of renal nodules indeterminate on CT by identifying benign cystic lesions not requiring histological diagnosis.

METHOD AND MATERIALS

72 patients with 83 indeterminate renal nodules on CT underwent baseline US and CEUS that classify lesions as benign (Bosniak I, II or IIF cysts) or potentially malignant (Bosniak III or IV cysts, solid nodules). The reasons to consider a nodule as indeterminate include: A. Study with only an unenhanced phase with a nodule > 20HU; 10 nodules. B. Study without an unenhanced phase; 40 nodules; C. Study with an unenhanced and at least 1 enhanced phase with a nodule > 20HU and a difference of enhancement <20HU between the unenhanced and enhanced phases; 33 nodules. The accuracy of US and CEUS in the differentiation between benign cysts and potentially malignant nodules was analyzed and compared with the final diagnosis obtained by histology or follow-up of at least 18 months with CEUS +/- a conclusive CT /MR study.

RESULTS

Final diagnoses comprised 50 benign complex cysts (44 Bosniak I-II and 6 Bosniak IIF), 1 focal nephritis, 1 multilocular cystic nephroma, 3 oncocytomas, 1 transitional cell carcinoma and 27 renal cell carcinomas. CEUS correctly classified 48 out of 50 (96%) nodules as benign cysts with a final diagnosis of Bosniak I-II or IIF cysts and 31 out of 33 (93.9%) nodules as potentially malignant with a final diagnosis of Bosniak III, IV or solid lesions, with a sensitivity of 96%, specificity of 93.9%, positive predictive value of 96%, negative predictive value of 93.9% and accuracy of 95.2%. The accuracy of CEUS was significantly better than that of US (95.2% vs. 45%).

CONCLUSION

CEUS is very useful in the differentiation between benign complex cysts and other lesions that require further investigation in non-conclusive renal nodules detected on CT.

CLINICAL RELEVANCE/APPLICATION

The use of CEUS to differentiate benign cystic lesions that do not require immediate further investigation (Bosniak I-II-IIF cysts) from other potentially malignant solid lesions and complex Bosniak III or IV cysts that usually require histology to achieve a final diagnosis facilitates the management of indeterminate renal masses with the advantage of its price and absence of radiation and nephrotoxicity.
To elucidate whether apparent diffusion coefficient (ADC) of a tumor is a predictor of recurrence after nephrectomy in localized renal cell carcinoma (RCC)

METHOD AND MATERIALS
We retrospectively studied 49 patients with localized RCC who underwent magnetic resonance imaging including diffusion-weighted imaging preoperatively. Fifteen patients developed recurrence during follow-up periods of 89 to 1837 days, while the remaining 34 showed no recurrence during follow-up periods of 1209 to 4822 days. ADC was measured by placing a region-of-interest in each tumor on ADC map, as avoiding necrosis and hemorrhage. Mean ADC was calculated by averaging ADC values obtained from three images, and minimum ADC was defined as the lowest ADC value among the three. The correlations between clinicopathological variables that could affect recurrence (age, gender, tumor side, tumor size, growth/invasion pattern, Fuhrman's grade, histology, venous invasion, average ADC and minimum ADC) and disease free survival were analyzed using Cox proportional hazards model.

RESULTS
In univariate analysis, tumor size, venous invasion, mean ADC and minimum ADC showed significant correlations with disease free survival (p < 0.05). In multivariate analysis, only venous invasion and minimum ADC revealed significance (p < 0.05).

CONCLUSION
Minimum ADC of a tumor, as well as venous invasion, was an independent predictor of recurrence after nephrectomy in localized RCC.

CLINICAL RELEVANCE/APPLICATION
Because a localized RCC showing low minimum ADC may recur in the early stage, we can propose the necessity of adjuvant therapy and shortening of the follow-up interval by imaging after surgery for such a tumor.

SSA09-03
Quantitative CT Texture Analysis: Can It Differentiate between Minimal Fat Renal Angiomyolipoma (mfAML) and Renal Cell Carcinoma on Non-contrast Enhanced Computed Tomography (NECT)?

Taryn Hodgdon MD (Presenter): Nothing to Disclose, Rebecca Thornhill: Nothing to Disclose, Matthew Donald Fernand Mclnnes MD, FRCPC: Nothing to Disclose, Nicola Schieda MD: Nothing to Disclose, Leslie Lamb MD, MSc: Nothing to Disclose, Trevor A. Flood MD, FRCPC: Nothing to Disclose

PURPOSE
To evaluate the accuracy of texture analysis to differentiate mfAML from RCC on non-enhanced computed tomography (NECT), using histopathologic diagnosis of surgically resected renal lesions as the reference standard.

METHOD AND MATERIALS
A retrospective case-control study was approved by the institutional review board. Patients with AML and RCC were obtained from the pathology database of surgically resected specimens from January 2002 to August 2013. The study included 16 patients with mfAML and 68 patients with RCC. mfAML was defined by the absence of visible fat on NECT. Preoperative NECTs were reviewed, and texture analysis was performed on 3 axial images of each renal lesion. The most discriminative features were used to generate a support vector machine (SVM) classifier. Accuracy of the SVM was then determined by 10-fold cross validation. The NECT for each patient was also independently reviewed by two blinded radiologists who subjectively graded lesion heterogeneity. The diagnostic performance of textural classifiers was compared with radiologist ratings using McNemar tests.

RESULTS
CT texture features related to lesion homogeneity and entropy were evaluated. There was significantly lower lesion homogeneity and higher lesion entropy in RCC compared to mfAML (p

CONCLUSION
CT texture analysis may be useful for differentiating mfAML from RCC on NECT.

CLINICAL RELEVANCE/APPLICATION
CT texture analysis features related to lesion homogeneity and entropy may be useful for differentiating mfAML from RCC on NECT.

SSA09-04
Frequency of Minimally Enhancing Small RCC on Contrast-enhanced CT

Naoki Takahashi MD (Presenter): Nothing to Disclose, Kohei Sasaguri MD: Nothing to Disclose, Mitsuru Takeuchi MD, PhD: Nothing to Disclose, Akira Kawashima MD: Nothing to Disclose

PURPOSE
To evaluate the frequency of minimally enhancing small RCC on contrast-enhanced CT.

METHOD AND MATERIALS
130 patients 148 with pathologically proven small RCC (<4cm) (mean age 61; 78 male, 52 female; 98 cc-RCC, 36 pap-RCC, and 14 other subtypes of RCC, mean size 25 mm) who underwent both unenhanced (NC) and contrast-enhanced (CE)-CT were included. CT attenuation of renal mass was measured on NC and CE-CT by placing a largest possible ROI. Renal mass with enhancement <20 HU (attenuation difference between CE-CT and NC-CT) was categorized as minimally enhancing mass. CT and clinical history of these patients were
reviewed by 2 radiologists. The difficulty of making prospective diagnosis of solid mass was categorized using 4-point scale based CT imaging features.

RESULTS
Of 148 RCC, 14 RCC (3 cc-RCC, 11 pap-RCC, mean size: 21 mm) were categorized as minimally enhancing (enhancement: 1-19 HU, mean 12 HU, mean unenhanced CT value: 32HU). Concomitant RCC (either minimally enhancing or enhancing (>20 HU) mass) were common (9/14). 3 pap-RCC were categorized as difficult to diagnose; 2 were homogeneous and showed enhancement < 5HU but ultrasound confirmed solid nature, 1 lesion was difficult to detect but found at the time of surgery for other RCC. 3 pap-RCCs were categorized as somewhat difficult; all were mildly heterogeneous and showed enhancement >15 HU and ultrasound confirmed solid nature. 5 RCCs (1 cc, 4 pap) were categorized as somewhat easy to diagnose; all were moderately heterogeneous with higher degree of enhancement at the periphery the mass.

CONCLUSION
Minimally enhancing RCC represented 14/130 of small RCC. 6/14 (all pap-RCC) were relatively difficult to diagnose by CT, and required ultrasound for confirmation. 8/14 could be diagnosed relatively easily by CT imaging features.

CLINICAL RELEVANCE/APPLICATION
Minimally enhancing RCC is uncommon, but the diagnosis is challenging when the tumor is homogenous.

SSA09-05

Dual Energy MDCT in Renal Cysts: Effect of Virtual Monochromatic Imaging on Pseudoenhancement in an In-Vitro and In-Vivo Study


PURPOSE
To investigate, in a phantom experiment and a clinical study, the impact of dual energy MDCT with virtual monochromatic imaging on renal cysts pseudoenhancement.

METHOD AND MATERIALS
Four renal compartments inserted into torso phantoms were filled with both saline and iodinated solutions to simulate the noncontrast state and three different levels of renal parenchymal enhancement (+140, +180, and +240 HU). Saline-filled spheres simulating renal cysts (15-mm, 18-mm) were serially suspended in the renal compartments and imaged with both dual-energy MDCT and single-energy MDCT at four polychromatic energy levels (80, 100, 120, and 140 kVp). Twenty-eight patients (mean age, 66±10 years; mean BMI, 31.3±6.2 kg/m2) with 34 renal cysts underwent dual-energy MDCT. Virtual monochromatic images were reconstructed at energy levels ranging from 40 to 140 keV at 10 keV increments.

RESULTS
In the phantom experiment, all polychromatic datasets demonstrated pseudoenhancement in all investigated conditions, which was inversely proportional to cyst size (P <0.0001), proportional to depth of intraparenchymal location (P =0.0001), and proportional to the renal background attenuation level (P <0.0001). Virtual monochromatic images at energy levels ranging from 80 to 140 keV did not show pseudoenhancement, with the lowest attenuation increase (mean, 6.1±1.6 HU; range, 1.6-7.7 HU) at 80 keV. In patients, pseudoenhancement did not occur on virtual monochromatic images at energy levels ranging from 90 to 140 keV. Patient's body size had a significant proportionate effect (P =0.0070) on the optimal monochromatic energy level.

CONCLUSION
Dual energy MDCT with reconstruction of optimal energy virtual monochromatic images can overcome renal cyst pseudoenhancement.

CLINICAL RELEVANCE/APPLICATION
Optimal energy virtual monochromatic images may enable the unequivocal diagnosis of simple renal cysts, eliminating the need of additional work-up.

SSA09-06

Role of Unenhanced CT in Undiagnosed Renal Cell Carcinoma (RCC)

Munazza Anis MD (Presenter): Nothing to Disclose, Nancy S. Curry MD: Nothing to Disclose

PURPOSE
To investigate the incidence of RCC with low attenuation values (<20 HU) in our patient population on unenhanced CT
METHOD AND MATERIALS

Retrospective, IRB approved study Search of pathology archives of 600+ nephrectomies performed at MUSC from 2008-2013 91 patients with renal cell carcinoma 97 tumors had unenhanced MDCT within 6 months (120 kVp and slice thickness 3-5 mm) The lesions were identified by pathology reports and compared with enhanced CT or MR 81/91 patients with unenhanced CT's were excluded: Tumors smaller than 1.5 cm, >7 cm Signs of obvious solid renal tumor on unenhanced CT (e.g., lobulated margins, heterogeneity, internal calcification) Patients with > 2 masses/ resected kidney Polycystic kidneys Tumors > 20 HU Study population of 10/91 (11%) pts with 11 homogeneous tumors with attenuation < 20 HU ROI measurements of the lesions (at PACS review station) from middle of lesion on axial scan and/or coronal scan, sampling at least half the lesion volume; soft tissue window settings (350 width, 50 level) Renal parenchymal ROI and water attenuation standards were also measured (gallbladder or urinary bladder) when possible.

RESULTS

10/91 patients (11%) with 11 low attenuation (< 20 HU), homogeneous RCC: 10 clear cell RCC (9 Gr II, pT1a; 2 pT3a) 1 pap RCC Gr III Size: 1.7 - 3.9 cm (mean 2.9 cm, median 3.2 cm) ROI: 7 HU - 19 HU (mean 14.7, median 15 HU) 2 tumors w necrosis (1 ccRCC, 1 pap RCC) One showed adjacent calcified cyst Only two of the 10 showed avid hypervascularity

CONCLUSION

Low attenuation tumors on unenhanced CT are uncommon but were found in 10/91 patients (11%) with RCC, averaging 15 HU. (Regional areas of minimum attenuation less than 20 HU and maximum attenuation greater than 70 HU were seen in 24.9% (48/193) and 2.1% (4/193) of RCCs, respectively) All but one were clear cell subtype, none were cystic tumors; only two showed necrosis.

CLINICAL RELEVANCE/APPLICATION

Short of continuous sampling which is not clinically applicable, it may be advisable to check tumor ROI against water attenuation standards and renal HU measurement. ? Revise the “safe” lower level to < 15 HU. Further study needed.

SSA09-07

MRI Features of Renal Cell Carcinoma that Predict Favorable Outcomes

Ankur Doshi MD (Presenter): Nothing to Disclose , William C. Huang MD : Nothing to Disclose , Nicholas Donin : Nothing to Disclose , James S. Babb PhD : Nothing to Disclose , Hersh Chandarana MD : Research support, Siemens AG

PURPOSE

To determine MRI features of renal cell carcinoma (RCC) that are associated with lower histological grade, stage and favorable outcomes following resection.

METHOD AND MATERIALS

This IRB-approved, retrospective study included 241 RCCs in 230 patients who had a preoperative contrast enhanced MRI, pathology results from surgically excised tumor, and at least 3 months of follow-up. A Board certified radiologist (abdominal radiology fellow), blinded to the pathology and clinical outcome, assessed tumor features on MRI, including pre-contrast T1 signal relative to renal cortex and percent of solid enhancing components. The electronic medical record and/or follow-up imaging were reviewed to assess for development of local recurrence or metastases. Statistical analysis was performed using Fisher’s exact test.

RESULTS

RCC subtypes included clear cell (n=144), papillary (n=59), chromophobe (n=21) and unclassified/other (n=17). On a patient level, the following tumor features were observed: solid component ≤25% (n=28), solid component >25% (n=202), T1 hypointensity (n=93) and T1 intermediate/hyperintensity (n=137). Mean follow-up time was 34 months (range 3 - 98). Local recurrence /metastases were observed in 14 patients (11 clear cell, 3 unclassified/other). RCC with T1 hypointensity and ≤25% solid component (n=14) showed no recurrence or metastases on follow-up. This group had lower stage (p<0.05) and clear cell grade (p<0.05) compared to tumors that wereT1 intermediate/hyperintense and >25% solid component (n=123). In a 24-month follow-up period, T1 hypointense signal alone was associated with decreased recurrence/metastases (p=0.05).

CONCLUSION

RCCs which are T1 hypointense and also have ≤25% solid enhancing component on MRI are associated with lower stage and nuclear grade. No recurrence or metastases were observed in this group.

CLINICAL RELEVANCE/APPLICATION

Assessment of T1 signal and solid component on MRI can provide important prognostic information related to RCC tumor grade, stage and clinical outcome.

SSA09-08

MR Imaging of Papillary Renal Cell Carcinoma: Does Intracellular Lipid Content Correlate with T2 Weighted (T2W) Imaging Characteristics?

Christian Balthasar Van Der Pol MD (Presenter): Nothing to Disclose , Matthew Donald Fernand McInnes MD, FRCPC : Nothing to Disclose , Bardia Moosavi MD : Nothing to Disclose , Trevor A. Flood MD, FRCPC : Nothing to Disclose , Nicola Schieda MD : Nothing to Disclose

PURPOSE

The purpose of this study was to validate the recent observation that papillary renal cell carcinoma (pRCC) may
contain intracellular lipid at chemical shift (CS) MRI, and to determine if this finding is associated with T2 weighted (T2W) imaging characteristics.

**METHOD AND MATERIALS**

With IRB approval, 77 consecutive patients were identified over an 11 year period who underwent MRI prior to surgery with a histologic diagnosis of pRCC. Two abdominal radiologists independently assessed each tumor for the presence of intracellular lipid on CS-MRI. T2W images were evaluated for tumor homogeneity and signal intensity (SI) relative to renal cortex and paraspinal muscle. Inter-observer agreement was calculated using the Kappa coefficient. Discordant cases at CS-MRI were reviewed in tandem to establish consensus. T2 SI ratios (SI.tumor/SI.muscle), CS-SI index (SI.IP-SI.OP)/SI.IP x 100 and tumor-to-spleen SI ratios ((SI.tumor.OP - SI.spleen.OP)/(SI.tumor.IP - SI.spleen.IP)-1) x 100, were measured. Associations between intracellular lipid and T2W characteristics were assessed using chi square test and correlations of parametric data were performed using the Pearson correlation coefficient.

**RESULTS**

After consensus review, 17% of pRCC contained intracellular lipid, with moderate inter-observer agreement (K=0.41). Homogenous T2 SI was observed in 24.2-33.3% of tumors (K=0.63). 56.1-71.2% were hypointense to renal cortex (K=0.43) and 9.1-21.2% were iso/hypointense to muscle (K=0.17). The median (range) for T2 SI ratio was 2.26 (0.33-8.81), CS-SI index was 3.88 (-208.7-77.03)%, and tumor-to-spleen SI ratio was -40(-530-205)%). No tumor with intracellular lipid was homogeneous on T2 and 92% of tumors were hyperintense to muscle on T2. There was an association between T2 heterogeneity and intracellular lipid (p=0.01-0.04). There was no correlation between T2 SI ratio and tumor-to-spleen SI ratio (B=-0.14, p=0.30) or CS-SI index (B=0.24, p=0.054).

**CONCLUSION**

Intracellular lipid is detected in a minority of papillary RCC but does not occur in tumors with homogeneously low T2 signal intensity tumors; findings which may help discriminate pRCC from minimal fat angiomyolipoma.

**CLINICAL RELEVANCE/APPLICATION**

Minimal fat AML are homogeneously low on T2, overlapping with pRCC; and both may demonstrate intracellular lipid. This study shows that pRCC with intracellular lipid are heterogeneously bright on T2.

**Virtual Non-contrast Spectral Imaging for Evaluation of Renal Masses-A Preliminary Study**

**PURPOSE**

To qualitatively and quantitatively evaluate the feasibility of CT virtual non-contrast (VNC) spectral imaging in renal masses.

**METHOD AND MATERIALS**

Sixty-two patients with histologically proven renal masses underwent gemstone spectral imaging (GSI) including noncontrast(TNC), arterial, cortex and medullary phase acquisitions. The triphasic GSI dataset was sent to workstation and 3 sets of VNC images (including VNCa, VNCC, VNCm) were obtained by subtract iodine from iodine-water images in the triphasic enhanced GSI images, respectively. The quality of VNCs and TNC images was evaluated on a five-point scale. Interobserver agreement with regard to image quality was assessed using Cohen’s kappa, and four groups of image quality was compared with ANOVA analysis. The contrast-to-noise ratio (CNR) of mass-to-kidney in the TNE and VNCs images was calculated, and difference between these four datasets was compared with ANOVA analysis. Using appearance of masses on triphasic images as a standard, the masses detection ratio of four groups was calculated and compared with chi-square test.

**RESULTS**

Interobserver agreement with regard to image quality was excellent (k>0.600). There was no significant difference among the image quality of TNC, VNCa and VNCc. The image quality of VNCa was significant worse than that of other three groups. VNCa significant higher than that of TNC (P<0.05). No statistically significant difference was observed among VNCa, VNCc and TNC(P>0.05); there was no statistically significant difference was observed among TNC,VNCa ,VNCc and VNNe.

**CONCLUSION**

VNC images obtain from arterial phase may be a surrogate for conventional noncontrast scan in renal masses diagnosis.

**CLINICAL RELEVANCE/APPLICATION**

VNC images obtain from arterial phase may be a surrogate for conventional noncontrast scan in renal masses diagnosis.
Gadolinium Chelate Contrast in Pregnancy: Fetal Biodistribution in the Nonhuman Primate

Karen Y. Oh MD (Presenter): Nothing to Disclose, Victoria Roberts PhD: Nothing to Disclose, Matthias C. Schabel PhD: Nothing to Disclose, Kevin L. Grove PhD: Nothing to Disclose, Mark Woods PhD: Nothing to Disclose, Antonio E. Frias MD: Nothing to Disclose

PURPOSE

To determine whether gadolinium chelate is found in the nonhuman primate fetal tissues and amniotic fluid after maternal injection of intravenous gadoteridol.

METHOD AND MATERIALS

Gravid macaques (n=12) were maintained on a control diet (14% calories from fat, n=4) or a high fat diet (36% calories from fat, n=8). On gestational day 129, the macaques were injected with ProHance gadolinium contrast for placental imaging (equivalent to the third trimester). Gadolinium dose was varied based on maternal weight, using 0.1 mmol/kg dosing. Fetuses were delivered via cesarean section within 24 hours of maternal injection (range 19-21 hours). Gadolinium concentration in the placenta, fetal tissues (bone, liver, brain, kidney) and amniotic fluid was obtained by inductively coupled plasma mass spectrometry.

RESULTS

Gadolinium chelate crosses the placenta from the maternal circulation. The levels of residual ProHance in fetal tissue after 19-21 hours following maternal injection expressed as percent dose per gram (%ID/g) or percent dose per organ (%ID/organ). Highest concentrations are present in the amniotic fluid and placenta (0.126 and 0.087 %ID/organ respectively). Per gram of tissue, highest concentrations were found in the fetal kidneys (0.0151 %ID/g). Overall amounts of gadolinium were minimal compared to the injected maternal dose. No difference in concentrations was found between those primates fed the high fat or Western diet (n=8) and the control diet (n=4).

CONCLUSION

Minimal residual gadoteridol gadolinium chelate is found in primate fetal tissues and amniotic fluid by 24 hours following maternal injection of weight-based clinical doses of gadolinium in the third trimester. Given the similarities between human and nonhuman primate placentas, we suggest there is relatively little deposition in human fetal tissues following maternal ProHance injection. While there will likely be continued debate whether gadolinium administration during pregnancy is justified, our study provides information that may alleviate some uncertainty regarding the potential for gadolinium free ion toxicity to the fetus following maternal dosing.

CLINICAL RELEVANCE/APPLICATION

After injection of gadoteridol in the gravid primate, minimal amounts of this gadolinium chelate is found in fetal tissues and amniotic fluid within 24 hours after injection. Our results may have implications for the safety of contrast-enhanced magnetic resonance imaging in pregnancy.

Can Diffusion-weighted MR Images of the Uterine Cervix Predict Impending Preterm Delivery?

Gabriele Masselli MD (Presenter): Nothing to Disclose, Maria Giulia Bernieri MD: Nothing to Disclose, Roberto Brunelli: Nothing to Disclose, Saadi Sollaku: Nothing to Disclose, Elisabetta Pioletti: Nothing to Disclose, Gian Franco Gualdi MD: Nothing to Disclose

PURPOSE

To determine whether the analysis of the apparent diffusion coefficient (ADC) maps of the subglandular area of the cervical canal helps to predict a forthcoming delivery when dealing with an asymptomatic patient presenting with a sonographic short cervix (SCX) below 15mm and with positive fetal fibronectin (FN) at 22-26 weeks of gestation.

METHOD AND MATERIALS

The institutional review board approved this prospective, hypotheses-generating study and waived the informed consent requirement. Our study population comprised 30 pregnant women (mean age: 29 (20-39) with a mean...
RESULTS
8/30 patients ultimately delivered within 7 days after admission (impeding delivery group) while 22 patients delivered after at least 7 days after admission (between 7-63 days; mean 32 days) and entered the late delivery group. The subglandular ADC and Δ ADCs were significantly higher in patients with impending delivery than in patients with late delivery (p <0.0001 for both parameters). The ROC curve analysis classified the subglandular ADC as an extremely accurate parameter to predict impending delivery (AUC = 1.000, p <0.0001), with an overall sensitivity (95% CI: 63.1% - 100%) and a specificity (95% CI: 63.1% - 100%) of 100%. The ADCs of cervical stromal did not help to differentiate the two groups.

CONCLUSION
When considering a diagnosis of impending preterm delivery, ADC maps targeted to the subglandular area of the uterine cervix greatly increase the PPV granted by the combined findings of a short cervix and positive cervico-vaginal fibronectin.

CLINICAL RELEVANCE/APPLICATION
The ADC maps of the subglandular area of the uterine cervix can predict impending preterm delivery. This result cannot be obtained with other techniques and can be particularly useful in the acute management of patients presenting with SCX and positive FN in the late second trimester of pregnancy.
Chorionic bump, a convex bulge from the choriodedical surface into the gestational sac on first trimester ultrasound, has been considered a risk factor for non-viability in pregnant patients with this rare finding, though the strength of this association has recently been questioned. We performed a systematic review and meta-analysis to summarize the association between chorionic bump and non-viability.

**METHOD AND MATERIALS**

A comprehensive literature search was performed. We included all studies except case reports. A meta-analysis was performed using a random-effects model.

**RESULTS**

After screening five studies, two studies with a total of 67 patients met inclusion criteria. This was combined with one study (N=52) from our institution (submitted for publication to JUM) of 52 patients, for a total of 119 unique patients. Overall, the live birth rate (LBR) was 62% (74/119). 51 chorionic bump pregnancies were otherwise normal (i.e., pregnancies in which a gestational sac, yolk sac and embryo with heartbeat was seen at some point), and in this subset, LBR was 83% (42/51). There was no significant relationship found between vaginal bleeding and live birth (p=0.857); no significant difference in bump volume between live birth and no live birth (p=0.19); and for subset analysis of pooled odds ratio for the relationship between live birth and history of infertility, there was no significant relationship found (p=0.186).

**CONCLUSION**

Chorionic bump remains a risk factor for non-viability in pregnancy, however if the pregnancy is otherwise normal, then the majority result in live birth.

**CLINICAL RELEVANCE/APPLICATION**

If a first-trimester ultrasound demonstrates a chorionic bump, then the results of this meta-analysis suggest that if the pregnancy is otherwise normal, the majority will result in live birth.

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**SSA10-05**

**Amniotic Fluid Volume Estimation by MR Hydrography**

Nicholas Hilliard MBChir (Presenter): Nothing to Disclose, Rebecca Baker: Nothing to Disclose, Andrew Patterson PhD: Nothing to Disclose, Martin John Graves BA: Nothing to Disclose, Christoph Lees: Nothing to Disclose, Patricia Ai Khoon Set MBBS: Nothing to Disclose, David John Lomas MD: Nothing to Disclose

**PURPOSE**

Hypothesis:
Hydrographic MR imaging can provide a rapid non-invasive in-vivo estimate of amniotic fluid volume (AFV).

Background:
Current ultrasound based methods, such as amniotic fluid index and single deepest vertical pocket, are indirect measures of AFV and are known to have limitations, making their use in routine management and research controversial.

**METHOD AND MATERIALS**

23 women with healthy singleton pregnancies between 28 and 32 weeks gestation were consented for MR examinations of the gravid uterus using a 1.5T MRI system. Two breath-hold techniques were used: (1) 2D 5mm thick section FIESTA, surface array coil (2) 2D 200mm thick section FSE TE 800ms, integrated volume body coil. A reference fluid volume of 50mls normal saline was positioned anterior to the abdominal wall and within the field of view of (2). Manual planimetry was used to outline all of the amniotic fluid demonstrated on each 5 mm section of (1), which were summed to provide the reference standard for AFV. Manual regions of interest were used to outline the reference volume and amniotic fluid sac on (2). Using the signal area product, the volume of the amniotic fluid was estimated. The maximum values from the 5 acquisitions were compared with the reference planimetry results using a non-parametric Spearman’s rank correlation.

**RESULTS**

Fluid volumes between 146 and 884 mls were found on planimetry. High inter-rater agreement was noted for both the methods (ICC=0.961 and 0.997). The rank order correlation between the planimetry and the hydrographic method was highly significant (r=0.864, p<0.001). A linear fit equation of y=0.6083 + 163.05mls was obtained, with planimetry defined as the independent variable. This relationship suggests that the inclusion of fetal fluid structures is likely to bias the results positively at lower AFV, and the inhomogeneity of B1 excitation is likely to bias the results negatively at larger AFV.

**CONCLUSION**

This initial study indicates that it is possible to estimate AFV with MRI using a rapid hydrographic technique, based on single thick slab acquisitions. Further optimisation for fetal fluid structures, RF inhomogeneity, as well as data at different gestational ages will be required.

**CLINICAL RELEVANCE/APPLICATION**

A rapid MR hydrographic based estimate of amniotic fluid volume may allow for improved pregnancy management, and new research into fetal outcomes.
The Ups and Downs of CT Utilization in Pregnancy

Joseph Steven Konrad MD (Presenter): Nothing to Disclose, Ana P. Lourenco MD: Nothing to Disclose, Elizabeth Lazarus MD: Nothing to Disclose

PURPOSE

To review CT utilization in pregnant women from 2006-2013 and to evaluate for an interval decrease as concerns over radiation exposure from medical imaging have increased.

METHOD AND MATERIALS

This IRB approved, HIPAA compliant retrospective review of the radiology database at a large academic women's hospital was conducted to identify all CT examinations performed in pregnant females from January 1, 2006 - December 31, 2013. Patient age, gestational age at the time of CT, indications for the study, final impression, radiation dose and additional imaging exams performed within one week for the same complaint were recorded.

RESULTS

There were a total of 440 CT examinations performed in pregnant patients during the study period. There were 69,508 deliveries during the study period. 24 patients had 2 CT exams during the same pregnancy. Average patient age was 27 (range 15-40 yrs). Average gestational age at time of CT was 27 weeks (range 5 to 40 weeks). The majority of CTs were performed in the third trimester, 56% (246/440). The most common CT examination performed over the 8 year span was a CT Pulmonary Embolus 44% (194/440) followed by a CT of the abdomen and pelvis 33% (144/440). The most common indication for a CT exam was shortness of breath 33% (144/440). Positive, acute findings were identified in 21% (91/440) of exams. There were a total of 301 additional imaging studies performed on this patient cohort, with chest X-ray being the most common 35% (106/301). CT utilization per 1000 deliveries in 2006/2007 was 6.1, increasing 33% to 8.1 in 2008/2009. Utilization decreased 50% from peak utilization in 2008/2009 to 4.1 in 2012/2013. The average overall CT acquired radiation dose for all patients was 27.63 mGy.

CONCLUSION

CT utilization in pregnant patients has declined 50% over the past 4 years.

CLINICAL RELEVANCE/APPLICATION

CT utilization in pregnancy has declined over the past 4 years as awareness of radiation related to medical imaging has increased among both patients and providers.

Three-dimensional Visualization of the Placental Arterial and Venous Vasculatures ex vivo by 64-spiral CT

Meizhi Li: Nothing to Disclose, Xiaoling Zhang (Presenter): Nothing to Disclose, Jian Guan MD: Nothing to Disclose, Shurong Li: Nothing to Disclose, Mingjuan Liu MMEd: Nothing to Disclose, Chenyu Gou: Nothing to Disclose, Yan Guo MD: Nothing to Disclose

PURPOSE

The purpose of this study is for the first time to investigate the three-dimensional visualization of the placental arterial and venous vasculatures ex vivo on 64 spiral CT angiography by injecting two different concentrations of contrast agent into arteries and veins.

METHOD AND MATERIALS

The placentas from 25 healthy singleton pregnancies were injected with two different concentrations of color dyed non-ionic iodinated contrast medium in umbilical arteries and veins (red solution with 150 mg of iodine per milliliter for chorionic arteries paired with blue solution with 30mg of iodine per milliliter for chorionic veins in each placenta, respectively). Computed tomography angiography was employed by 64 spiral CT and reconstructed using Vital Images' Vitrea® medical imaging software, allowing for the three-dimensional configuration of placental vascular tree with chorionic arteries and veins in different densities or colors. The branches of the intraplacental villous vascular trees were observed, and the diameters of each branches of arteries and veins were measured on digital photograph.

RESULTS

The 3D visualization of placental vascular tree was delineated with arteries and veins in different densities or colors. The CT angiography showed the vessels starting with the chorionic vessels branching off into 5-6th generation blood vessels in arteries and 4-5 generation blood vessels in vein, of which some in the placental parenchyma. The blood vessels with the smallest diameter of 0.6mm was delineated.

CONCLUSION

Placental arteries and veins could be differentiated in one CT angiography by injecting different concentrations of contrast agent. The deep blood vessels in the placental parenchyma could be delineated.

CLINICAL RELEVANCE/APPLICATION
Ex vivo CT angiography of the placental arteries and veins can demonstrate deep blood vessels in the parenchyma and is recommended in the investigation of deep arterio-venous anastomoses within twin or triplets placentas.

**SSA10-08**

**Automatic Differentiation of Functional Placental Compartments for Perfusion Analysis in the Mouse Using the Time-to-peak Model at 7T**

Chressen Catharina Remus MD (Presenter): Nothing to Disclose, Nils Daniel Forkert: Nothing to Disclose, Jan Sedlacik: Nothing to Disclose, Gerhard B. Adam MD: Nothing to Disclose, Petra Arck: Nothing to Disclose

**PURPOSE**

DCE MRI is a commonly applied imaging technique for perfusion quantification and is frequently used in experimental setups for perfusion analysis in the mouse placenta. To date, placental perfusion analysis is commonly performed by determining the average perfusion value for the entire placenta without taking the different functional placental compartments into account. The purpose of this work was to develop an automatic differentiation of the two functional placenta zones in a mouse model based on bolus arrival times for a detailed and reproducible perfusion assessment.

**METHOD AND MATERIALS**

Ten pregnant BALB/c mice at gestation day 16.5 were examined at 7T. Coronal dual-echo 3D T1-weighted gradient-echo sequences were acquired after application of contrast agent for dynamic MR-imaging. An adapted gamma variate function was fitted to the concentration time curves to evaluate the effect of noise on perfusion and segmentation results. Maps of the bolus arrival time were calculated based on discrete and fitted curves and used to classify each voxel into a high-flow and low-flow compartment based on k-mean clustering. Segmentation results were evaluated based on the DICE coefficient with manually delineated compartments from two independent observers. Perfusion analysis was performed on discrete and fitted curves using the steepest slope model.

**RESULTS**

Manually delineated high-flow and low-flow compartments agreed with automatic segmented compartments for discrete (D=0.76/0.75; D=0.76/0.79) and fitted (D=0.80/0.80; D=0.81/0.82) concentration time curves. Mean perfusion values of discrete and fitted curves ranged in the high flow compartment from 134 to 142 ml/min/100ml (discrete) vs. 138 to 143 ml/min/100ml (fitted) and in the low-flow compartment from 91 to 94 ml/min/100ml (discrete) vs. 74 to 82 ml/min/100ml (fitted).

**CONCLUSION**

Functional perfusion compartments can be automatically differentiated using bolus arrival times with a high agreement to manual differentiations. Fitting of the gamma variate function improves segmentation results. The proposed method may overcome reported limitations in perfusion analyses by eliminating the subjective choice of regions of interest.

**CLINICAL RELEVANCE/APPLICATION**

The heterogeneity within the placenta with its two functional compartments generates the need for separate compartment analysis to enable a more detailed and reproducible understanding of placenta perfusion.

**SSA10-09**

**DCE MRI of the Placenta Reveals Alterations of Placenta Perfusion after a Stress Challenge during Pregnancy in Mice**

Chressen Catharina Remus MD (Presenter): Nothing to Disclose, Fabian Kording: Nothing to Disclose, Nils Daniel Forkert: Nothing to Disclose, Jan Sedlacik: Nothing to Disclose, Emilia Solano: Nothing to Disclose, Gerhard B. Adam MD: Nothing to Disclose, Petra Arck: Nothing to Disclose

**PURPOSE**

Stress during pregnancy is known to have a negative effect on fetal outcome, possibly via placenta mediated pathways. The purpose of this study was to examine alterations in placental perfusion upon a stress challenge during pregnancy in mice.

**METHOD AND MATERIALS**

MRI was performed on a 7Tesla scanner (ClinScan, Bruker, Germany) on 20 pregnant Balb/c mice on gestation day (gd) 16.5. 10 dams were exposed to an established model of acoustic stress challenge. 10 dams served as controls. For DCE-MRI, a contrast enhanced 3D T1-weighted gradient-echo sequence was used. Placental perfusion was calculated based on the steepest slope model in 2 placentas per dam. The two functional placental compartments, the highly vascularized labyrinth and the endocrine junctional zone, were assessed separately. Immunohistochemistry, including staining for neoangiogenesis, was performed on placentas after imaging.

**RESULTS**
Perfusion increased significantly upon a stress challenge, compared to the control group (192 ± 51 ml/ml/min vs. 141± 28ml/ml/min ) (p< 0.001) in the highly vascularized labyrinth - the zone of oxygen and nutrition exchange of the placenta. This observation was supported by immunohistochemistry of the placentas, demonstrating an increased expression of the angiogenesis biomarker CD31 (p ≤ 0.01) and an increased count of small and medium vessels in the placental labyrinth of the stress challenged group (p ≤ 0.01).

CONCLUSION

Placental perfusion increases upon a stress challenge during pregnancy, possibly by neoangiogenesis of small and medium size vessels.

CLINICAL RELEVANCE/APPLICATION

Stress has a profound impact on fetal outcome and health conditioning, yet the underlying mechanisms remain unknown. Studying placental vascular alteration may help to understand these pathways.
**SSA11-03**

**Does Resident Report Modification Depend on Level of Attending? - Preliminary Analysis of Resident Report Modifications by Attending Radiologists as a Measure to Improve Resident Education and Quality Control**

Supriya Gupta MBBS : Nothing to Disclose, Yulia Melenevsky MD (Presenter): Nothing to Disclose

**PURPOSE**

Learning to create accurate, concise, clinically relevant reports is a critically important part of radiology resident education. The resident reports are subsequently reviewed and modified by attending prior to signing. Feedback from this review is crucial to resident development and education. We wanted to assess differences between resident and attending reports at our institution and various factors which influence it.

**METHOD AND MATERIALS**

In this ongoing retrospective study, 145 resident and corresponding final attending reports from musculoskeletal radiology were collected. For resident reports, postgraduation training year and work setting (call vs regular workday) and for attending reports, experience of attending (<5 years - Junior, >5 years - Senior) were recorded. Report differences were analyzed broadly under three categories: grammatical or spelling mistake changes, misinterpretation of findings and missed findings. Chi square test was used to assess variance in degree of report changes in senior versus junior categories.

**RESULTS**

Of current data, 145 musculoskeletal radiographic reports were analyzed. Overall, only 6 reports had major grammatical changes or spelling mistakes. 18/145 (12.4%) contained missed finding (incidental or significant) while 29/145 (20%) had misinterpreted findings. 52 (35.8%) reports were read by senior staff radiologists and 93 (64/13%) by junior staff. Among reports signed by Senior attendings, most final report changes were deemed either none (59.6%) or minor (28.8%) versus major (11.5%); whilst for reports read by Junior staff radiologists, distribution was none (50.5%), minor (22.5%) versus major (26.88%). The degree of changes between senior and junior attending reports were statistically significant (p<0.001).

**CONCLUSION**

Preliminary data showed significant difference between report modifications between junior and senior attendings for the same resident report. Junior attendings tend to modify reports more, compared to more experienced colleagues. This is intuitive since experience increases diagnostic confidence of radiologists and this is reflected in not only their dictation styles but also in their teaching styles.

**CLINICAL RELEVANCE/APPLICATION**

Analysis of resident reports compared to final attending reports can provide valuable quality metrics for Quality Control.
SSA11-04

Search Pattern Training for Improving Pulmonary Nodule Identification on Chest Radiographs

William Auffermann MD, PhD (Presenter): Nothing to Disclose, Brent Little MD: Nothing to Disclose, Travis S. Henry MD: Spouse, Employee, F. Hoffmann-La Roche Ltd, Stefan Tigges MD: Stockholder, Microsoft Corporation Stockholder, General Electric Company, Srini Tridandapani PhD, MD: Nothing to Disclose

PURPOSE

Many chest radiograph interpretation errors occur because observer’s eyes do not fixate on a relevant abnormality, which may be partially due to a lack of a search strategy. This project’s goal is to determine if providing a standardized chest radiograph search pattern to medical trainees improves performance on a nodule identification task.

METHOD AND MATERIALS

Healthcare trainee participants included: medical and nurse practitioner students, and non-radiology residents and fellows. The image set included 50 chest radiographs; 25 normals and 25 with pulmonary nodules (one nodule per image, size range 10-20 mm). Subjects were divided into control and treatment groups, and were shown the 50 radiographs randomized into two case sets of equal size. Subjects were asked to mark nodules if present and give a rating of their diagnostic confidence using a 5 point scale. The control group received no training between case sets. The treatment group received chest radiograph search pattern training between the first and second case sets. Performance on nodule identification between control and treatment groups were compared using localization receiver operator characteristic (LROC) analysis and differences in the area under the LROC curve (D-AUC). P-values of less than 0.05 were considered statistically significant.

RESULTS

Control Group: There was no statistically significant difference in subject performance between case sets 1 and 2, D-AUC = 0.0521, p-value = 0.1910. Treatment group: There was a statistically significant improvement in subject performance between case sets 1 and 2, D-AUC = 0.1079, p-value = 0.0150.

CONCLUSION

Providing healthcare trainees with a chest radiograph search pattern improved performance on a nodule identification task.

CLINICAL RELEVANCE/APPLICATION

Search pattern training may be useful for healthcare trainees who will evaluate chest radiographs as part of their practice.

SSA11-05

Assessment of Web Based Interactive Learning of Basic Image Interpretation

Betty Anne Schwarz MSc, RN (Presenter): Nothing to Disclose, Mark E. Schweitzer MD: Consultant, MMI Munich Medical International GmbH Data Safety Monitoring Board, Histogenics Corporation, Rebecca Ann Peterson MD: Nothing to Disclose

PURPOSE

Following the Flexnor report in the early 1990’s undergraduate medical school training underwent a revolution. These changes overwhelmingly affected clinical disciplines. Until recently formal medical school imaging training was extremely limited. As imaging is digital we felt it lended itself to web based teaching. Hence, we developed and systematically assessed the educational effects of a web-based series of modules to ameliorate this deficit.

METHOD AND MATERIALS

A web based teaching module was developed to be used by trainees from other services. These modules were based on what should be the critical mass of imaging that all non-imaging specialists should know. The curriculum consisted of 600 de-identified cases organized by body part, with text and user controlled animation. The 600 cases were felt to run the gamut of typical imaging that would be seen by the generalist. These cases were supplemented by 13 video power-point lectures including: Introduction to Head CT, An Approach to CT Head, Contrast Use, Basic Abdomen, Basics of Chest Imaging, Radiology of Spine Trauma, Easily Missed Musculoskeletal Injuries, Radiology of Extremity Fractures, Review of Chest Image Interpretation. Assessment of learning was done via a web based questionnaire. This questionnaire was based on the post test given as part of our University’s radiology elective. Our assessment was given to third and fourth year medical students both pre and post web based educational intervention assessments. A fraction of later students also expressed their confidence in their answers.

RESULTS

The average on the pre-test was 40% whereas their post-test average was 71% (P < 0.0001 CI 23.26-38.45)

CONCLUSION

This web based systematic didactic and case based review of radiology demonstrably enhanced medical student
familiarity with our field.

**CLINICAL RELEVANCE/APPLICATION**

We implemented and evaluated the effectiveness of a web based program to significantly aid in teaching non-imaging clinicians the basics of image interpretation.

**SSA11-06**

**A Pocket-Size, Portable PACS and Open-Source Software Development Platform for Biomedical Researchers and Educational Institutions**


**CONCLUSION**

A portable, cost-efficient radiology application development ecosystem was created for biomedical researchers. Furthermore, low cost hardware coupled with open-source software makes the device a viable solution as a radiology teaching aid and rapid software development platform.

**Background**

A pocket-size PC utilizing open-source software was created to fulfill the need for a low cost software developer tool and teaching aid for biomedical researchers and educational institutions. The system was designed for "plug-and-play" setup and rapid application creation and deployment. Additionally, the device functions as a teaching instrument demonstrating basic PACS function and software development. A unique user interface with standard or touch screen display integration was designed to facilitate ease of use for users with no programming background.

**Evaluation**

Hardware includes a credit card size, Linux OS based PC with internet connectivity. Open-source software was modified and compiled specifically for the device and is comprised of (1) a PACS suite; (2) DCMTK library; (3) programming libraries (JAVA, PERL, Python); (4) internet server/services (Apache, PHP, SQL); (5) indexing search engine with anonymized database that allows keyword queries. All data including OS and developer software reside on a removable SD card.

**Discussion**

SD card contents are stored as an 'image' file which allows for a rapid and efficient backup solution. This equates to no down-time in the event of hardware failure. Also, the image can be cloned on to a new card, creating a multitude of identical devices, and eliminating time needed to reinstall/recompile the OS and developer libraries. Incorporating DCMTK binaries used in conjunction with the most common programming languages and web services provides for a robust and versatile software development environment. Coupled with a locally running PACS and keyword queryable database, applications specific to a researcher's needs can be written. Additionally, radiology image based studies can be initiated by simply uploading DICOM images and associated radiology, pathology, or similar text data to the device. This data is then processed by the device and accessible via the device's web interface.

**SSA11-07**

**Senior Medical Students’ Awareness of Radiation Risks from Common Diagnostic Imaging Examinations**

Elena Scali MD (Presenter): Nothing to Disclose, John R. Mayo MD: Speaker, Siemens AG, Savvas Nicolaou MD: Nothing to Disclose, Silvia D. Chang MD: Nothing to Disclose

**PURPOSE**

The radiology component of the undergraduate medical curriculum at our institution aims to provide medical students, as future practitioners, with broad-based knowledge about commonly performed imaging studies. The purpose of this study is to investigate senior medical students' awareness of radiation exposures from common diagnostic imaging studies as well as radiation risks.

**METHOD AND MATERIALS**

The study population consisted of medical students in their final year at our institution. An anonymous multiple-choice questionnaire was distributed. Questions were designed to assess knowledge of radiation from common diagnostic procedures and radiation-related risks.

**RESULTS**

48 eligible medical students responded. The majority of students felt that knowledge of the radiation dose of common imaging examinations is somewhat or very important (98%). However, only 6% of students routinely discussed radiation-related risks with patients when recommending imaging examinations. 83% of students recognized that CT is most responsible for medical radiation received by the population. While almost all recognized children as most sensitive to the effects of radiation, only 35% correctly identified gonads as the most radiation-sensitive tissue. 30% correctly identified the absolute dose (in miliSieverts) of a chest x-ray and relative dose compared to background radiation. The proportion of students able to correctly identify the relative dose of common imaging studies in chest x-ray equivalents varied from 26-65%; the remainder underestimated the dose received by the patient. Approximately half of the student correctly identified the risk of inducing a fatal cancer from an abdominal CT in an adult; the remainder underestimated this risk.

**CONCLUSION**
Medical students acknowledge the importance of radiation-related issues to patient care. While almost all students are familiar with radiation-free modalities, many students are not familiar with, and commonly underestimate, the relative doses and risks of medical radiation. This may expose patients to increasing imaging investigations and exposure to radiation hazards.

**CLINICAL RELEVANCE/APPLICATION**
Medical students commonly underestimate radiation-related doses and risks, and would do well to receive further instruction on the radiation-related hazards of commonly performed imaging studies.

**SSA11-08**
**Educational Exhibit "Likes" at the 2013 RSNA Annual Meeting: A Detailed Analysis**
Paul Michael Bunch MD (Presenter): Nothing to Disclose, Jeremy Robert Wortman MD: Nothing to Disclose, Katherine P. Andriole PhD: Nothing to Disclose

**PURPOSE**
The 2013 RSNA DPS offered educational exhibit (EE) viewers the opportunity to "like" an EE. We sought to evaluate any relationship between an EE's popularity and its chance of winning an award or being selected for Radiographics. We also evaluated any relationship between an EE's recognition and its subsequent popularity.

**METHOD AND MATERIALS**
The number of likes each EE received was captured from DPS on Tuesday evening prior to Wednesday's announcement of award selections, on Thursday evening prior to Friday's announcement of Radiographics invitations, and on Friday evening upon closure of the exhibit halls. Data analysis was performed by means of oneway ANOVA.

**RESULTS**
At the 2013 RSNA meeting, there were 1856 EEs, which received 4391 likes (Mean 2.37, Min 0 [n=527], Max 55 [n=1]). Awards were given to 423 EEs (22.8%), which received a total of 1490 likes (33.9%, Mean 3.52, Min 0 [n=59], Max 55 [n=1]). Radiographics invitations were given to 190 EEs (10.2%), which received a total of 752 likes (17.1%, Min 0 [n=32], Max 55 [n=1]). EEs receiving awards had significantly more likes prior to announcement of award selection (Mean 1.9 vs 1.3, SD 2.7 vs 2.1) and at the end of the meeting (Mean 3.5 vs 2.0, SD 4.6 vs 2.9) than non-awarded EEs [p<0.001 for both]. EEs receiving Radiographics invitations had significantly more likes prior to announcement of Radiographics invitations (Mean 2.4 vs 1.3, SD 3.5 vs 2.1) and at the end of the meeting (Mean 4.0 vs 2.2, SD 5.6 vs 3.0) than non-invited EEs [p<0.001 for both]. EEs receiving at least 15 likes prior to announcement of awards had a 44.4% chance of being recognized compared to a 22.7% chance. EEs receiving at least 15 likes prior to announcement of Radiographics invitations had a 33.3% chance of receiving an invitation compared to a 10.0% chance. Receiving an award on Wednesday had a statistically significant association with the number of likes (Mean 1.7 vs 0.7, SD 2.4 vs 1.2) an EE subsequently received [p<0.001].

**CONCLUSION**
The DPS "like" feature at the 2013 RSNA meeting, similar to social media impact, allowed for substantial audience feedback on EEs, with over 4000 distinct entries made. Receiving an award or a Radiographics invitation was associated with a subsequent increase in EE popularity.

**CLINICAL RELEVANCE/APPLICATION**
EE likes gauge radiologists' opinions of EEs and may predict awards and Radiographics invitations.

**SSA11-09**
**Rapid-feedback Using a Web-based Module to Teach the Grading of Degeneration on an MRI of the Lumbar Spine**
Alexander T. Ruutiainnen MD (Presenter): Nothing to Disclose, Po-Hao Chen MD, MBA: Nothing to Disclose, Howard Lee Roth MD: Nothing to Disclose, Tessa S. Cook MD, PhD: Nothing to Disclose

**PURPOSE**
Grading the severity of lumbar degeneration on an MRI is an important task which carries treatment implications. Although published criteria exist for assigning such grades, the consistency of their use varies among radiology trainees and some practicing radiologists. We hypothesized that such cutoffs could be effectively taught by providing rapid feedback to a learner. To this end, we developed a free web-based module, named Centaur, to teach the grading of spine degeneration using rapid feedback.

**METHOD AND MATERIALS**
Seven musculoskeletal radiologists were asked to rate the size of disc bulges and the severity of spinal canal and neuroforaminal narrowing using a 7 point scale ranging from "normal" to "severe." The correct response for each case was determined by statistical consensus; for weighting Fleiss' kappa, responses were considered discordant if they differed from the consensus by more than one point. Next, a web-based module was created to present these cases to subjects: using the module, learners attempt to grade the established cases, and are provided with immediate feedback regarding their choices. The module automatically tracks performance to determine whether the accuracy of the responses improves with time.

**RESULTS**
Inter-observer concordance among practicing musculoskeletal radiologists was higher for assessing the size of disc bulges (Fleiss' weighted kappa = 0.78), than central canal narrowing (kappa = 0.59) or neuroforaminal narrowing (kappa = 0.54). Detailed results from the analysis of all respondents who consent to the collection of their performance data using our web based module will be presented. Specifically, we aim to show that providing rapid feedback is an effective tool for teaching this concept.
CONCLUSION

We demonstrate the use of a web-based module that delivers rapid feedback to teach the grading of degenerative changes on an MRI of the lumbar spine. We believe that these results add to the body of radiologic pedagogy and highlight the general feasibility of using such web modules to teach some concepts in diagnostic radiology.

CLINICAL RELEVANCE/APPLICATION

Learning to grade the severity of degeneration on a lumbar spine MRI is challenging but clinically important: we demonstrate the use of a web-based module that delivers rapid feedback to teach these criteria.

SSA12

Molecular Imaging (GYN/Breast Cancer)

Sub-Events

SSA12-01

Christopher Devin Malone MD (Presenter): Nothing to Disclose, Emilia Sue Olson MD, PhD: Nothing to Disclose, Robert Frederic Mattrey MD: Nothing to Disclose, Nadia Nashi: Nothing to Disclose, Tao Jiang PhD: Nothing to Disclose, Leslie Ellies: Nothing to Disclose, Roger Y. Tsien MD: Research Consultant, Avelas Biosciences, Inc Stockholder, Avelas Biosciences, Inc, Quyen Nguyen: Nothing to Disclose

PURPOSE

Matrix metalloproteinases-2 and -9 (MMP-2/-9) are upregulated in many aggressive tumors. We aimed to compare the tumor detection performance of a standard Gd-chelate to that of Gd-loaded MMP-2/-9 activatable cell-penetrating peptide dendrimers (ACPPD-Gd) using a murine tumor model representative of aggressive triple-negative breast cancer with 3T MR.

METHOD AND MATERIALS

Using a protocol approved by the Institutional Animal Care and Use Committee, 2 of 4 inguinal breast fat pads of 16 albino C57BL/6 mice were inoculated with Py8119 cells and the other 2 with saline at random. MR at 3T was performed on 8 mice before and 2-3 minutes after 0.1mmol/kg gadobutrol and on 8 mice 24-hours after 0.036mmol/kg Gd of ACPPD-Gd on days 4, 9, and 14 after inoculation. T1w tumor signal was normalized to adjacent muscle and compared between agents and the non-contrast groups using analysis-of-variance. Experienced and trainee blinded readers assessed for the presence of tumor in each of the 4 breast regions. ROC curves were constructed and the area-under-the-ROC curve (AUC) calculated.

RESULTS

Mouse mammary tumors imaged by MR at 3T 24 hours after ACPPD-Gd showed significantly greater T1w signal compared to tumors imaged 2-3 minutes after gadobutrol (1.57±0.2 vs. 1.25±0.13, p<0.05) were removed from the ROC analysis for the experienced observer (0.96 vs. 0.86, p=0.098), and more so for the trainee (0.86 vs. 0.69, p=0.04).

CONCLUSION

ACPPD-Gd results in significantly more T1w signal in tumors compared to gadobutrol at 3T, resulting in increased conspicuity and improved detection for experienced and more so less experienced observers.

CLINICAL RELEVANCE/APPLICATION

ACPPD-Gd improves tumor conspicuity, the performance of the less experienced observers, and may highlight early stage tumors that could be missed on T1w MR imaging at clinically relevant fields strengths and scan times.

SSA12-03

Funmilayo Tade MD, MPH (Presenter): Nothing to Disclose, Oluwaseun Odewole MD, MPH: Nothing to Disclose, Oyeladun Oyenuga MD, MPH: Nothing to Disclose, Michael A. Cohen MD: Nothing to Disclose,
Amino acid transport is upregulated in breast carcinoma. Anti-1-amino-3-[18F]fluorocyclobutane-1-carboxylic acid (anti-3-[18F]FACBC) is a synthetic amino acid analog positron emission tomography (PET) radiotracer which is transported primarily via system ASC2 and LAT1 amino acid transporters. The purpose of this exploratory study is to characterize anti-3-[18F] FACBC uptake in benign and malignant breast lesions.

METHOD AND MATERIALS

Four women with histologic confirmation of breast carcinoma or about to undergo biopsy for suspected breast carcinoma not currently undergoing therapy underwent 45 minute dynamic anti-3-[18F]FACBC PET-CT. Standardized uptake values (SUVs) within malignant and benign breast lesions as well as the contra-lateral normal breast were recorded at 5-8mins, 17-21mins, 29-32mins and 41-44mins time frames. Findings were validated by histologic and imaging correlation. T-tests were used to examine the significance of difference in the mean SUVmax of benign lesions as well as to normal breast lesions.

RESULTS

Average age ±SD was 64.25 ± 11.2 years. Average dose ±SD of anti-3-[18F] FACBC injected was 9.8mci ±0.3. There were 7 breast lesions characterized in 4 patients; 3 benign and 4 malignant (Figure 1A and B). Malignant lesions had significantly higher SUVmax compared to benign lesions and normal contra-lateral breast tissue at all time points (Figure 1C). There was no significant difference in the mean SUVmax of benign breast lesions and normal contra-lateral breast at any time point (Figure 1).

CONCLUSION

Anti-3-[18F] FACBC shows promise in delineating malignant from benign breast lesions and normal breast tissue. Our result may guide the design of larger studies examining its utility in breast cancer detection, staging and restaging.

CLINICAL RELEVANCE/APPLICATION

Anti-3-[18F] FACBC characterization of amino acid transport upregulation may be useful for the diagnosis of breast cancer and to differentiate malignant from benign lesions.

Diagnostic Value of Diffusion-weighted Imaging in a Simultaneous 18F-FDG PET/MRI Protocol for Whole-body Staging of Female Patients with Pelvic Malignancies

PURPOSE

To evaluate the diagnostic benefit of diffusion-weighted imaging (DWI) in a simultaneous 18F-FDG PET/MRI protocol for whole-body staging of patients with primary or recurrent malignancies of the female pelvis.

METHOD AND MATERIALS

67 patients with primary or a suspected recurrence of a pelvic malignancy were included in our study. All patients underwent whole-body 18F-FDG PET/MRI (Biograph mMR, Siemens) including DWI. Two radiologists separately evaluated the 18F-FDG PET/MRI datasets without DWI followed by a second reading including DWI. After assessment of (1) overall lesion detection, all lesions considered as malignant were evaluated concerning (2) lesion conspicuity (4-point ordinal scale) and (3) diagnostic confidence (3-point ordinal scale). In a second session, the lesion-to-background contrast and diagnostic confidence for PET and DWI was assessed qualitatively. Wilcoxon signed-rank test was applied to assess statistical significance.

RESULTS

A total of 136 primary and recurrent tumor lesions were detected in 58 of the 67 patients. 18F-FDG PET/MRI including DWI revealed an insignificantly minimal higher lesion conspicuity (PET/MRI + DWI: 3.85 ± 0.38; PET/MRI - DWI: 3.88 ± 0.37) and diagnostic confidence (PET/MRI: 2.71 ± 0.57; DWI: 2.77 ± 0.50) in comparison to PET/MRI without DWI. Furthermore, the lesion-to-background contrast revealed significantly higher values for PET (3.82 ± 0.43) in comparison to DWI (3.57 ± 0.80) with a significantly higher diagnostic confidence (PET: 2.70 ± 0.58; DWI: 2.51 ± 0.68) for malignancy (p < 0.01).

CONCLUSION

DWI in PET / MRI does not provide a diagnostic benefit for whole-body staging of patients with pelvic malignancies. Regarding the advantages of PET in comparison to DWI in the delineation and characterization of tumor lesions, DWI should be questioned as an integral part of PET / MRI protocols for whole-body tumor staging.
The omission of DWI in whole-body tumor staging of pelvic malignancies may lead to a significant reduction of examination times, thus increasing patient comfort without a relevant decrease in diagnostic competence.

**Purposes**

**Fulvestrant, an estrogen receptor degrader,** is now widely used in management of breast cancer (BrCa). Currently, there are no methods to optimize treatment dosing of fulvestrant. This study assesses the utility of pharmacodynamic imaging using 16α-[18F]-fluoroestradiol (18F-FES) in dose optimization of fulvestrant in a preclinical model of ER+ BrCa.

**Method and Materials**

MCF7 cells (ER+) were incubated with different doses of fulvestrant for 24 h. Retention of 18F-FES was measured and compared to ERA protein expression (ELISA) and ESR1 mRNA transcription (qPCR). MCF7 tumors were grown in ovariectomized nude mice. The mice were randomly assigned to vehicle, low- (0.05mg), medium- (0.45mg) or high-dose (5mg) treatment groups (n=5-7). Two days after fulvestrant treatment, PET/CT was performed using 18F-FES and 18F-FDG. ER expression was assayed by immunohistochemistry (IHC), ELISA, and qPCR on xenografts. Tumor proliferation was assessed using Ki-67 IHC.

**Results**

In vitro, fulvestrant was equipotent at reducing 18F-FES uptake as ER protein expression, despite stimulating mRNA transcription severalfold. In xenografts, ER expression significantly decreased with fulvestrant treatment in a dose-dependent manner both in ELISA of tumor lysates and IHC staining, despite similar mRNA expression. No difference in Ki-67 staining was observed among the treatment groups. We observed a significant dose-dependent reduction of 18F-FES PET SUVmean with fulvestrant treatment, but no significant difference among the treatment groups in 18F-FDG PET parameters.

**Conclusion**

We demonstrated that 18F-FES uptake mirrors the dose-dependent changes in functional ER expression with fulvestrant treatment which precedes the changes in tumor metabolism and proliferation. Pharmacodynamic imaging of estrogen receptor may be useful for tracking early efficacy of ER degradation and guiding ER-targeted therapy dosing in BrCa patients.

**Clinical Relevance/Application**

Precise anti-ER dosing in individual patients using pharmacodynamic imaging of ER may improve therapy response.
FDG PET/CT has been disappointing in staging early endometrial and cervical tumors. We have evaluated 18F-FEC, an alternative tracer which is effective in prostate cancer staging. Preliminary results show imaging of endometrial and cervical cancers with 18F-FEC is feasible. There is positive correlation with FDG uptake but in general tumor FEC SUVmax is lower than FDG SUVmax.

CLINICAL RELEVANCE/APPLICATION

Preliminary results suggest that imaging of primary endometrial and cervical cancers with 18F-fluoroethylcholine PET/CT is feasible. Further evaluation is now required to assess staging accuracy.

A Novel PET Probe for Imaging HER3 Receptor Status

Eric Wehrenberg-Klee MD (Presenter): Nothing to Disclose, Nafize Selcan Turker PhD: Nothing to Disclose, Pedram Heidari MD: Nothing to Disclose, Umar Mahmood MD, PhD: Research Grant, Sabik Medical Inc, Bryan Chang: Nothing to Disclose

PURPOSE

HER3 is a surface receptor tyrosine kinase that plays an important role in pro-oncogenic signaling pathways. The receptor is expressed at low-copy number, which is potentially limiting for PET probe development. We developed an antibody-based PET probe specific for HER3, characterized it in vitro, and successfully image HER3 expressing xenografts. We demonstrate that the ability to image this low-expression surface protein is time-dependent, and is related to internalization of receptor-probe complex

METHOD AND MATERIALS

64Cu-DOTA-HER3 F(ab')2 was prepared from whole HER3 monoclonal antibody with F(ab')2 fragmentation and chelator conjugation, and its affinity for HER3 assessed using radio-labeled binding studies. HER3 surface-expression on multiple cell lines was confirmed using fluorescent-activated cell sorting (FACS). Probe internalization kinetics were determined by conducting cell uptake studies at both 4°C and 37°C. Results of cell uptake studies were correlated with geometric mean FITC signal obtained from FACS. In vivo PET-CT imaging with 64Cu-DOTA-HER3 F(ab')2 was conducted using mouse xenografts of MDA-MB 468 and HCC 70 tumors (n=3 for both groups).

RESULTS

The HER3 PET probe demonstrates a HER3 Kd of 6.8 nM. FACS confirmed HER3 expression of approximately 200 receptors per cell across multiple lines. Cell uptake studies demonstrate counts/minute/cell of 0.28, 0.45, 0.82 for MCF-7, HCC-70, and MDA-MB-468 cells, respectively after 1 hour. Time course studies demonstrate linear increase of HER3 probe uptake over time at 37°C but not at 4°C that correlates with findings on FACS. In vivo imaging with the HER3 PET Probe of MDA-MB-468 and HCC70 tumor xenografts demonstrate SUVs of 0.35 and 0.59, with TBRs of 6.0 and 11.4 respectively.

CONCLUSION

We have developed a HER3 specific PET probe, and demonstrate successful in vivo imaging of HER3 expressing xenografts. We demonstrate that imaging of a low-expression surface protein is possible, and is dependent upon internalization of the receptor-probe complex. These findings have relevance for the development of PET probes for imaging of low-expression receptors of clinical interest.

CLINICAL RELEVANCE/APPLICATION

The developed HER3 PET probe has utility for measuring HER3 expression levels on cancers, which is thought to be a primary mediator of resistance to HER2 inhibition.

Breast Cancer Follow Up: Comparison of Whole-body Hybrid PET/MR and PET/CT Imaging: Initial Experience

Onofrio Antonio Catalano MD (Presenter): Nothing to Disclose, Bruce R. Rosen MD, PhD: Research Consultant, Siemens AG, Dushyant V. Sahani MD: Research Grant, General Electric Company, Carlo Iannace MD: Nothing to Disclose, Angelo Luongo: Nothing to Disclose, Marco Catalano: Nothing to Disclose, Mark Vangel PhD: Nothing to Disclose, Marco Aiello: Nothing to Disclose, Emanuele Nicolai: Nothing to Disclose, Alexander Ramos Guimaraes MD, PhD: Speakers Bureau, Siemens AG Expert Witness, Rice, Dolan, Kershaw, Andrea Soricelli MD: Nothing to Disclose, Marco Salvatore MD: Nothing to Disclose

PURPOSE

To compare the diagnostic performance of whole-body PET/MR with PET/CT in patients followed up for treated breast cancer

METHOD AND MATERIALS

76 consecutive patients with treated breast cancer underwent whole-body FDG-PET/CT (Gemini TF, Philips) and same day FDG-PET/MR (Biograph mMR, Siemens). Two readers independently evaluated PET/CT and PET/MR studies for local recurrence as well as metastases according to published imaging criteria

RESULTS

5 patients were excluded due to data corruption, 1 because of study interruption. MRPET quality was adequate in the remaining 70 patients. PET/MR and PET/CT were concordant in 59 patients, ruling out recurrent disease/metastases in 24 and disclosing recurrent disease/metastases in 35. PET/MR and PET/CT were discordant in: in 4 PET/MR disclosed metastases not detected at PET/CT, in 1 PET/MR demonstrated local recurrence not seen on PET/CT. In 5 PET/MR correctly interpreted benign findings (sarcoidosis in 1, benign pelvic disease in 1, benign bony lesions in 3) confused with metastases on PET/CT. PET/CT demonstrated
sclerotic bony lesion in 1 that was missed at PET/MR, however comparison with prior CT dating back to 4 years ago showed stability and therefore it was interpreted as a benign lesion.

CONCLUSION

PET/MR imaging of treated breast cancer is feasible and provides diagnostic image quality in the assessment of possible local recurrent disease as well as metastases. PET/MR did not under-stage any patient when compared to PET/CT and provided the correct diagnosis for all 11 discordant cases (95% binomial upper confidence limit 0.24).

CLINICAL RELEVANCE/APPLICATION

PET/MR might represent an innovative and valid tool for accurate follow up of breast cancer patients.

SSA12-09

Multimodal Magnetic Resonance and Near Infrared-Fluorescent Imaging of Intraperitoneal Ovarian Cancer Using a Dual-Mode, Dual-Gadolinium Liposomal Contrast Agent

Murali Ravoori : Nothing to Disclose, Sheela Singh : Nothing to Disclose, Rohan Bhavane PhD : Nothing to Disclose, Bahman Anvari PhD : Nothing to Disclose, Ananth Annapragada PhD : Stockholder, Marval Pharma Ltd Stockholder, Alzeqa Biosciences LLC Stockholder, Sensulin LLC Stockholder, Abbott Laboratories Stockholder, Johnson & Johnson, Vikas Kundra MD, PhD (Presenter): License agreement, Introgen Therapeutics Inc, James Bankson PhD : Nothing to Disclose

PURPOSE

To assess whether a dual-mode, dual-Gadolinium (DM-Dual Gd) liposomal contrast agent can be used to visualize intraperitoneal ovarian tumors by multimodal magnetic resonance (MR) and near infra-red (NIR) imaging.

METHOD AND MATERIALS

DM-Dual Gd was manufactured based on the Dual Gd format for MR, with gadolinium molecules on the surface and within the lumen of the liposome to increase relaxivity, and the NIR agent indocyanine green (ICG) within the lumen. Phosphorus (P) and Gd content were measured by ICP-AES. Female nude mice bearing intraperitoneal Hey A8 human ovarian cancer tumors were injected IV with or without DM-Dual Gd (n=6). Two days later, the animals were imaged by T1-weighted MR. Afterwards, NIR imaging of open abdomen and excised tumors/organs was performed. Signal to noise ratio (SNR) was used to compare tumor enhancement by MR and radiant efficiency to compare tumor signal by NIR imaging. For robustness, experiments were repeated using a second human ovarian cancer (OVCAR-3) model.

RESULTS

Gd content was 60.34 mM and P content was 29.44 mM resulting in a Gd/P ratio of 2.05 per particle. On T1-weighted MR images, intraperitoneal ovarian tumors (HeyA8 or OVCAR3) enhanced compared to control tumors two days after DM-dual Gd injection (SNR, p<.05). As seen in the laparatomy and excised tumors views, HeyA8 or OVCAR3 tumors from animals injected with DM-dual Gd had increased fluorescence compared to control tumors (p<.05).

CONCLUSION

DM-Dual Gd can be used to visualize intraperitoneal ovarian tumors by MR and NIR imaging in pre-clinical intraperitoneal ovarian cancer mouse models.

CLINICAL RELEVANCE/APPLICATION

Nearly 75% of patients with ovarian cancer present with intraperitoneal disease; and, the degree of cytoreduction at surgery is one of the most important factors for prognosis. Current imaging is limited in detecting peritoneal disease and surgery relies on the naked eye to identify nodules for resection. The current findings suggest clinical potential for using a single injection of a single nanoparticle (DM-Dual Gd) to localize tumor by MR for pre-surgical planning and by NIR at the time of surgery for resection.
SSA13-01

**Musculoskeletal Keynote Speaker: Soft Tissue Tumors—Diagnosis and MR Tools for Characterization**

Mark Douglas Murphey MD (Presenter): Nothing to Disclose

**Carcinomatosis of Muscle: A Potential Mimic of Myositis**

Fatima Soliman MD, PhD (Presenter): Nothing to Disclose, Sinchun Hwang MD: Nothing to Disclose, Jonathan Landa DO: Nothing to Disclose, Robert Andrew Lefkowitz MD: Nothing to Disclose, David M. Panicek MD: Nothing to Disclose

**PURPOSE**

To determine the prevalence of an unusual, infiltrative pattern of primary carcinoma metastatic to muscles of an extremity, which sometimes mimics myositis at MRI.

**METHOD AND MATERIALS**

This retrospective study was IRB and HIPPA compliant. The reports of extremity MRI exams of 907 patients with a proven diagnosis of carcinoma from a recent two-year period were reviewed to identify those that mentioned muscle metastasis or myositis in an extremity. Pathology reports, follow-up imaging, and clinical records were used to confirm the diagnosis of metastasis. MR images from each patient with muscle metastasis then were reviewed by two radiologists in consensus to record whether the metastases manifested as discrete masses or as an infiltrative process (i.e., carcinomatosis).

**RESULTS**

36 (4%) of 907 MRI reports described muscle metastases (n=18) or myositis (n=18), in 25 males and 11 females (mean age, 64 yrs; range, 33-83 yrs). After review of the medical records, three cases reported as myositis were found to actually represent muscle metastases. Metastases manifested as discrete masses at MRI in 16 (76%) of 21 patients; in each of the remaining 5 (24%), the metastases showed extensive infiltration of multiple muscles. All five (100%) cases of carcinomatosis of muscle were caused by primary esophageal (n=3) or gastric (n=2) cancers. One such case was proven by biopsy; in the other four patients, the lesions were determined to represent metastases based on follow-up imaging and clinical course. Only two of the five cases were correctly diagnosed as carcinomatosis of muscle in the original MRI report; the other three cases of carcinomatosis had been misdiagnosed as myositis. The most common types of primary carcinoma resulting in discrete muscle metastases were lung (4/21=19%) and kidney (4/21=19%).

**CONCLUSION**

Muscle metastases usually manifest as discrete masses at MRI, with primary lung or renal cancers being the most common sources. An infiltrative pattern, representing carcinomatosis of muscle, is uncommon; typically results from primary esophageal or gastric cancers; and may mimic myositis at MRI.

**CLINICAL RELEVANCE/APPLICATION**

Esophageal and gastric cancers uncommonly metastasize to multiple muscles of an extremity as infiltrative carcinomatosis, which may be misdiagnosed as myositis at MRI.

SSA13-04

**Radiologic Imaging Features and Clinicopathologic Correlation of Hemosiderotic Fibrolipomatous Tumor: Experience in a Single Tertiary Cancer Center**

Dearbhail O Driscoll FFR(RCSI) (Presenter): Nothing to Disclose, Meera Hameed MD: Nothing to Disclose, Edward Athanasian MD: Nothing to Disclose, Sinchun Hwang MD: Nothing to Disclose

**PURPOSE**

To determine imaging features of hemosiderotic fibrolipomatous tumor (HFLT), which is increasingly recognized as an entity with propensity for local recurrence and the potential to transform into myxoinflammatory fibroblastic sarcoma (MIFS), and to correlate with its clinicopathologic behaviour.

**METHOD AND MATERIALS**

This retrospective study was conducted by searching the electronic medical records from 1990 to 2014. Eight patients (3 males, 5 females; mean age 58, ranging 48-71 years) with histologic diagnosis of HFLT and imaging available on PACS were identified. The review of imaging studies included radiographs (n=2/8), ultrasonograms (n=3/8), and MRI scans (n=16/8). Clinical course of each patient and diagnosis of MIFS were recorded. Imaging features at diagnosis or local recurrence were evaluated including body site, location, calcification, echogenicity at US, and size, border, MR signal characteristics, and contrast enhancement of tumor at MRI.

**RESULTS**

HFLT was most commonly located in the ankle and foot present in 4/8 (50%) and subcutaneous in 8/8; the mean size was 6.0 cm (range 2-18 cm). Histology at initial diagnosis was HFLT alone in 4 patients and HFLT coexisting with MIFS in 4 patients, and 3/7 after surgical resection recurred as MIFS or HFLT with MIFS. None
were calcified on radiograph (2/2), and on US most (2/3) were heterogeneously iso- or hypo echoic to subcutaneous fat with greater than 10 foci of vascular flow on color Doppler. Two of 8 patients had MRI only at local recurrence. The tumor border at initial diagnosis was infiltrative in 4/6 and multinodular in 2/6 patients; it was infiltrative in 2 patients with MRI at recurrence only. Fat interspersed and multiple internal septations in HFLT were present in 7/8 at both initial diagnosis and recurrence. Contrast enhancement was heterogenous in 7/7; blooming in 2/3 cases with GRE sequence suggested intratumoural haemorrhage. None developed distant metastases.

CONCLUSION

HFLT is a subcutaneous tumor with an infiltrative border, interspersed fat, and septations at MRI. In this series we found high prevalence of concurrent MIFS at initial diagnosis or transformation into MIFS at local recurrence.

CLINICAL RELEVANCE/APPLICATION

HFLT often presents as a subcutaneous mass with an infiltrative border and interspersed fat at MRI; it has a high local recurrence rate and can coexist with MIFS or recur as MIFS.

Angiomatoid Fibrous Histiocytoma: Novel MR Observations, Pathologic & Clinical Features

Courtney Ann Coursey Moreno MD (Presenter): Nothing to Disclose, Salutario Jose Martinez MD: Nothing to Disclose, Emily N. Vinson MD: Nothing to Disclose, Brian Brigman: Nothing to Disclose, Leslie Dodd MD: Nothing to Disclose

PURPOSE

To describe MR imaging, pathologic, and clinical characteristics of soft tissue angiomatoid fibrous histiocytoma (AFH).

METHOD AND MATERIALS

The MR imaging studies of six cases of pathology-proven AFH were compiled from a single institution, the largest single institution series to date. Features evaluated included lesion location, morphology, margin, predominant T1 and T2 signal, and enhancement pattern. Specific features including presence of alternating layers of high and low signal around the periphery of the lesion (‘double rim’ sign), infiltrating cords of tumor cells (‘Medusa head’ sign), cystic-solid pattern, and fluid-fluid levels were assessed. Pathologic findings and clinical presentation and outcome were reviewed.

RESULTS

Mean patient age was 23 years (range 3-46 yrs; 3 male, 3 female). Lesions occurred in the upper extremity (n=3) and lower extremity (n=3). All tumors were primarily cystic. Five tumors were located in the subcutaneous tissues, and one was intramuscular. Primary tumors were surrounded by a low T1 and low T2 signal fibrous capsule with hemosiderin staining. A high signal lymphocytomatous infiltrate was visible in T2 and post contrast images as a high signal rim around the low signal capsule (‘double rim’ sign). Infiltrating cords of tumor cells extended through capsular defects (‘Medusa head’ sign). Fluid-fluid levels were variably present. Post-contrast imaging demonstrated the cystic component, enhancement of tumor cell nodularity, and the lymphocytomatous infiltrate. Recurrent tumors appeared as multiple 1-1.5 cm masses in the subcutis with peripheral enhancement, variable fluid-fluid levels, and were often misinterpreted as post-surgical change. Clinically, patients were often thought to have benign lesions such as hematomas at initial presentation and underwent marginal resection rather than the preferred treatment of wide excision. Five patients experienced local tumor recurrence, and one patient developed distant metastatic disease (mean follow-up 3.6 years).

CONCLUSION

A predominantly well-circumscribed, primarily cystic mass with a low signal capsule and infiltrating cords of tumor cells suggests the possibility of AFH, in particular in a child or young adult with a subcutaneous mass in a limb.

CLINICAL RELEVANCE/APPLICATION

Inclusion of AFH in the differential diagnosis is important so that the patient can undergo the preferred treatment of wide excision as tumors may recur following marginal resection.

MRI with Gadolinium-based Contrast for Locally Recurrent Soft Tissue Sarcoma: A Prospective Reader Study


PURPOSE

MRI with gadolinium-based contrast (Gd) is used to screen for recurrence after soft tissue sarcoma (STS) treatment. Previously, we failed to demonstrate that Gd improved the detection of recurrent STS in our population, although Gd-enhancing recurrences were more conspicuous. We hypothesized that Gd could improve diagnostic performance, especially for readers without high levels of expertise.
METHOD AND MATERIALS
This prospective reader study was IRB-approved and HIPAA compliant. From patients undergoing MRI for possible STS recurrence, we selected 26 (13 with recurrence, 13 without) who had MRI without and with Gd (52 total scans). 4 readers of differing expertise (radiology resident, fellow, and attending; and tumor surgeon), blinded to the diagnosis, rated each MRI for recurrence on a 7-point scale to create receiver operating characteristic (ROC) curves. Net reclassification index (NRI) was used to evaluate changes in confidence.

RESULTS
All readers discriminated recurrence from non-recurrence; areas under the ROC curves ranged from 0.976 to 1.0 without Gd and from 0.997 to 1.0 with Gd (p>0.1 for improvement for each reader). However, NRI showed that with Gd, diagnostic confidence improved for resident (p<0.001), fellow (p=0.001), and surgeon (p=0.001), but not attending (p=0.17). The resident showed more confidence for both assigning and excluding recurrence; the fellow showed more confidence assigning recurrence only; and the surgeon showed more confidence in excluding recurrence only.

CONCLUSION
Gd does not improve the detection of recurrent soft tissue sarcoma by MRI, but may improve the confidence level depending on the reader's expertise.

CLINICAL RELEVANCE/APPLICATION
Gd is not necessary in the detection of local STS recurrence, but may be helpful in improving confidence depending on the reader's expertise. Costs and potential morbidity associated with Gd could be eliminated, with the same diagnostic results.

A Comparative Study for Soft Tissue Sarcoma between Diffusion Weighted Imaging and Histopathology

Shao Wu Wang MD : Nothing to Disclose , Minting Zheng (Presenter): Nothing to Disclose , Dianxiu Ning MD : Nothing to Disclose , Yue Dong : Nothing to Disclose , Zhang Lina : Nothing to Disclose , yingzi wang : Nothing to Disclose

PURPOSE
To investigate the statistical correlation between Apparent Diffusion Coefficients(ADCs) of MR-DWI and histopathologic grade of soft tissue sarcomas(STSs).

METHOD AND MATERIALS
1. Case data: 33 cases of STSs were chosen for surgical treatment. 2. Equipment and technology: DWI(b=600s/mm2) scanned before the DCE-MRI, the lesion site was fixed. 3. DWI post-processing and data collection: Functool functional software was used to post-process the original image, each of them were worked with the ROI-1 and ROI-2, recording ADCs on the ADC reconstruction maps respectively. 4. Observational indexes: (1) ADCs of STSs : including minimum ADCs(average 3 minimum ADCs from ROI-1) and average ADCs(average all of the average ADCs from ROI-2). (2) The histopathological grade of STSs : according to the histopathological grading system of French Federation Cancer Centre, we classified STSs into grade I,II,III. (3) According to mucinous in STSs pathological diagnosis, we divide STSs into myxoid and non-myxoid groups.

RESULTS
1. As STSs histopathological grade increased, Minimum ADCs and Average ADCs decreased gradually. But there was no significant difference with ADCs among 9 cases of grade 1, 13 cases of grade II and 11 cases of grade III (p>0.05). 2. Average ADCs of 13 myxoid STSs was significantly higher than the other 20 with non-myxoid STSs, when Average ADCs is 1.357×10-3 mm2/s,they were identified with the sensitivity of 76.9% and specificity of 80.0%;Minimum ADCs of the myxoid STSs was higher than the non-myxoid STSs, but the difference was not significant (p> 0.05). 3. Minimum ADCs and histopathological level of 20 non-myxoid STSs cases were negatively correlated (r = -0.824, P = 0.000).there were significant difference between the non-myxoid STSs of each grade(p <0.05); there were no significant difference in average ADCs between non-myxoid STSs of each grade (p> 0.05); and also no significant difference in minimum ADCs,average ADCs between myxoid STSs of each grade (p> 0.05).

CONCLUSION
1. As STSs pathological level increased, Minimum ADCs and Average ADCs decreased gradually, but we can not identify STSs histopathological level based on Minimum ADCs and Average ADCs. 2. Average ADCs of myxoid STSs was higher than that of non-myxoid STSs. 3. Minimum ADCs can show the histopathological grading of non-myxoid STSs.

CLINICAL RELEVANCE/APPLICATION
ADCs of MR-DWI can reflect histopathologic grade of STSs.

The Efficacy of Intravoxel Incoherent Motion Diffusion-weighted MR Imaging in the Evaluation of Benign and Malignant Bone and Soft Tissue Tumors

You Seon Song (Presenter): Nothing to Disclose , In Sook Lee : Nothing to Disclose , Jeung Il Kim MD, PhD : Nothing to Disclose , In Seong Kim PhD : Nothing to Disclose
PURPOSE
To evaluate the efficacy of intravoxel incoherent motion (IVIM) diffusion-weighted (DW) MR imaging for differentiating benign and malignant bone and soft tissue tumors

METHOD AND MATERIALS
From June to December 2013, 304 patients underwent musculoskeletal MR imaging including IVIM DW sequence with ten b values (0-1000 sec/mm²). Among them, 73 consecutive patients (38 women, 35 men; age range, 1-84 years; mean age, 47 years) with bone or soft tissue mass lesions were included. All ROIs about the mass were manually positioned on parametric maps obtained with software (MatLab), and then apparent diffusion coefficient (ADC) and IVIM-derived parameters (Dslow, Dfast, perfusion fraction) were calculated. The ADC value, Dslow, Dfast and perfusion fracture (PF) parameters were compared between the benign and malignant group by using independent samples t-test and ROC analysis.

RESULTS
41 patients had malignant tumors and 32 had benign tumors. The ADC value and Dslow parameter were statistically significant factors (p<0.05) in differentiating between benign and malignant bone or soft tissue tumors. By ROC analysis, Dslow (AUC, 0.801; SE, 0.0579; 95% confidence interval, 0.691-0.885; p<0.0001; cut-off value, 1.15x10⁻³mm²/sec; sensitivity, 80.5%; specificity, 75%) demonstrated higher significance and specificity than the ADC value (AUC, 0.739; SE, 0.0646; 95% confidence interval, 0.623-0.834; p=0.0002; cut-off value<1.5x10⁻³mm²/sec; sensitivity, 82.9%; specificity, 62.5%).

CONCLUSION
IVIM-derived Dslow values demonstrated superior performance compared with the ADC value in differentiating benign from malignant bone and soft tissue tumors.

CLINICAL RELEVANCE/APPLICATION
IVIM diffusion-weighted MR imaging is useful in diagnosing musculoskeletal tumors since it reflects pure diffusion effect of the tumor.

SSA13-09
Metabolic versus Morphologic Therapy Monitoring in Soft Tissue Sarcoma under ILP Utilizing Simultaneous [18F]-FDG PET/MRI


PURPOSE
The use of tumor necrosis factor in isolated limb perfusion (ILP) has shown to be a successful treatment of locally advanced limb soft-tissue sarcomas (STS). Hence, the assessment of therapy response is an important issue of neoadjuvant cancer treatment. The aim of this study was to compare the diagnostic ability of metabolic (tracer uptake in PET/MRI) and morphologic (maximum diameter; RECIST) for assessment of cancer response in correlation to pathologic response.

METHOD AND MATERIALS
10 patients with histologically proven STS were enrolled in this trial and underwent an [18F]-FDG PET/MRI examination (a) prior and (b) 6 weeks after ILP (Biograph mMR, Siemens). The MR-scan protocol comprised: 1) STIR cor, 2) T2 TSE ax, 3) fatsaturated T1w TSE post contrast ax. and cor. after the application of 0.5 mmol/kg BW Dotarem (Guerbet). All tumor lesions were assessed in the baseline and follow-up, in regard of the metabolic (SUVmax) and morphologic response (maximum diameter according to RECIST). Results were correlated to pathological response according to Salzer-Kuntschik regression scale. Wilcoxon rank test was applied to test for statistical significance.

RESULTS
According to histopathology and Saltzer-Kuntschik, 3 patients were classified as pathologic responders (R1=2; R3=1) and 7 patients were classified as non-responders (R4=3, R5=3, R6=1). Accordingly, the pathologic responders showed a mean decrease of SUVmax of 63.2%, while pathologic non-responders showed a mean decrease of SUVmax of 16.7%. According to RECIST criteria, neither pathologic responders (mean decrease of max diameter 4%), nor non-responders (mean decrease of max diameter 19%) showed morphologic response, and were hence classified as clinical non-responders.

CONCLUSION
PET/MRI enables superior assessment of therapy monitoring based on functional metabolic response, while exclusive morphologic assessment, in terms of RECIST evaluation does not provide sufficient evaluation of therapy response in STS after ILP.

CLINICAL RELEVANCE/APPLICATION
Aside from morphologic assessment, PET/MRI provides beneficial additional metabolic assessment of STS under
ILP, enabling superior assessment of therapy response.

SSA14

**ISP: Musculoskeletal (Translational Imaging Techniques in Tendon and Muscle)**

*Scientific Papers*

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**AMA PRA Category 1 Credits™:** 1.50  
**ARRT Category A+ Credits:** 1.50  
**Sun, Nov 30 10:45 AM - 12:15 PM Location: E451A**

**Participants**

**Moderator**
Joshua M. Farber MD : Research Consultant, Q-Metrics, Inc Shareholder, Q-Metrics, Inc  
Gregory Chang MD : Nothing to Disclose

**Sub-Events**

**SSA14-01**  
**Musculoskeletal Keynote Speaker: Translational Imaging of Tendon and Muscle—Clinical Challenges and Need for More**
Siegfried Trattnig MD (Presenter): Nothing to Disclose

**SSA14-03**  
**Shear Wave Elastography (SWE) in the Evaluation of Tendinopathies**
Simone Schrading MD (Presenter): Nothing to Disclose, Christiane Katharina Kuhl MD : Nothing to Disclose, Matthias Gatz : Nothing to Disclose, Timm Dirrichs : Nothing to Disclose, Valentin Quack : Nothing to Disclose

**PURPOSE**

The evaluation of tendinopathy as well as that of epicondylitis humeri are usually done with B-mode ultrasound (US) and power Doppler. SWE has been shown to be useful to evaluate tissue elasticity. Aim of this study was to evaluate the diagnostic utility of complementary SWE in patients with Achilles or patellar tendinopathy or epicondylitis humeri who undergo B-mode and power Doppler US.

**METHOD AND MATERIALS**

A total 92 patients (35 with tendinopathy of the Achilles, 30 of the patellar tendon, and 27 with epicondylitis humeri) were systematically examined with B-mode US using a high-resolution linear 15 MHz probe (Aixplorer, Supersonic). Neovascularization was determined by power Doppler. In all patients, at least 3 SWE maps were acquired. Quantitative, ROI-based analysis of tendon elasticity was done. SWE values < 50kPa had been established previously to indicate pathologically “soft” tendons.

**RESULTS**

In 59/92 symptomatic tendons (64%), pathologic changes at B-mode US were detected (thickening, hypo- or hyperechoic areas and calcifications and/or neovascularization). In 77/92 (84%), SWE exhibited pathologically soft tissue values in 28 of these 33 B-mode-normal-appearing tendons (84%). This included 10 of the 11 symptomatic, but B-mode negative Achilles tendons (91%), 9 of the 10 symptomatic, but B-mode negative patellar tendons, and 8 of the 12 symptomatic, but B-mode negative elbow tendons (67%). Overall sensitivity for displaying a correlate for clinically symptomatic Achilles, patellar, and elbow tendinopathy was 69%, 67%, and 56% for B-mode and Doppler US. Adding SWE increased the sensitivity significantly to 97%, 100%, and 85%, respectively.

**CONCLUSION**

SWE provides diagnostic information that is complementary to that of B-mode and power Doppler ultrasound, and helps significantly improve US sensitivity for diagnosing tendinopathy.

**CLINICAL RELEVANCE/APPLICATION**

SWE reveals a pathologic correlate for clinical tendinopathy in over two-thirds of patients with normal B-mode and power Doppler US.

**SSA14-04**  
**Sodium MRI Detects Glycosaminoglycan Alteration in the Achilles Tendon after Ciprofloxacin Intake in Healthy Subjects**
Vladimir Juras BMEdSc, PhD (Presenter): Nothing to Disclose, Yvonne Winhofer : Nothing to Disclose, Pavol Szomolanyi PhD : Nothing to Disclose, Benedikt Hager : Nothing to Disclose, Anton Luger MD : Nothing to Disclose, Siegfried Trattnig MD : Nothing to Disclose
PURPOSE
To investigate novel quantitative MRI techniques (sodium MRI, gagCEST, and T2*-mapping) as potential markers for biochemical changes in the Achilles tendon induced by ciprofloxacin intake.

METHOD AND MATERIALS
Fourteen ankles from seven male subjects (32±12 years) were included in the study (all subjects gave written, informed consent). All subjects underwent MRI examinations of the Achilles tendon at baseline (tB), as well as 10 days (t10D) and five months (t5M) after ciprofloxacin intake. For sodium imaging, the variable echo time sequence adapted to x-nuclei capabilities was used in the 2D mode. gagCEST effects were measured by a train of Gaussian RF pulses followed by signal readout with a 3D-RF-spoiled-GRE sequence. The variable-echo-time sequence (vTE) was used to generate the bi-exponential T2*-maps. In order to compare average MRI parameters at different time points, a hierarchical-linear-model was used in order to consider multiple measures per patient.

RESULTS
The mean sodium signal was significantly decreased by 25% in the whole tendon (from 130±8 (tB) [a.u.] to 98±5 (t10D) [a.u.], P = 0.020) and in the insertion part (from 134±8 (tB) [a.u.] to 105±5 (t10D) [a.u.], P = 0.026). The mean gagCEST value was significantly decreased from 4.74±0.75 (tB) [%] to 4.50±0.23 [%] (t10D)(P<0.037). Morphologically, there were no significant changes found between tB, t10D, and t5M.

CONCLUSION
In conclusion, this study demonstrates a ciprofloxacin induced reversible reduction of the normalized sodium MRI signal and the gagCEST effect in the Achilles tendon of healthy volunteers. The observed changes in glycosaminoglycan content contribute to the characterization of the pathomechanism of FQ associated tendinopathy.

CLINICAL RELEVANCE/APPLICATION
Sodium imaging of the Achilles tendon may improve the detection of biochemical alterations after ciprofloxacin intake.

PURPOSE
To characterize the pathophysiological abnormalities of Idiopathic Inflammatory Myopathy (IIM) patients using multi-parametric quantitative magnetic resonance imaging (MRI) methods, including fat/water, T1, T2, magnetization transfer (MT), and diffusion tensor imaging (DTI).

METHOD AND MATERIALS
Eleven IIM patients (six polymyositis (PM) and five dermatomyositis (DM)) and eleven age-matched healthy controls were examined. Images were acquired from their right thighs. T1-weighted and T2-weighted images were acquired as anatomical references. Fat/water contents were estimated with a multiple gradient echo sequence. T1 and T2 values were estimated using inversion recovery and multiple spin-echo methods, respectively. QMT parameters were estimated using pulsed saturation method. DTI parameters were estimated with 15 diffusion-weighted directions (and one b = 0 image). All data were processed in pixel-wise approach. Imaging data were analyzed using a two-way ANOVA, with main effects for disease and muscle. CPK and LDH levels were measured with blood test.

RESULTS
The patients had higher mean fat fractions (0.142) than the controls (0.063) (p < 0.05), indicating significant fat infiltration/replacement. In patients vs. controls, there were higher mean T2 (37.1 vs. 32.1 ms), higher T1 (1.54 vs. 1.47 s), lower macromolecular fractions (qMT) (0.077 vs. 0.089), and higher ADC values (0.0018 vs. 0.0017) (p < 0.05), indicating inflammation. Fiber tracking indicated that the fiber tracts in patients are shorter, less dense, and less ordered. ANOVA test indicated differences between PM and DM patients with more significant muscle damage in quadriceps muscles compared to other muscle groups. Consistent with MRI findings, all patients have higher CPK (1498) and LDH (470) levels than the controls (107 and 169, respectively) (p < 0.05).

CONCLUSION
These multi-parametric methods may provide an improved understanding of the pathological processes associated with inflammatory diseases at a microscopic level, objectively, quantitatively, and independently of the acquisition details. In the future, they may be applied to longitudinal studies to track treatment response in individuals and other muscle diseases.

CLINICAL RELEVANCE/APPLICATION
The proposed multi-parametric approach may allow clinicians to correlate the quantitative parameters to variations in lab findings, and to track treatment response on an individual basis.
**SSA14-06**

**Assessment of Thigh Muscle in Healthy Controls and Dermatomyositis Patients with Diffusion Tensor Imaging, Intravoxel Incoherent Motion, and Dynamical DTI**

Eric Sigmond PhD (Presenter): Nothing to Disclose, Steven Baete: Nothing to Disclose, Thomas Luo: Nothing to Disclose, Mary Bruno RT: Nothing to Disclose, David Mossa: Nothing to Disclose, David Stoffel: Nothing to Disclose, Alisa Femia MD: Nothing to Disclose, Sarika Ramachandran MD: Nothing to Disclose, Andrew Franks MD: Nothing to Disclose, Jenny T. Bencardino MD: Nothing to Disclose

**PURPOSE**

We have employed diffusion tensor imaging (DTI), intravoxel incoherent motion (IVIM), and a new dynamic DTI approach to evaluate the proximal lower musculature in a cohort of dermatomyositis (DM) patients and healthy controls and compared with their clinical workup.

**METHOD AND MATERIALS**

In this IRB-approved, HIPAA-compliant study, anatomical imaging, Dixon fat/water imaging, and diffusion imaging (DTI, IVIM, and dynamic DTI) were collected in bilateral thigh imaging of 6 normal controls (2M, 4F; ages 24-65, 42±16) and 7 DM patients (1M, 6F, ages 32-65, 56±11) in a Siemens Skyra 3 T scanner with body matrix and spine array coils. DTI (MD, FA, eigenvalues) and IVIM (D*, f, Dp) metrics were derived from each of 8 thigh muscle compartments bilaterally segmented on high resolution Dixon imaging. Single voxel dynamic DTI provided time series of radial and axial diffusion before and after a 3 minute unilateral leg lift exercise period, focusing on the anterior quadriceps (rectus femoris and vastus lateralis). The relative exercise response and rate of recovery were determined for radial and axial diffusion in each subject. In DM patients, correlations were performed with serum markers and manual muscle tests (MMT).

**RESULTS**

DM patients showed significantly larger fat fraction (FF), higher tissue diffusivity (Dz), lower pseudodiffusion (Dp), and lower perfusion fraction (fp) than controls. Dynamically, radial diffusion exercise response was significantly larger and slower to recover to equilibrium than controls, and showed significant inverse correlation with manual muscle test score.

**CONCLUSION**

DM patients show significantly higher static FF and Dz and significantly lower fp and Dp than controls. Radial diffusion in DM patients shows significantly larger and longer-lived exercise response than controls. These are novel probes of muscle function that may dramatically enhance diagnostic power in this group. Ongoing work will investigate the prognostic potential of these markers in predicting response to immunosuppressive therapy.

**CLINICAL RELEVANCE/APPLICATION**

Dermatomyositis is a degenerative muscle condition needing diagnostic/prognostic biomarkers. The sensitivity of diffusion imaging to microstructure, vascularity, and activity fulfills this need.

**SSA14-07**

**Selective and Quantitative Functional Muscle Imaging with Intravoxel Incoherent Motion (IVIM): Initial Experience**

Christian Federau (Presenter): Nothing to Disclose, Patrick Omoumi MD: Nothing to Disclose, Joachim Forget MD, PhD: Nothing to Disclose, Jean-Baptiste Ledoux: Nothing to Disclose, Fabio Becce MD: Nothing to Disclose

**PURPOSE**

To evaluate the feasibility of quantitative assessment of gradual and selective skeletal muscle activation using intravoxel incoherent motion (IVIM) MRI.

**METHOD AND MATERIALS**

We included 6 right-handed healthy volunteers (mean age 31, 3 males). The muscle exercise consisted of selective contraction of right biceps and triceps brachii, with 2kg of weight against gravity. Two series of 12 and 24 contractions were performed for each muscle, alternating muscle between series. Images were obtained before, and 1 min 15 sec after the end of each series. The MRI acquisition consisted of 10 slices of a standard Stejskal-Tanner diffusion sequence with single shot echo planar imaging read-out, at 3 T and using an 8 matrix and spine array coils. DTI (MD, FA, eigenvalues) and IVIM (D*, f, Dp) metrics were derived from each of 8 thighs muscle compartments bilaterally segmented on high resolution Dixon imaging. Single voxel dynamic DTI provided time series of radial and axial diffusion before and after a 3 minute unilateral leg lift exercise period, focusing on the anterior quadriceps (rectus femoris and vastus lateralis). The relative exercise response and rate of recovery were determined for radial and axial diffusion in each subject. In DM patients, correlations were performed with serum markers and manual muscle tests (MMT).

**RESULTS**

Both muscles showed gradual increase in blood-flow related perfusion parameters (D*) after exercise (biceps after biceps flexion: D* rest=0.00133 +/- 0.00007mm2/s, D* 2kg 12repeats=0.00139 +/- 0.00003, p=0.02; D* 2kg 24repeats=0.00144 +/- 0.00005, p=0.01), (triceps after triceps flexion: D* rest=0.00140 +/- 0.00180, D* 2kg 12repeats=0.00148 +/- 0.02331, p=0.03; D* 2kg 24repeats=0.00153 +/- 0.0349, p=0.02). The increase was significantly correlated to the number of contractions for the triceps, and but not statistically significant for the biceps muscles (p triceps=0.04, p biceps=0.12). The increase of D* was selective for the triceps 24 repeats compared to the antagonist (p=0.01), but below significance for triceps 12 repeats (p=0.11), biceps 12 repeats (p=0.29) and biceps 24 repeats (p=0.18).
CONCLUSION

IVIM perfusion imaging is a promising, non-invasive method for assessing skeletal muscle activation after exercise.

CLINICAL RELEVANCE/APPLICATION

IVIM perfusion imaging could contribute to the physiological exploration of complex muscle activities (such as in sports) and in pathological conditions where a follow-up of muscle function is requested (such as after revascularization or reinnervation surgery).

SSA14-08

Longitudinal Study of Myofiber Diameter Recovery after Injury Using Time-dependent Diffusion MRI

Gregory Lemberskiy BA (Presenter): Nothing to Disclose, Dmitry S. Novikov PhD: Nothing to Disclose, Amir Paydar, MD: Nothing to Disclose, Thorsten Feiweier DIPLPHYS, PhD: Employee, Siemens AG Stockholder, Siemens AG Patent holder, Siemens AG, Leon Axel MD, PhD: Nothing to Disclose, Els Fieremans PhD: Nothing to Disclose

PURPOSE

A random permeable barrier model (RPBM) has been suggested [Nature Physics 2011, 7:508; PNAS 2014, doi:10.1073/pnas.1316944111] to quantify cell size and membrane permeability using time-dependent diffusion MRI. We apply this framework to monitor the recovery of an atrophied calf muscle.

METHOD AND MATERIALS

Calf muscles of a 30 y/o male, recovering from a posterior tibial (PT) tendon rupture on one foot, were scanned using a Trio 3T Tim system (Siemens AG, Erlangen) with a Tx/Rx CP extremity coil. The injured leg was in a non-weight bearing cast for 6 weeks, where it atrophied from inactivity, after which both calf muscles were scanned. The volunteer was then enrolled in physical therapy after his cast was removed and switched to a walking boot. Subsequent scans of the affected leg occurred after 4 and 8 weeks. Regions were manually outlined on T2-weighted anatomical images, Fig.(a, b), to study the time-dependent diffusion Fig.(c) in the Anterior Tibialis (AT), Extensor Digitorum Longus (EDL), Gastrocnemius Medialis (GM), Gastrocnemius Lateralis (GL), Peroneous Longus (PL), PT and Soleus (SOL). RPBM was used to extract fiber diameter and permeability from each region.

RESULTS

Fig.(d)-(j) show signs of recovery across all muscle groups with no changes in membrane permeability. After 8 weeks, fiber diameters of AT, SOL, and EDL of the injured leg surpassed those of the healthy leg by 1.5%, 19.5%, and 5.3% respectively. After 8 weeks fiber diameters of the immobilized PT and GM were still 22.8% and 24.8% smaller than those of the control leg.

CONCLUSION

Large differences in fiber diameter were observed between immobilized and control muscle regions. RPBM was sensitive to recovery processes during physical therapy. E.g., inversion and plantarflexion were avoided in the early stages of physical therapy. Congruently, our analysis shows that muscle groups associated with such movements initially showed minimal signs of recovery (PT) and continued atrophy (EDL, GM), while recovery was observed in the AT, GL and SOL early on due to walking and dorsiflexion.

CLINICAL RELEVANCE/APPLICATION

Time-dependent diffusion MRI with RPBM allows for quantifying subtle changes in myofiber diameter, and enables non-invasive monitoring of the process of muscle building and healing. Such quantitative information could be utilized in the field of physical therapy and sports medicine for developing efficient casts and exercises.

SSA14-09

7-Tesla Chlorine and Sodium MR Imaging Detects Mutation Dependent Alterations in Muscular Sodium and Chloride Concentrations in Muscular Periodic Paralyses

Marc-Andre Weber MD (Presenter): Research Grant, Bayer AG Research Grant, Guerbet SA Research Grant, Bracco Group Research Grant, Siemens AG Speakers Bureau, Merck & Co, Inc, Armin Nagel DiplPhys: Nothing to Disclose, Anja Marschar: Nothing to Disclose, Karin Jurkat-Rott PhD: Nothing to Disclose, Maya B. Mueller-Wolf MD: Nothing to Disclose, Hans-Ulrich Kauczor MD: Research Grant, Boehringer Ingelheim GmbH Research Grant, Siemens AG Research Grant, Bayer AG Speakers Bureau, Boehringer Ingelheim GmbH Speakers Bureau, Siemens AG Speakers Bureau, Novartis AG, Frank Lehmann-Horn PhD: Nothing to Disclose

PURPOSE

Patients with periodic paralysis experience episodic weakness spells with intervals of normal muscle function caused by altered muscle membrane potential due to changes in ion conductivities, such as nonselective cation leaks in hypokalemic periodic paralysis and Kir2.1 mutations of the myocellular potassium (K⁺) channel in Andersen-Tawil syndrome. The objective was to assess whether altered sodium (Na⁺) and chloride (Cl⁻)
homeostasis can be visualized in these periodic paralyses using ultrahigh field MRI.

**METHOD AND MATERIALS**

Institutional review board approval and informed consent of all participants were obtained. Twelve $^{23}\text{Na}$-MR (TR/TE=160/0.35) und ten $^{35}\text{Cl}$-MR examinations (TR/TE=40/0.6) of both lower legs were performed on a 7-Tesla system in genetically confirmed hypokalemic periodic paralysis (Cav1.1-R1239H mutation, n=5; Cav1.1-R528H mutation, n=5) and Andersen-Tawil syndrome (n=2); median age, 47 years. Data from previous examinations of four healthy volunteers (median age, 45 years) were taken as reference. Additionally, each patient received 3-Tesla proton MR imaging on the same day using T1-weighted, STIR and DIXON sequences. Muscle edema was assessed on STIR images, fatty degeneration on T1-weighted images and the muscular fat fraction was quantified using DIXON. Na$^+$ and Cl$^-$ were quantified in the soleus muscle using three phantoms containing 10, 20, and 30 mM NaCl solution as reference.

**RESULTS**

Median muscular $^{23}\text{Na}$ concentration in mmol/l was higher in Cav1.1-R1239H (34.7, p=0.008), Cav1.1-R528H (29.8, p=0.001), and Kir2.1 mutation (24.2, p<0.001) than in healthy volunteers (17). Median muscular $^{35}\text{Cl}$ concentration in mmol/l was higher in Cav1.1-R1239H (27.7, p=0.002) and Cav1.1-R528H (25.1, p=0.003) but not in Kir2.1 mutation (14.6, p=0.073) than in volunteers (11). Compared with volunteers, Cav1.1-R1239H and Cav1.1-R528H showed muscular edema (p=0.027, p=0.018) but only Cav1.1-R1239H had fatty muscle degeneration (p=0.036) with a fat fraction of 0.26 vs. 0.08 both in Cav1.1-R528H and Kir2.1 mutations.

**CONCLUSION**

Using 7-Tesla MRI changes of Na$^+$ and Cl$^-$ homeostasis can be visualized in periodic paralyses, most pronounced in the severe phenotype Cav1.1-R1239H with up to daily paralytic episodes.

**CLINICAL RELEVANCE/APPLICATION**

7-Tesla $^{23}\text{Na}$ and $^{35}\text{Cl}$ MRI can monitor myocellular ion homeostasis non-invasively and may help in testing of pathogenesis, estimating prognosis, and monitoring of treatment in periodic paralyses.

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**SSA15**

**Neuroradiology (The Aging Brain & Neurodegenerative Diseases)**

**Scientific Papers**

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**Participants**

**Moderator**
- Mykol Larvie MD, PhD: Nothing to Disclose

**Sub-Events**

**SSA15-01**

**Subclinical Atherosclerosis and Cognitive Impairment: The XXXXX Heart Study**

Christopher Maroules MD (Presenter): Nothing to Disclose, Jarett Berry MD: Nothing to Disclose, Amit Khera MD, MSc: Nothing to Disclose, Heidi Rossetti PhD: Nothing to Disclose, Kirstine Carter PhD: Nothing to Disclose, Mohit Kumar Gupta MD: Nothing to Disclose, Ronald M. Peshock MD: Nothing to Disclose, Roderick McColl PhD: Nothing to Disclose, Colby Ayers MS: Nothing to Disclose, Nagina Maluria MBBS: Nothing to Disclose, Suhny Abbara MD: Research Consultant, Radiology Consulting Group, Kevin S. King MD: Nothing to Disclose

**PURPOSE**

Limited studies have explored the relationship between atherosclerosis and cognitive impairment. We sought to determine associations between subclinical atherosclerosis, cognitive screening, and white matter hyperintensities on MRI, a predictor of cognitive function.

**METHOD AND MATERIALS**

The study consisted of 1903 participants from the XXXXX Heart Study (mean age 44 ± 10 years, 56% female) without cardiovascular disease who underwent carotid and brain MRI at 3 Tesla. Semi-automated techniques were used to define wall contours of the internal and common carotid arteries (ICA and CCA) and white matter hyperintensity volume (WMH). Subjects also underwent Montreal Cognitive Assessment (MoCA) testing and multidetector CT for measurement of coronary artery calcium (CAC) using the Agatston method. A MoCA score less than 26 was used to indicate the presence of at least mild cognitive impairment. Large WMH was defined as greater than 1 SD above the age-specific median. We related CAC and carotid wall areas to WMH and MoCA scores using Spearman correlation and multivariable linear and logistic regression models after adjusting for traditional risk factors, including age, ethnicity, male sex, diabetes mellitus, hypertension, smoking, and body mass index.
RESULTS
ICA and CCA wall areas correlated with WMH and MoCA score (all p<.001) in unadjusted models. After adjusting for traditional risk factors, ICA wall area remained associated with MoCA (β= -0.02, p<.05), and CCA wall area remained associated with WMH (β= 0.002, p=0.04). Increasing ICA wall area predicted MoCA score <26 (OR 1.12 per SD change, 95% CI 0.99-1.26, p=0.04) after multivariable adjustment, but increasing CCA wall area did not predict MoCA score <26 (p=0.5). After adjusting for traditional risk factors, CAC was associated with WMH (β= 0.013, p=0.0008). Increasing CAC score predicted large WMH (OR 1.19 per SD change, 95% CI 1.03-1.38, p=0.02).

CONCLUSION
Subclinical coronary and carotid atherosclerosis are predictors of poorer cognitive function as measured by MoCA score and white matter hyperintensity volume on MRI.

CLINICAL RELEVANCE/APPLICATION
Subclinical atherosclerosis may predict cognitive decline independent of traditional cardiovascular risk factors. Different sites and measures of atherosclerosis may have different sensitivities for predicting cognitive dysfunction.

SSA15-03
ASL Predicts Cognitive Deterioration in Healthy Elderly Individuals

PURPOSE
To explore whether arterial spin labeling (ASL) imaging in cognitively intact elderly individuals may predict subsequent early neuropsychological decline.

METHOD AND MATERIALS
The local ethics committee approved this prospective study and written informed consent was obtained from all participants. We included 148 consecutive controls, 75 of whom remained stable (sCON, mean age 75.9 ± 3.4 years, 43 females), and 73 who deteriorated cognitively at 18 months clinical follow-up (dCON, 76.8 ± 4.1 years, 44 females).
years, 44 females) and 65 mild cognitive impairment (MCI, 76.2 ± 6.1 years, 25 females). 2-D pulsed ASL was performed at baseline visit. Image analysis included voxel-wise analysis of the ASL relative cerebral blood flow (relCBF) data and receiver operator characteristics (ROC) analysis.

RESULTS
The voxel-wise comparison of ASL revealed decreased relCBF in dCON compared to sCON notably in the posterior cingulate cortex (PCC). MCI versus sCON revealed slightly more extensive decreased relCBF in PCC as well, while the comparison of dCON versus MCI revealed no significant differences. ROC analysis of the relCBF in the PCC discriminated dCON (p

CONCLUSION
Reduced ASL in PCC at baseline is associated with the development of subsequent subtle neuropsychological deficits in healthy elderly controls. At a group level, dCON display similar ASL patterns than MCI at baseline indicating that these cases may initially maintain their cognitive status via the mobilization of their neurocognitive reserve at baseline, yet are prone to develop subsequent subtle cognitive deficits.

CLINICAL RELEVANCE/APPLICATION
Deteriorating controls and MCI have similar ASL patterns indicating that deteriorating controls already have perfusion alterations at baseline imaging despite apparent normal cognition, due to mobilization of the neurocognitive reserve. The cut-off value of 58.5 ml/100g/min in the posterior cingulate may predict subsequent very early cognitive with a sensitivity of 58.9 % and a specificity of 65.3 %.

SSA15-04
Impacts of KIBRA and ApoE Variants Associated with Alzheimer’s Disease on the Functional Connectivity Density in Healthy Young Adults
Ningnannan  Zhang PhD (Presenter):  Nothing to Disclose ,  Qiuhui  Wang :  Nothing to Disclose ,  Zhang  Zhang :  Nothing to Disclose ,  Chun-Shui  Yu :  Nothing to Disclose

PURPOSE
Recent research has suggested that Alzheimer’s disease (AD) is associated with KIBRA rs17070145 polymorphism, in addition to the hallmark risk gene ApoE ε4. The effects of the polymorphism in the KIBRA or ApoE gene on brain function has been documented separately in AD and aging brain, while the interaction effect of the two has not been well studied. We investigated the main and interaction effects of these genetic variants on the resting-state fMRI using functional connectivity density (FCD).

METHOD AND MATERIALS
A total of 267 young healthy subjects (22.8±2.4 years old; 149 women) were included. MR images were acquired using a Signa HDx 3.0 Tesla MR scanner (General Electric, Milwaukee, WI, USA). Resting-state fMRI data were obtained using the Single-Shot Echo-Planar Imaging (SS-EPI, TR/TE = 2000/30 ms; FOV = 240 mm × 240 mm; matrix = 64 × 64; FA = 90°, slice thickness = 4 mm; no gap; 40 interleaved transversal slices; 180 volumes). The global FCD (gFCD) was calculated by using a voxel-wise data-driven approach in the home made script. Both the main and interaction effect of genotype were calculated and compared using a full factorial analysis of covariance.

RESULTS
The main effect of KIBRA gene was in the superior occipital cortex, but no significant main effect of ApoE genotype was found. Significant KIBRA and ApoE interaction effect was found in the gFCD of the bilateral dorsolateral prefrontal cortex (DLPFC). Post hoc tests showed a nonlinear relationship between the KIBRA and ApoE genotypic subgroups on gFCD.

CONCLUSION
Our results suggest that KIBRA and ApoE risk genotypes in healthy young subjects exert differential impacts on the bilateral DLPFC, which is may sustain attention and working memory. The complex interactions between KIBRA and ApoE should be considered when investigating the impact of these two genetic variants on the brain.

CLINICAL RELEVANCE/APPLICATION
Comprehensive understanding of the KIBRA and ApoE genetic variants may provide additional information for AD early diagnosis.

SSA15-05
Periventricular vs. Deep White Matter Hyperintensity in Normal Aging
Soham  Banerjee  BS (Presenter):  Nothing to Disclose ,  Kevin S.  King MD :  Nothing to Disclose ,  Roderick  McColl PhD :  Nothing to Disclose ,  Anthony R.  Whitemore MD :  Nothing to Disclose ,  Keith  Hulsey :  Nothing to Disclose ,  Ronald M.  Peshock MD :  Nothing to Disclose

PURPOSE
To map the spatial distribution of white matter hyperintensity (WMH) related to normal aging in the absence of hypertension, diabetes, and hypercholesterolemia.

METHOD AND MATERIALS
MRI brain images were acquired from a population based study. An automated algorithm generated each participant’s WMH distribution registered onto the MNI-152 standard template. A cohort of 827 participants (age range 18-83; 337 males, 490 females) without hypertension, diabetes, or hypercholesterolemia was identified.
This cohort was divided into two groups: 702 participants <=55 years and 125 participants >55 years, based on previous studies demonstrating a tenfold increase in WMH volume after age 55. Logistic regression was performed at every voxel determining the voxel WMH probability. The two age groups predicted probabilities were compared, to create a probability ratio map representing the age effect on WMH at each voxel. The distance of each WMH voxel from the lateral ventricles was calculated and compared with its probability ratio using double log linear regression analysis.

**RESULTS**

Individual analysis was performed for each of the 216694 voxels that comprised the entire population's WMH distribution. On average, the older age group had predicted probabilities 6.2 times greater than the younger group at each voxel. Double log linear regression revealed a positive association ($r^2=0.23$ with >75000 data points, slope $p<0.0001$) between probability ratio and distance from the lateral ventricles, suggesting that aging is associated with WMH further away from the ventricles. In comparison, in voxels directly adjacent to the lateral ventricles, age was only associated with a 1.06 times increased probability.

**CONCLUSION**

Normal aging had the highest impact on the prevalence of deep WMH and lowest impact on periventricular WMH.

**CLINICAL RELEVANCE/APPLICATION**

The disparate impact of normal aging on periventricular and deep WMH may assist in evaluating the relative contributions aging and treatable cardiovascular pathology make towards WMH in these regions.

**SSA15-06**

**Changes in Brain Microstructure Predict Cognitive Decline in Elderly Subjects at Risk of Vascular Disease**

**Michiel Sala (Presenter): Nothing to Disclose , Albert De Roos MD : Nothing to Disclose , Gerard-Jan Blauw : Nothing to Disclose , Huib A. Middelkoop PhD : Nothing to Disclose , Mark A. Van Buchem MD, PhD : Research Consultant, Medis Medical Imaging Systems, Inc , Ton de Craen : Nothing to Disclose , Jeroen Van Der Grond : Nothing to Disclose**

**PURPOSE**

To investigate whether magnetic resonance imaging markers of brain microstructure predict cognitive decline in elderly subjects at risk of vascular disease.

**METHOD AND MATERIALS**

520 nondemented elderly subjects (296 men, mean age 74 ± 3 years) at risk of vascular disease were included. We used linear regression analysis to assess cross-sectional associations between mean magnetization transfer ratio (MTR), normalized MTR histogram peak height (PH), and z scores of cognition. Models were adjusted for age, gender, depressive symptoms, education level, individual white matter lesion volume, and brain atrophy. In 193 subjects with complete imaging and cognition data at baseline and follow up, we compared difference in cognition at baseline versus 3.3-year follow-up across tertiles of baseline MTR PH using one-way analysis of variance.

**RESULTS**

In the adjusted models, high MTR PH was associated with better cross-sectional performance on the STROOP-III test (mean test score, lower versus upper tertile, 61.9 versus 52.3 seconds, $p=0.002$). Likewise, both PH and mean MTR were positively associated with the delayed Picture Word Learning (PWL) test ($p=0.008$ and $p=0.032$, respectively) and the Letter Digit Coding (LDC) test ($p=0.001$ and $p=0.007$, respectively). Subjects with low baseline MTR PH demonstrated worse performance at follow-up as compared to baseline on the STROOP-III test ($p=0.008$), immediate PWL test ($p=0.044$), and delayed PWL test ($p=0.003$). On the contrary, in subjects with intermediate or high MTR PH height, cognitive performance was maintained after 3.3 years.

**CONCLUSION**

In the elderly, MTR measures appear to be not only a general marker for cognition cross-sectionally, but especially MTR-peak height values seem also predictive for cognitive changes over time.

**CLINICAL RELEVANCE/APPLICATION**

MTR histogram peak height may be considered as MRI marker of cognition in future clinical intervention studies.

**SSA15-07**

**Gray Matter and White Matter Microstructural Change in Nondemented Elderly Persons with CLU Gene**

**Lihua Qiu PhD, MD (Presenter): Nothing to Disclose , Yong He : Nothing to Disclose , Hehan Tang BS : Nothing to Disclose , Yi Zhou : Nothing to Disclose , Zhengyan Li : Nothing to Disclose , Weizhe Zhang : Nothing to Disclose , Lanlan Wang : Nothing to Disclose , Qiyong Gong : Nothing to Disclose , Ling Zou MD : Nothing to Disclose**

**PURPOSE**

To clarify the gray matter and white matter integrity changes in nondemented elderly subjects with AD risk gene of C allele in clusterin, and their correlation with cognitive performance.
Thirty-one subjects with AD risk gene of clusterin C (CLU-C) allele carriers and 15 subjects with non C/C (TT+TC) genotype were recruited in our study. High resolution 3D brain structure, DTI data and cognitive measurements (measured by using the Mini-Mental State Exam (MMSE), Alzheimer’s Disease Assessment Scale (ADAS), Wechsler Memory Scale and Montreal Cognitive Assessment (MoCA)) were available for all subjects. By using voxel-based analysis, gray matter volume (GMV), gray matter concentration (GMC) and fractional anisotropy (FA) were compared between C/C genotype and non C/C genotype subjects with a two-sample t test and were tested for correlation with cognitive measurements.

RESULTS

There was no significant difference in age, sex, handedness and cognitive measurements between the two groups. Compared with the non C/C genotype carriers, the C/C genotype carrier group showed reduced GMC in the left parahippocampal gyrus (PHC), right middle frontal gyrus and right temporal middle gyrus as well as increased GMC in left middle frontal gyrus, right fusiform and increased GMV in left middle frontal gyrus (p<0.001). The C/C genotype carrier group also showed decreased FA in left external capsule and increased FA value in left temporal sub-gyrus and left anterior cingulate sub-gyrus. Furthermore, the GMC of left PHC was negatively associated with MoCA score (r=-0.564, p=0.045) and positively related with the ADAS (r=0.753, p=0.003) in non C/C genotype carrier group while the FA value in left external capsule were positively related with the MMSE score (r=0.531, p=0.003), digit span score (r=0.377, p=0.044) and language proficiency score (r=0.415, p=0.025) in C/C genotype carrier group.

CONCLUSION

CLU-C allele carrier showed function related GMV, GMC and white matter integrity alteration in brain regions implicated in AD patients, which may testify the CLU-C allele to be a valid genetic risk factor for late-onset AD.

CLINICAL RELEVANCE/APPLICATION

Our findings provide the possible pre-clinical neuroimaging phenotype of AD, add the understanding of the genetics of AD pathology and the necessity of targeted preventive and therapeutic strategies in particular subpopulation with AD risk.

SSA15-08

Epicentral Disruption of Structural Connectivity in Alzheimer’s Disease

Carlo Augusto Mallio MD (Presenter): Nothing to Disclose, Ruben Schmidt: Nothing to Disclose, Fabrizio Vernieri: Nothing to Disclose, Bruno Beomonte Zobel MD: Nothing to Disclose, Carlo Cosimo Quattrocchi MD, PhD: Nothing to Disclose, Martijn P. Van den Heuvel: Nothing to Disclose

PURPOSE

To test whether structural connectivity impairment is centered on enthorinal cortex and hippocampus in Patients with diagnosis of alzheimer’s disease (AD) and amnestic mild cognitive impairment (aMCI).

METHOD AND MATERIALS

Fifteen healthy controls (HC), 14 amnestic mild cognitive impairment (aMCI), 13 mild, and 15 moderate AD patients, participated in this study. Images were acquired using a 1.5 Tesla MRI system (Avanto B13, Siemens, Erlangen, Germany), including a T1 weighted MPRAGE (Magnetization Prepared Rapid Acquisition with Gradient Echo) and DTI obtained using b values of 0 and 1000 mm2/s and gradients applied in 12 different directions. White matter pathways were reconstructed for each subject, using the Fiber Assignment by Continuous Tracking (FACT) algorithm. We a priori selected the enthorinal cortex and the hippocampus as disease epicenter and calculate the percentage of affected connections directly linking to the epicenter (first ring) and to nodes with topological distance = 2 from the epicenter (second ring). Connections with a lower average strength (t-test, p < 0.05, uncorrected) in the patient group compared to the HC group were labeled as affected. For each of the three patient groups, the analysis was repeated for 10,000 random permutations of group assignments (i.e., HC or patient) to test for significance of the findings.

RESULTS

The analysis of number of streamlines yielded 5.2% of affected connections in the first ring (p = 0.1013) and 2.9% in the second ring (p = 0.1739) for aMCI; 20% of affected connections in the first ring (p = 0.0001) and 10.6% in the second ring (p = 0.0001) for mild AD; 37.9% of affected connections in the first ring (p < 0.0001) and 17.5% in the second ring (p < 0.0001) for moderate AD.

CONCLUSION

The results of this study show epicentral disruption of structural connectivity in aMCI and AD. Enthorinal cortex and hippocampus together form a good target to be considered as epicenter of structural connectivity impairment in aMCI and AD.

CLINICAL RELEVANCE/APPLICATION

The pathways linking to nodes with lowest topological distance from the epicenter are prone to the most structural damage also reflecting disease progression from aMCI to moderate AD.

SSA15-09

Neural Correlates of Apathy and Disinhibition in FrontoTemporal Dementia

Sheela Kumari R MSc (Presenter): Nothing to Disclose

PURPOSE

The frontal variant FTD is defined by the presence of behavioural manifestations such as apathy, disinhibition
and executive disinhibition, but their neuroanatomical correlates are still not clearly defined.

**METHOD AND MATERIALS**

Patients with a clinical diagnosis of FTD in the SCTIMST Memory Clinic were included in the study. Study was performed after getting approval from the Institutional Ethics Committee. We administered Frontal system behaviour scale (FrSBe) to 20 patients with FTD and 20 normal control (NC) subjects. All the subjects were underwent a high resolution T1 weighted Volumetric Magnetic Resonance Imaging (MRI) sequence in 1.5 Tesla Siemens scanner. Voxel Based Morphometry (VBM) was used to explore the pattern of GM atrophy in apathy and disinhibition profiles as measured by FrSBe. By using VBM, subject brains were segmented into GreyMatter (GM), White Matter (WM) and Cerebrospinalfluid(CSF). Segmented images were then smoothed with an isotropic Guassian kernel of 12 mm Full Width Half Maximum (FWMH). The smoothed images were used to compare the GM density between FTD patients and controls. A two sample t test comparison by setting up a voxel-wise General Linear Model (GLM) was performed between FTD and NC to provide an overall indicator of pattern atrophy in FTD patients. For multiple comparison age, sex and TIV were included as covariates in the design matrix. Apathy and disinhibition scores were entered as disease factors in the design matrix. A level of significance of p<0.001, uncorrected was accepted for the multiple comparison of whole brain analysis.

**RESULTS**

Compared with a group of controls, FTD patients revealed a wide spread atrophy in the frontal and the anterior temporal lobes. Apathy profile in FTD is correlated with atrophy in right prefrontal cortex, right rectal gyrus, anterior cingulate and right rolandic operculum regions. Disinhibited profile is correlated with atrophy in right Heschl gyrus, right hippocampus, right insula and olfactory regions.

**CONCLUSION**

Atrophy in frontal and temporal regions associated with apathetic and disinhibited profile. The correlation analysis between regional atrophy and corresponding symptoms in FTD was successfully validated by VBM.

**CLINICAL RELEVANCE/APPLICATION**

Our study may help in the better understanding of the neural correlates of this dreaded dementing disease as well as facilitate the understanding of human brain.
CONCLUSION

Temporal bone images acquired at 320-row CT using axial volume scanning and IR are of adequate diagnostic quality and allow for a substantial reduction in the radiation exposure and imaging time.

CLINICAL RELEVANCE/APPLICATION

Axial volume scanning with iterative reconstruction at 320-row CT allows for a substantial reduction in the radiation exposure and imaging time and maintains the image quality in temporal bone CT.
necessity for an additional z-axis-filter. 0.4 mm images were reconstructed using standard filtered-back-projection (FBP) or iterative reconstruction (IR) technique for the first two generations of DSCT and a novel model based IR algorithm for the 3rd generation DSCT. Objective image quality was evaluated for identical regions-of-interest and subjective image quality was evaluated on a 5-point Likert scale. Radiation dose parameters were assessed and compared between the three DSCT systems. Comparisons between the groups were analyzed with two-way ANOVA or Wilcoxon-Rank-Sum Test depending on the distribution of the data.

RESULTS

The statistically significantly highest subjective and objective image quality was found for the 3rd generation DSCT when compared to the 1st or 2nd generation DSCT systems (subjective image quality: 3rd generation DSCT 5[5-5], 2nd generation DSCT 4[4-4], 1st generation DSCT 3[2-3] all p<0.0001). Total effective dose was 63%/39% lower for the 3rd generation system when compared to the 1st and 2nd generation DSCT (0.25±0.04 mSv vs. 0.67±0.04 mSv and 0.41±0.04 mSv; p<0.0001 respectively).

CONCLUSION

Temporal bone imaging without z-axis-UHR-filter and a novel third generation IR algorithm allows for significantly higher image quality, while lowering effective dose when compared to the first two generations of DSCTs.

CLINICAL RELEVANCE/APPLICATION

UHR temporal bone imaging with a 3rd generation DSCT allows for significantly lower radiation doses, while improving image quality, which is especially important in order to reduce organ radiation dose.

SSA16-04

Three Dimensional Reconstruction of the Inner Ear Using High Resolution MR-Imaging before Cochlear Implantation: Does the Volume of the Cochlea and Inner Ear Affect the Results of Speech Recognition Outcome after Implantation?

Nagy Naguib Naeem Naguib MD, MSc (Presenter): Nothing to Disclose, Ahmed Fathy Emam MBBCh: Nothing to Disclose, Constanze Hey: Nothing to Disclose, Nour-Eldin Abdelrehim Nour-Eldin MD, MSc: Nothing to Disclose, Marc Harth: Nothing to Disclose, Iris Burck MD: Nothing to Disclose, Boris Bodelle MD: Nothing to Disclose, Thomas Lehnert MD: Nothing to Disclose, Thomas Josef Vogl MD, PhD: Nothing to Disclose

PURPOSE

To test whether the volume of the inner ear and cochlea measured using three dimensional (3D) reconstruction of the high resolution MRI sequence affect the speech recognition outcome following cochlear implantation.

METHOD AND MATERIALS

The study was retrospectively performed on 36 patients (17 males and 19 females) with a mean age of 53.58 year +/- 22.1. All patients suffered from longstanding sensorineural hearing loss and received unilateral cochlear implantation. High resolution MRI was performed using a T2-weighted SPACE sequence with 0.6 mm slice thickness. 3D reconstructions and pre-operative volume measurements were performed using an advantage workstation for diagnostic imaging. Speech recognition (SR) was tested using the Freiburger Monosyllabic Words (MSWT) and Numbers tests (NT) preoperatively, postoperatively, at 3, 6 and 12 month follow-up. Speech Recognition tests and Volume assessment were performed in a double blinded fashion. The correlation between the Speech Recognition test results and inner ear and cochlear volume measurements in 3D were tested for statistical significance using the Spearman's rank correlation test.

RESULTS

The mean 3D volume of the inner ear was 0.48 cm3 (Standard deviation: 0.08, Range: 0.31 - 0.7) and the mean 3D volume of the cochlea was 0.16 cm3 (Standard deviation: 0.03, Range: 0.1 - 0.22). The mean percentages of the SR-MSWT were 5.4, 25.19, 38.54, 46.04 and 53.85 in the preoperative, postoperative, and 3, 6 and 12 month follow-up respectively. The mean percentages of the SR-NT were 30.4, 66.15, 81.6, 82.5 and 87.6 in the preoperative, postoperative, 3, 6 and 12 month follow-up respectively. There was no significant correlation (p > 0.05) between the preoperative volume of the inner ear and cochlea and the results of the SR assessment at any time point of the study.

CONCLUSION

The preoperative volume of the inner ear and the volume of the cochlea do not correlate significantly with the outcome of the speech recognition tests following cochlear implantation.

CLINICAL RELEVANCE/APPLICATION

The current study results showed that even patients with a small volume of the inner ear or small volume of the cochlea can benefit from cochlear implantation since the volume does not influence the speech recognition outcome.

SSA16-05

Cochlear Implants: Electrode Migration and its Implications

Mariano Sturla MD (Presenter): Nothing to Disclose, Alejandro Gomez RT: Nothing to Disclose, Eduardo Galli MD: Nothing to Disclose, Natalia A. Hiriart MD: Nothing to Disclose

PURPOSE

Show the usefulness and implications of electrode position detection in cochlear implant patients.
METHOD AND MATERIALS

68 patients with cochlear implants were studied with CT after surgery and in the followup (5 years period). In all of them electrodes were placed in the Scala Tympani at surgery. We used a 4 row scanner Philips MX8000Quad. Scan parameters were 0.5mm thickness, 0.5 reconstruction index and 0.5 pitch. To determinate the exact position, we perform reconstructions(MPR, cMPR and 4D) and to determinate implant functionality we performed functional tests (voice perception, interpretation and discrimination) in all patients.

RESULTS

In 68 patients (75 implants) were imaged after surgery. 71 implants were followed up within a period of 5 years. Exact position of electrodes was identify in 97.1% (69/71). 2 implants (2.9%) were impossible to determinate due to strike artifact. We had two main types of migration; one occurs towards the tympanic box and the other inside the cochlea(scalar migration). 95.7% implants (66/69) were located at the Scala Tympani. All patients had normal functional tests for voice perception, interpretation and word discrimination. Only one showed at followup, abnormal tests and was proved to be a software calibration issue. In 4.3% (3 of 69) implants we discovered migration. In 2 of this 3 patients( 2.8% of total) the electrode was identified at Scala Vestibuli beyond de basal turn of the cochlea, confirmed by CT. No one had impaired hearing functional tests. The other patient showed electrode migration within the middle ear towards the tympanic cavity (1.5% of total),presenting abnormal tests.

CONCLUSION

Computed Tomography is a reliable method to determinate the electrode position and migration. Electrodes localization is a relevant information to the surgeon and must always be reported. This preliminary results suggest that the existence of middle ear migration is more associated with hearing loss than the scalar migration. Scalar migration is more frequent beyond de basal turn of the cochlea. We beleive that a larger series of patients is needed to confirm this preliminary results.

CLINICAL RELEVANCE/APPLICATION

Electrode position and location plays an important roll in the post-operative followup providing critical information to the surgeon.

SSA16-06

Auditory Brainstem Implant: Computer Tomography Assessment of Electrodes Dislocation

Nicolo Cardobi (Presenter): Nothing to Disclose , Roberto Cerini : Nothing to Disclose , Federica Spagnolli : Nothing to Disclose , Marco Barillari  MD : Nothing to Disclose , Marco Carner : Nothing to Disclose , Vittorio Colletti  MD : Nothing to Disclose

PURPOSE

the main goal of our study was to evaluate the contribution of the Computed Tomography to demonstrate Auditory Brainstem Implant (ABI) electrodes dislocation.

METHOD AND MATERIALS

from 2008, out of 75 patient with ABI implant positioned in our Hospital, 7 patients with malfunctioning ABI were selected and retrospectively revised. CT examination was performed on our 64 slices CT scanner (Philips Brilliance 64, Philips Eindhoven, The Netherlands) at implant activation, usually 15 days after surgery and repeated later to verify any electrodes dislocations. Implant dislocation was defined as electrodes array rotation and/or translation. Rotation was defined as change in angulation, measured in degrees, of electrodes plate in each plane examined, between the CT examination performed at the ABI activation and subsequent follow-up CT. Translation was defined as displacement in millimetres of electrodes plate's iso-center, in each plane examined, between the CT examination performed at the ABI activation and subsequent follow-up CT. Electrodes translation and rotation were measured on fusion CT image in each plane and then compared to number of active electrodes of the array.

RESULTS

CT was able to identify electrodes plate rotation and/or dislocation in all patients. In 3/7 patients there were electrodes plate rotation and translation. In 2/7 patients there was only electrodes plate translation. Maximum rotation measured was 44.9°; maximum dislocation was 3.6 mm.

CONCLUSION

CT was able to identify electrodes plate rotation and/or dislocation in all patients.

CLINICAL RELEVANCE/APPLICATION

computer tomography is a useful tool to detect ABI dislocation and should be used in case of decrease ABI performance over time

SSA16-07

Volumetric Assessment of the Inner Ear in Patients Presenting with Meniere Disease

Ahmed Fathy Emam  MBBCh (Presenter): Nothing to Disclose, Nagy Naguib Naeem  Naguib  MD, MSc : Nothing to Disclose, Nour-Eldin Abdelrehem, Nour-Eldin  MD, MSc : Nothing to Disclose, Mohammed Ahmed Alsubhi  BMBS : Nothing to Disclose, Katrin Eichler  MD : Nothing to Disclose, Thomas Josef  Vogl  MD, PhD : Nothing to Disclose

PURPOSE
To assess the volume of the Cochlea and Vestibular Labyrinth in patients presenting with Meniere Disease and to compare with the volume of normal inner ears using 3D reconstruction of MR-Imaging.

**METHOD AND MATERIALS**

A retrospective study was performed on 135 inner ears (79 females and 56 males) with a mean age of 48.9 year (standard deviation: 25.4, range: 5 month - 88 year). Of the 135 inner ears 75 inner ear (37 right and 38 left inner ears) presented with Meniere and 60 inner ears (32 right and 28 left inner ears) diagnosed as morphologically normal. High resolution MR-Imaging was performed using a T2-weighted SPACE sequence with 0.6 mm slice thickness. 3D reconstructions were performed using Advantage Workstation for diagnostic imaging. The difference between the volumes in patients with and without Meniere was tested using the Mann-Whitney test.

**RESULTS**

Right sided Meniere: semicircular canals mean volume was 0.290 mm^3^ (SD: 0.06, Range: 0.190 - 0.430 mm^3^), vestibule's mean volume was 0.086 mm^3^ (SD: 0.02, Range: 0.060 - 0.160 mm^3^) and Cochlea's mean volume was 0.180 mm^3^ (SD: 0.04, Range: 0.180 - 0.340 mm^3^). Normal right inner Ear: semicircular canals mean volume was 0.260 mm^3^ (SD: 0.04, Range: 0.180 - 0.340 mm^3^), Vestibule's mean volume was 0.070 mm^3^ (SD: 0.02, Range: 0.120 - 0.200 mm^3^). Left sided Meniere: semicircular canals mean volume was 0.290 mm^3^ (SD: 0.05, Range: 0.200 - 0.410 mm^3^), vestibule's mean volume was 0.080 mm^3^ (SD: 0.02, Range: 0.070 - 0.150 mm^3^) and Cochlea's mean volume was 0.180 mm^3^ (SD: 0.04, Range: 0.140 - 0.260 mm^3^). Left normal inner ears: semicircular canals mean volume was 0.260 mm^3^ (SD: 0.04, Range: 0.200 - 0.340 mm^3^), vestibule's mean volume was 0.070 mm^3^ (SD: 0.01, Range: 0.040 - 0.090 mm^3^) and Cochlea's mean volume was 0.160 mm^3^ (SD: 0.02, Range: 0.120 - 0.210 mm^3^). There was a statistically significant difference between the semicircular canal volume, vestibular volume and cochlear volume in inner ears affected with Meniere Disease in comparison with normal inner ears. (P value ranging between 0.002 and 0.045).

**CONCLUSION**

Patients presenting with Meniere Disease show a statistically significant larger volume of the semicircular canals, vestibule and cochlea compared to patients without Meniere disease.

**CLINICAL RELEVANCE/APPLICATION**

An increased volume of the inner ear might be responsible for Meniere disease.

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**SSA16-08 Reproducibility of Volumetric Assessment of the Inner Ear using Three Dimensional Reconstruction of the High Resolution MRI Sequence**

*Nagy Naguib Naeem Naguib MD, MSc (Presenter): Nothing to Disclose, Ahmed Fathy Emam MBBCh : Nothing to Disclose , Nour-Eldin Abdelrehim Nour-Eldin MD, MSc : Nothing to Disclose , Tatjana Gruber-Rouh : Nothing to Disclose , Boris Bodelle MD : Nothing to Disclose , Marc Harth : Nothing to Disclose , Thomas Lehnert MD : Nothing to Disclose , Thomas Josef Vogl MD, PhD : Nothing to Disclose*

**PURPOSE**

To assess the reproducibility of the volumetric assessment of the inner ear using three dimensional (3D) reconstruction of the high resolution MR-Imaging (HR-MRI) sequences.

**METHOD AND MATERIALS**

The study was retrospectively performed on 50 patients (F=27, M=23) with a mean age of 53.3 years. Patients were referred for MRI due to different disorders of the inner ear. HR-MRI was performed using a T2-weighted SPACE sequence with 0.6 mm slice thickness. 3D reconstructions were performed using Advantage Workstation. Assessed were the volumes of both inner ears together, of each side alone, of the cochlea and of the vestibular system. All volume measurements were performed twice. To avoid possible Bias the time interval between both measurements was 1 year and the previous results were not accessible during the second evaluation (blinded). The agreement between both results was tested using intra-class correlation (ICC) test.

**RESULTS**

For the first assessment the mean volume of both inner ears together was 1.01 cm^3^ +/-0.13 (Range: 0.69-1.33), of each inner ear alone 0.5 cm^3^ +/-0.07 (Range: 0.32-0.71), of the cochlea 0.17 cm^3^ +/-0.024 (Range: 0.13-0.23) and of the vestibular system 0.33 cm^3^ +/-0.06 (Range: 0.19-0.49). For the second assessment the mean volume of both inner ears together was 0.99 cm^3^ +/-0.11 (Range: 0.79-1.27), of each inner ear alone 0.5 cm^3^ +/-0.06 (Range: 0.38-0.66), of the cochlea 0.17 cm^3^ +/-0.025 (Range: 0.13-0.26) and of the vestibular system 0.33 cm^3^ +/-0.05 (Range: 0.23-0.45). ICC analysis showed a statistically significant (p<0.0001) excellent agreement for volumetric assessment of both inner ears together (ICC-Coefficient=0.82, Confidence Interval (CI) 95%) and of the cochlea (ICC-Coefficient=0.88, CI 95%). A statistically significant (p<0.0001) substantial agreement for volumetric assessment of each side alone (ICC-Coefficient=0.79, CI 95%) and of the vestibular system (ICC-Coefficient=0.7, CI 95%) was noted.

**CONCLUSION**

Volumetric assessment of the inner ear using 3D reconstruction of HR-MRI is a reproducible method with statistically significant excellent agreement for volumetric assessment of both sides together and cochlea and substantial agreement for each side alone and vestibular system.
CLINICAL RELEVANCE/APPLICATION

The reproducibility of the volumetric assessment makes it possible to introduce 3D volume assessment of the inner ear as one of the MRI assessment parameters for patients presenting with inner ear disorders.

SSA17

Neuroradiology/Head and Neck (Vascular Disease of the Head & Neck)

Scientific Papers

NR HN
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 10:45 AM - 12:15 PM Location: N227AB

Participants

Moderator
Pratik Mukherjee MD, PhD : Research Grant, General Electric Company Medical Advisory Board, General Electric Company
E. Turgut Tali MD : Nothing to Disclose

Sub-Events

SSA17-01 Plaque Echolucency and Stroke Risk in Asymptomatic Carotid Stenosis: A Systematic Review and Meta-Analysis

Hediyeh Baradaran MD (Presenter): Nothing to Disclose, Kartik Kesavabhotla: Nothing to Disclose, Edward E. Mtui MD: Nothing to Disclose, Diana Delgado MS: Nothing to Disclose, Ashley Giambrone PhD: Nothing to Disclose, Ajay Gupta MD: Nothing to Disclose

PURPOSE

Among methods to further risk-stratify patients with asymptomatic carotid stenosis, carotid artery plaque echolucency on ultrasound (US) has been identified as a noninvasive imaging marker for future stroke risk. We performed a systematic review and meta-analysis to evaluate the association between echolucent plaque identified on US and future ischemic events in asymptomatic patients with carotid atherosclerotic disease.

METHOD AND MATERIALS

We performed a comprehensive literature search evaluating the association of US-based characterization of carotid plaque with ischemic events. The included studies were prospective observational studies examining plaque echolucency on US in asymptomatic patients with mean follow-up of at least 1 year assessing for development of ipsilateral ischemic event. A meta-analysis with assessment of study heterogeneity and publication bias was performed. Results were summarized using a random or fixed-effects model.

RESULTS

Of the 5409 manuscripts screened, 7 met eligibility for systematic review and meta-analysis. A total of 7727 patients with a mean age of 72.1 were included. Because no significant heterogeneity was found between studies, a fixed effects model was used. The relative risk (RR) for ipsilateral stroke in patients with echolucent plaque was 3.00 (95% CI, 1.858-4.852; p = 0.00). In a subset analysis, the RR for ipsilateral stroke in patients with >50% carotid artery stenosis and echolucent plaque was 2.56 (95% CI, 1.275-5.137; p = 0.01). No statistically significant publication bias was found between studies.

CONCLUSION

In this meta-analysis of 7727 patients, we found that the presence of echolucent plaque on carotid artery US increases the risk of future ipsilateral stroke in asymptomatic patients with carotid atherosclerotic disease.

CLINICAL RELEVANCE/APPLICATION

US imaging routinely acquired for carotid artery stenosis screening can also be used to classify plaque echolucency and potentially offers a simple tool to further risk stratify asymptomatic patients with carotid atherosclerotic disease.

SSA17-02 A Population-based Study on MRI-based Automated Segmentation of Carotid Atherosclerotic Plaque Burden

Mariana Selwaness MD (Presenter): Nothing to Disclose, Reinhard Hameeteman MSC: Nothing to Disclose, Oscar H. Franco: Nothing to Disclose, Aad Van Der Lugt MD, PhD: Nothing to Disclose, Jolanda J. Wentzel PhD: Nothing to Disclose, Meike Willemijn Vernooij MD: Nothing to Disclose

PURPOSE

The extent of carotid atherosclerosis is considered a potentially relevant risk marker for stroke. In a large stroke-free population, we identified cardiovascular risk factors and carotid plaque components associated with carotid plaque burden and lumen volume.
METHOD AND MATERIALS
Within The Rotterdam Study, we performed prescreening of carotid arteries with ultrasound to select participants with carotid plaques >=2.5 cm. On 1.5-Tesla carotid MRI scanning, plaque composition and luminal stenosis were visually assessed. Inner and outer wall of the carotid arteries were bilaterally segmented using a validated automated method in order to measure plaque burden. We analyzed sex-specific standardized relations of cardiovascular and imaging risk factors to plaque burden and lumen volumes using regression analysis.

RESULTS
In 1562 participants (mean age 72.7±9.2 years, 46% women), we automatically segmented 2821 carotid atherosclerotic plaques. Women had larger plaque burden (50.7±7.8% vs. 49.2±7.7%, p

CONCLUSION
Several cardiovascular risk factors as well as plaque composition, in particular IPH, are associated with plaque burden. Carotid IPH is a strong risk factor for luminal stenosis.

CLINICAL RELEVANCE/APPLICATION
Carotid plaque burden could play a role as a promising biomarker for cardiovascular disease. MRI-based automated segmentation is a user-friendly and non-invasive tool that may serve to identify risk factors of plaque burden in population studies.

Feasibility of High-resolution MR Imaging for the Diagnosis of Intracranial Vertebrobasilar Artery Dissection
Miran Han MD (Presenter): Nothing to Disclose, Jin Wook Choi MD: Nothing to Disclose, Young Keun Sur MD: Nothing to Disclose, Seon Young Park MD: Nothing to Disclose, Sun Yong Kim MD: Nothing to Disclose

PURPOSE
To evaluate the feasibility of HR-MR imaging to diagnose intracranial vertebrobasilar artery dissection (VBD) and to find most useful imaging findings suggesting dissection

METHOD AND MATERIALS
We retrospectively reviewed 55 patients suspected of having intracranial VBDs and underwent HR-MR imaging between March 2012 and October 2013. Two neuroradiologists independently reviewed the HR-MR images. The diagnosis based on only HR-MR imaging was compared with final diagnosis by the consensus among neuroradiologists, neurointerventionist and neurologist after reviewing all clinical and paraclinical investigations available at hospital discharge (initial CT, MR, DSA images and etiologic work-ups) and follow up. Two neuroradiologists also looked for indications of dissection (mural hematoma, dissection flap, outer diameter enlargement on T2WI of steno-occlusive lesion on angiography) on each sequence of HR-MRI. Interobserver agreement for diagnosing the VBD and detecting dissection signs were estimated using the Cohen's kappa coefficient

RESULTS
5 patients were excluded because scanning range of HR-MR imaging did not fully cover the affected segment. Among the 50 study population, 33 patients were finally diagnosed with VBD by consensus of various specialists. Diagnosis based on HR-MR imaging corroborated the final diagnosis in 47 (94%, 31 VBD and 16 No VBD) patients. A mural hematoma was best detected on T1WI and CE-T1WI (54.3%). Dissection flaps were seen in almost all cases on CE-T1WI (91.4%) and secondly detected on T2WI (68.6%). Outer-diameter enlargement of the steno-occlusive lesions on angiography was detected in more than half of cases (62.86%). The two reviewers showed substantial to almost perfect agreement for diagnosis of VBD and detecting dissection signs on every sequence.

CONCLUSION
HR-MR imaging could be a useful and non-invasive diagnostic tool for intracranial VBDs and dissection flap on CE-T1WI is most confident sign for suggesting dissection

CLINICAL RELEVANCE/APPLICATION
HR-MR imaging can demonstrate direct findings of dissection and be non-invasive useful diagnostic tool for the diagnosis of intracranial vertebrobasilar artery dissection.

Haptoglobin 2-2 Genotype is Associated with Presence and Progression of MRI Depicted Carotid Intraplaque Hemorrhage
Tina Binesh Marvasti (Presenter): Nothing to Disclose, Navneet Singh MD: Nothing to Disclose, Mariam Afshin: Nothing to Disclose, Tishan Maraj: Nothing to Disclose, Pascal N. Tyrrell PhD: Nothing to Disclose, Alan Rowland Moody MD: Nothing to Disclose

PURPOSE
Intraplaque hemorrhage (IPH) - a component of late-stage atherosclerotic plaque- is a source of free hemoglobin (Hb) that binds the haptoglobin (Hp) protein and forms a complex cleared by tissue macrophages. There are three Hp genotypes: Hp1-1, Hp2-2 and Hp1-2. The Hb-Hp2-2 complex has a lower binding affinity for macrophages, resulting in retention of vascular Hb and oxidative burden. Studies have shown a higher risk of CV events in Hp2-2 individuals. We hypothesized that Hp2-2 patients' failure to clear Hb results in a greater prevalence and progression of MRI depicted IPH (MRIPH). We aimed to identify a biomarker (Hp) for routine testing of individuals at risk of IPH.

METHOD AND MATERIALS
Patients with non-surgical carotid artery disease (30-95% stenosis) underwent 3T carotid MRI (Philips Achieva) of both carotids annually from 2010 to 2014. MRI PH uses a T1-weighted inversion recovery fat suppressed 3D Fast Field Echo sequence in the coronal plane to detect IPH which appears of high signal due to methemoglobin. IPH volume was quantified using VesselMass software. Hp genotypes were identified using an established PCR protocol. Descriptive statistics and mixed effects model longitudinal regression analyses were performed.

RESULTS
The study cohort consisted of 80 patients (mean age, 72.8 years; range 52-100) with 160 carotid images. Patients homozygote for the Hp 2 allele had a significantly higher prevalence of IPH at baseline (BL) compared to those carrying an Hp 1 allele (57% vs 34%, OR = 2.52, 95% CI = 1.23-5.14, p = 0.01). IPH volume at BL did not differ significantly between the two groups (0.27 vs. 0.23 mL respectively, p = 0.836). Longitudinal analysis of 18 IPH positive carotids with two years follow up data indicated a significant progression of IPH volume over time in Hp 2 homozygote patients (β = 0.12, SE = 0.04, p < 0.01) and regression of IPH volume in patients carrying an Hp 1 allele (β = -0.09, SE = 0.03, p = 0.01).

CONCLUSION
Patients homozygote for the Hp 2 allele had a significantly higher prevalence of carotid BL-IPH at which worsened over a two year follow up period.

CLINICAL RELEVANCE/APPLICATION
Detection of pre-symptomatic vascular disease allows for prevention of CV events. Hp genotype is a biomarker of high risk vascular disease (IPH) that when detected using simple genotyping methods can identify at-risk populations for more targeted imaging investigations.
Artery of foramen rotundum is thought to be a sole arterial branch of the pterigopalatine segment of the internal maxillary artery to the cavernous sinus. However, we found another undescribed branch, provisionally-named artery of superior orbital fissure (SOF), from pterigopalatine segment of the internal maxillary to the cavernous sinus via the SOF in some cases of parasellar hypervascular lesions. In this paper, we investigated the frequency and course of the artery of SOF in cases with parasellar hypervascular lesions.

**METHOD AND MATERIALS**

We retrospectively reviewed biplane and 3D angiography of external carotid artery undergone from June 2010 to December 2013 in 17 patients with parasellar hypervascular lesions, including 13 cases of cavernous sinus dural arteriovenous fistulas and 4 cases of parasellar meningiomas. 3D angiographic images were reviewed by 2 experienced neuroradiologists with particular interest to the artery of SOF.

**RESULTS**

The artery of SOF was identified in 7 of 13 cases of cavernous sinus dural arteriovenous fistulas and 2 of 4 cases of parasellar meningioma. It arose at the pterygopalatine segment of the internal maxillary artery, either singly or by a common trunk with the artery of foramen rotundum, and run upward to reach the SOF, and then turned posteriorly to the cavernous sinus with acute angle and fed the AVFs or tumors. In one case, the artery of SOF communicated with lachrymal branch of the ophthalmic artery at the orbital apex.

**CONCLUSION**

Although it has not been described in anatomic paper, the artery of SOF could be observed approximately half of the cases of parasellar hypervascular lesions.

**CLINICAL RELEVANCE/APPLICATION**

This study demonstrates an arterial branch of the external carotid artery, artery of superior orbital fissure (SOF), which has not been recognized. The artery of SOF can feed the cavernous sinus dural AVFs and hypervascular tumor. Special attention should be paid for embolization of the artery of SOF because it potentially anastomose with ophthalmic artery and anterior branch of the inferolateral trunk of the internal carotid artery.

**Finding the Optimal Parameter for the DSA Time Density Curve When Evaluating Flow Changes in Patients with Carotid Stenosis**


**PURPOSE**

Cerebral circulation time provides instantaneous intravascular flow measurement from the time density curve (TDC) in digital subtraction angiography (DSA) series and accurately predicts flow changes in stenotic occlusive vessels. The purpose of our study was to compare the effectiveness of three major TDC variables for detecting flow changes in stenotic patients: relative time to maximum concentration (rTmax), maximum slope (MS), and area under curve (AUC).

**METHOD AND MATERIALS**

Seventy cases of unilateral carotid stenosis (group A) and 56 normal controls (group B) were retrospectively enrolled. Fixed contrast injection protocols and acquisition parameters were used in all angiographic series. The middle cerebral artery (M1), sigmoid sinus (SS), and internal jugular vein (JV) in the AP (anterior-posterior) view, and second branch of the middle cerebral artery (M2), parietal vein, and superior sagittal sinus (SSS) in the lateral view were chosen. rTmax, MS, and AUC of the TDC in individual ROIs were compared between the two groups using a DSA analyzer prototype.

**RESULTS**

rTmax in M1, SS, JV, M2, PV and SSS were significantly prolonged in group A compared to group B. Among all AUCs, only the AUC in SSS was significantly larger in group A than in group B. For the MSs, M1, M2, and SS showed significant decreases in group A compared to group B. The AUC for the SSS demonstrated the best single diagnostic performance at the optimal cutoff value of 536 with sensitivity 71% and specificity 64.5%.

**CONCLUSION**

Only the MSs for M1, M2, and the AUC for the SSS showed equivalent diagnostic performance with rTmax in differentiating carotid stenosis. rTmax thus remains the preferred measurement for all ROIs in routine DSAs.

**CLINICAL RELEVANCE/APPLICATION**

Using rTmax alone in different ROIs provides sufficient, rapid in-room assessment of intravascular hemodynamic and thus improves patient safety in endovascular treatments.
Extracranial Carotid Artery Stenting Followed by Intracranial Stent-based Thrombectomy for Acute Tandem Occlusive Disease

John Moshe Gomori MD (Presenter): Consultant, Medymatch Technology Ltd, Ronen Leker MD: Consultant, MedyMatch Technology Ltd, Roni Peter Eichel MD: Nothing to Disclose, Jose Enrique Cohen MD: Nothing to Disclose

PURPOSE

Acute tandem occlusions of the extracranial internal carotid artery (ICA) and a major intracranial artery respond poorly to intravenous tissue plasminogen activator (IV-tPA) and present an endovascular challenge. We describe our experience with emergent stent-assisted ICA angioplasty and intracranial stent-based thrombectomy of tandem occlusions.

METHOD AND MATERIALS

Procedures were performed from 3/2010-12/2013. National Institutes of Health Stroke Score (NIHSS) and Alberta Stroke Program Early CT Score (ASPECTS), occlusion sites, collateral supply, procedural details, and outcomes were retrospectively reviewed with IRB waiver of informed consent.

RESULTS

24 patients, mean age 66 years, mean admission NIHSS score 20.4, and mean ASPECTS 9 were included. Occlusion sites were proximal ICA-MCA trunk in 17 patients, proximal ICA-ICA terminus in six, ICA-MCA-anterior cerebral artery (ACA) in one. Stent-assisted cervical ICA recanalization was achieved in all patients, with unprotected pre-angioplasty in 24/24, unprotected stenting in 16/24 (67%), and protected stenting in 8/24 (33%), followed by stent-thrombectomy in 25 intracranial occlusions. There was complete recanalization/complete perfusion in 19/24 (79%), complete recanalization/partial perfusion in 2/14 (13%), and partial recanalization/partial perfusion in 2/24 (8%) with no procedural morbidity/mortality. Mean time to therapy was 3.8 hours (range 2-5.5). Mean time to recanalization was 51 minutes (range 38-69). At 3-month follow-up, among 17/22 surviving patients (77%), 13/17 (76%) presented mRS 0-2 and 3/17 (18%) were mRS 3.

CONCLUSION

In acute tandem ICA-MCA/distal ICA occlusions, extracranial stenting followed by intracranial stent-based thrombectomy appears feasible, effective, and safe. Further evaluation of this treatment strategy is warranted.

CLINICAL RELEVANCE/APPLICATION

With newer techniques, acute tandem carotid - intracranial occlusive disease is now amenable to treatment with high success and low complication rates.

ISP: Nuclear Medicine (PET/CT for Oncology)

Scientific Papers

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 10:45 AM - 12:15 PM Location: S505A

Participants

Moderator
Amir H. Khandani MD: Nothing to Disclose
Moderator
Terence Zekon Wong MD, PhD: Advisory Board, Eli Lilly and Company Consultant, Koninklijke Philips NV Advisory Board, Bayer AG

Sub-Events

SSA18-01 Nuclear Medicine Keynote Speaker: Recent Development in Oncologic PET Imaging


SSA18-03 FDG PET-based Parameters for Total Tumor Burden at Diagnosis are Highly Predictive for Outcome in Pediatric Hodgkin Lymphoma (HL): A COG AHOD0031 Retrospective Study

Steve Cho MD (Presenter): Nothing to Disclose, Alin Chirindel: Nothing to Disclose, Jongho Kim MD, PhD: Nothing to Disclose, Lu Chen: Nothing to Disclose, Allen Buxton: Nothing to Disclose, Sandy Kessels: Nothing to Disclose, Jeffrey P. Leal BA: Nothing to Disclose, Kathleen M. McCarron MD: Nothing to Disclose, Suzanne L. Wolden MD: Nothing to Disclose, Cindy Schwartz: Nothing to Disclose, Debra Friedman: Nothing to Disclose, Kara Kelly: Nothing to Disclose
PURPOSE

The purpose of this study was to assess the prognostic value of baseline tumor burden as determined by FDG PET-based parameters in pediatric HL.

METHOD AND MATERIALS

We retrospectively analyzed multi-site FDG PET/CT images from patients enrolled on COG AHOD0031, a Phase III study for newly diagnosed intermediate-risk pediatric HL. A cohort of 90 patients was identified based on availability of high quality archived PET/CT scans amenable to quantitative analysis and a pre-determined selection process that ensured inclusion of patients representative of different chemotherapy response groups. Baseline PET images were analyzed by consensus of 2 readers blinded to clinical outcome data using MIMVista software. PET standardized-uptake value (SUV) threshold values based on various absolute, liver, blood pool and tumor were assessed to derive PET parameters for total body nodal tumor burden including: average tumor SUV (SUVavg), metabolic tumor volume (MTV) and total tumor glycolytic activity (TGA). Event free survival (EFS) was the clinical endpoint of interest and analyzed by log-rank test and Cox proportional hazard model. Selected parameters were further assessed using receiver-operating-characteristic (ROC) analysis where the outcome was 2-year EFS.

RESULTS

Baseline FDG PET SUV derived MTV and TGA parameters were found to be highly predictive for EFS for a variety of thresholds (P<0.05). PET SUV threshold values found to be most predictive and reliable included: 1.5Lv + 2xliver standard deviation (1.5Lv+2SD), 2xmediastinal blood pool (2BP) and 20% maximal tumor SUV (TSUVmax). ROC area under the curve (AUC) for MTV using 1.5Lv+2SD, 2BP and TSUVmax threshold was 0.77, 0.84, and 0.79, respectively. Use of an "optimal cut-off" PET MTV value based on the ROC for 1.5Lv+2SD, 2BP and TSUVmax was able to separate EFS groups (P<0.005). Baseline tumor SUVavg was not found to be predictive for EFS.

CONCLUSION

Baseline FDG PET SUV derived total body tumor burden as represented by tumor volume (MTV) and total tumor glycolytic activity (TGA) is highly predictive of EFS in pediatric HL. These parameters need further validation for incorporation into HL prognostic stratification schemes.

CLINICAL RELEVANCE/APPLICATION

Baseline pre-therapy FDG PET derived metabolic tumor volume may be a potentially useful tool for use as a prognostic parameter and for risk-stratification of HL patients.

SSA18-04

Comparison of FDG-PET/ and US in Diagnosis of Primary Thyroid Lymphoma

Kunihiro Nakada (Presenter): Nothing to Disclose, Nozomu Fujimoto MD, PhD : Nothing to Disclose, Hiroki Sugie MD : Nothing to Disclose, Masayuki Sakurai : Nothing to Disclose

PURPOSE

Primary thyroid lymphoma (PTL) arises from Hashimoto's thyroiditis(HT), which could show diffuse thyroid FDG uptake. The aim of the study was to compare findings of FDG PET/CT with those of ultrasound (US) in PTL

METHOD AND MATERIALS

Total of 42 patients with PTL were enrolled. All patients underwent neck US, US-guided core needle biopsy, and PET/CT using FDG. Thyroid function at FDG PET/CT was euthyroid in 25, hypothyroid in 15, hyperthyroid in 2. Specimen of core needle biopsy was subjected to immunohistochemical staining (CD20,CD3,CD79a,Ki-67, etc.) along with H-E staining. IgH re-arrangement was analyzed by PCR. All patients were fasted overnight prior to injection of FDG. On PET/CT images, FDG uptake in the thyroid was categorized as nodular or diffuse by visual interpretation. Additionally, FDG uptake was semi-quantitatively determined in form of SUVmax. US findings was categorized as hypoechoic nodular or diffuse non-homogenous low echo.

RESULTS

Pathological diagnosis was MALT lymphoma in 32 and DLBCL in 10. clinical stage was IE in 27, IIE in 12, IIIE in 2 and IV E in 1. In PTL, FDG uptake was nodular in 14 and diffuse in 28. There was no significant difference in SUVmax between nodular uptake and diffuse uptake (6.7± 2.5 vs. 8.3 ±2.8). On US, 16 showed hypoechoic nodular lesion while the remaining 27 showed diffuse non-homogenous low echo. Surprisingly, 13(46%) out of 28 with diffuse FDG uptake showed nodular lesion on US. There no patients who showed diffuse non-homogenous low echo despite nodular FDG uptake.

CONCLUSION

our study, about 50% of PTL with diffuse FDG uptake had nodular appearance on US. Thus, combination of FDG-PET,CT and US should be helpful in assessment of intrathyroidal lesions from PTL.

CLINICAL RELEVANCE/APPLICATION

To evaluate accurate intrathyroidal status of PTL, combination of FDG PET/CT and US is highly recommended.

SSA18-05

Patient Survival Outcome and Follow Up/Surveillance 18F FDG PET/CT in Thyroid Cancer

Charles Marcus MBBS (Presenter): Nothing to Disclose, Antoniou Alexander MD : Nothing to Disclose, Rathan M. Subramaniam MD, PhD : Speakers Bureau, Eli Lilly and Company
PURPOSE
To evaluate the added value of follow-up and surveillance PET/CT to clinical assessment and survival outcome in thyroid cancer patients.

METHOD AND MATERIALS
This is a retrospective study of 258 biopsy proven thyroid cancer patients at a single tertiary center. A total of 349 follow up PET/CT scans done 6 or more months from initial treatment completion were included in this study. Median follow up from completion of primary treatment was 52.3 months (range, 6.0 - 705.0 months). Overall survival benefit was measured using Kaplan-Meier plots with a Mantel-Cox log-rank test. Multivariate Cox regression model is provided with clinical covariates.

RESULTS
Of the 349 PET/CT scans, 129 were positive and 220 were negative for recurrence. A subgroup analysis demonstrated a difference in overall survival (OS) in 166 scans completed between 6-48 months (p= 0.034), but did not demonstrate a difference in 183 scans completed after 48 months (p=0.5086) between the positive and negative cohorts. PET/CT identified recurrence in 12.6% (14/111) of scans without prior clinical suspicion and ruled out recurrence in 37.0% (88/238) of scans with prior clinical suspicion. There was significant difference in OS when grouped by clinical suspicion (p=0.0010). In a multivariate Cox regression model, factors associated with overall survival were age (p=0.0005), gender (p=0.0187), histology (p=0.0487), clinical suspicion (p=0.0004) and PET/CT result (p=0.0144). An age stratified subgroup analysis demonstrated significant difference in OS by PET scan result among patients between 40 and 65 years old, but not in those younger than 40 years or older than 65 years (p=0.0130, p=0.6694, and p=0.2706 respectively).

CONCLUSION
FDG PET/CT performed in follow-up more than 6 months from primary treatment completion adds value to clinical judgment and is a prognostic marker of overall survival in thyroid cancer patients.

CLINICAL RELEVANCE/APPLICATION
Follow-up PET/CT study performed after 6 months of treatment completion can add value to clinical judgment and provides prognostic information in thyroid cancer patients.

SSA18-06
Lymph Node Staging in Patients with Primary Prostate Cancer: Comparison of Quantitative Imaging Parameters in Diffusion Weighted Imaging and [11C]-Choline PET/CT
Tibor Vag MD, PhD (Presenter): Nothing to Disclose, Matthias Heck : Nothing to Disclose, Ernst J. Rummeny MD : Nothing to Disclose, Markus Schwaiger MD : Research Grant, Siemens AG, Matthias Johannes Eiber MD : Speaker, Siemens AG Speaker, Astellas Group Speaker, Johnson & Johnson

PURPOSE
To compare diagnostic performance of DWI and [11C]-Choline PET/CT in the assessment of preoperative lymph node status in patients with primary prostate cancer.

METHOD AND MATERIALS
33 patients underwent DWI and [11C]-Choline PET/CT prior to prostatectomy and extended pelvic lymph node dissection. Mean standardized uptake value (SUVmean) and mean apparent diffusion coefficient (ADC) of 76 identified lymph nodes (LN) were measured and correlated with histopathology. ADC-values and SUVs were compared using linear-regression analysis.

RESULTS
A significant difference between benign and malignant LN was observed for ADC-values (1.17 vs. 0.96x10^-3mm^2/s; P<0.001) and SUVmean (1.61 vs. 3.20; P<0.001). ROC analysis revealed an optimal ADC threshold of 1.01x10^-3mm^2/s for differentiating benign from malignant LN with corresponding sensitivity/specificity of 69.70%/78.57% and an Area under the Curve (AUC) of 0.785. The optimal threshold for SUVmean was 2.5 with corresponding sensitivity/specificity of 69.72%/90.48% and with an AUC of 0.832. ADC-values and SUVmean showed a moderate significant inverse correlation (r=-0.63).

CONCLUSION
Both modalities reveal similar moderate diagnostic performance for pre-operative lymph-node staging of prostate cancer. The only moderate inverse correlation between ADC-values and SUVmean suggests that both imaging parameters might provide complementary information on tumour biology.

CLINICAL RELEVANCE/APPLICATION
The application of both modalities in routine preoperative lymph node staging of primary prostate cancer is not justified at this time.

SSA18-07
Appearance of Untreated Bone Metastases from Breast Cancer on FDG PET/CT: Importance of Histologic Subtype
Brittany Dashevsky MD, DPhil (Presenter): Nothing to Disclose, Molly Parsons MD : Nothing to Disclose

PURPOSE
To compare imaging features of bone metastases from breast cancer on FDG PET/CT among patients with different primary histological subtypes of breast cancer.
PURPOSE

Studies suggest FDG PET is sensitive for lytic osseous metastases in breast cancer patients, but not blastic metastases. However, most studies have included patients who received systemic therapies, and the non-avid lesions may actually represent treated lesions. We evaluated breast cancer patients with osseous metastases at presentation, without prior systemic therapy, so the true sensitivity of FDG PET for untreated osseous metastases can be determined.

METHOD AND MATERIALS

This retrospective study was performed under an IRB waiver. Our Hospital Information System was screened for breast cancer patients with osseous metastases at presentation, who underwent PET/CT prior to chemotherapy, hormonal therapy, or radiation from 2009 to 2012. Patients with invasive ductal (IDC), invasive lobular (ILC), or mixed ductal/lobular (MDL) histology were included. Patients with prior cancer history were excluded. PET/CT studies were reinterpreted by a radiologist with 9 years PET/CT experience, blinded to other imaging and biopsy results. CT appearance of osseous metastases was classified per patient as blastic, lytic, occult (seen on FDG PET only), or mixed (mix of blastic, lytic, and occult). SUVmax per patient was recorded. Medical records were reviewed for biopsy results.

RESULTS

95 patients met inclusion criteria (74 IDC, 13 ILC, and 8 MDL). The CT appearance and SUVmax for these patients are reported in the table. For all 74 IDC and 8 MDL patients with osseous metastases apparent on PET/CT, at least one metastasis was FDG-avid, even in patients with only blastic CT appearance. For ILC, 6 of 6 patients with mixed CT appearance, and 1 of 1 with lytic CT appearance, had at least one FDG-avid metastasis. However, only 2 of 6 ILC patients with only blastic CT appearance were demonstrable on PET.

CONCLUSION

On a per patient basis, FDG PET has high sensitivity for detection of all subgroups of untreated bone metastases in IDC, even for patients with only blastic CT appearance. Sensitivity was also high in ILC patients with mixed CT appearance. Sensitivity of FDG PET was much lower for ILC patients with blastic CT appearance. Knowledge of breast cancer histology may improve PET/CT interpretation.

CLINICAL RELEVANCE/APPLICATION

On a per patient basis, FDG PET has high sensitivity for untreated osseous metastases in IDC with all CT appearances, including blastic, but not for ILC with only blastic CT appearance.
In this preliminary study, there was significant correlation between SUVmax and ADCmin, suggesting a relationship between glucose metabolism and restricted diffusion of the urothelial carcinoma similar to the other cancers reported by the literatures. Pathological characteristics of the urothelial carcinoma may be determined by the other factors of the tumor.

**CLINICAL RELEVANCE/APPLICATION**

Diuretic FDG PET/CT yields evaluation of glucose metabolism of urothelial carcinoma and may have incremental role of quantitative evaluation for the patients with urothelial carcinoma.

### SSA18-09

**Correlation of FDG PET-CT with Pelvic MRI in Staging of Patients with Rectal Cancer Using Fusion PET-MRI**

**Rajesh Gupta MD (Presenter):** Nothing to Disclose, **Elham Safaie MD :** Nothing to Disclose, **Robert Matthews MD :** Nothing to Disclose, **Matthew A. Barish MD :** Stockholder, Blackford Analysis Ltd, **Dinko Franceschi MD :** Nothing to Disclose, **Roberto Bergamaschi MD, PhD :** Nothing to Disclose

**PURPOSE**

To correlate FDG PET-CT findings with pelvic MRI and fusion imaging to assess metastatic extent in rectal cancer patients.

**METHOD AND MATERIALS**

Initially, we performed a retrospective chart review of rectal cancer patients at our institution from June 2008 to March 2013. We identified 18 patients, 11 males and 7 females with an average age of 58 years that had initial staging FDG PET-CT and pelvic MRI obtained within a 3 month interval. These patients were initially staged by pelvic MRI and confirmed with histology when available. The staging ranged from I to III. We compared PET-CT and MRI findings to assess tumor extent, local and distant metastases. We then fused PET and pelvic MRI to assess nodal involvement using MIM fusion software.

**RESULTS**

A total of 5 patients (28%) were upstaged based on hypermetabolic lesions seen on PET-CT. Three patients went from stage III to IV. The first had metastases to distant lymph nodes, the second had hepatic metastases and the third had local metastases to common iliac nodes. PET-CT upstaged one patient from II to IV as retroperitoneal and paraaortic nodes were identified, and one another patient upstaged from I to IV due to a lung metastasis. A total of 4 patients (22%) were downstaged because lymph nodes identified on MRI were negative on PET. Three patients went from stage III to I. Two patients had perirectal lymph nodes on MRI that were negative on histology and not FDG-avid, and the third patient had perirectal nodes on MRI that were not FDG-avid. An additional patient was downstaged from III to II as MRI and histology discovered several sigmoid mesentery nodes that were not FDG-avid. MRI and FDG PET-CT examinations were concordant in the remaining 50% of the patients. Fusion PET-MRI found additional hypermetabolic nodes in 2 patients. One had an external iliac node and another had perirectal nodes that were not clearly identified on PET-CT.

**CONCLUSION**

MRI provides excellent anatomical evaluation of tumor size and extent, while, PET-CT provides additional information on metabolic activity. Fusion PET-MRI can provide more accurate staging of local nodal involvement. This may change the initial stage which can affect treatment options.

**CLINICAL RELEVANCE/APPLICATION**

Both FDG PET-CT and pelvic MRI are standard of care for staging and restaging rectal cancer patients, however, fusion PET-MRI can provide a more accurate assessment of local disease extension.

### SSA19

**ISP: Physics (Computed Tomography I: New Techniques/Systems)**

**Scientific Papers**

**PH CT**

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

**ARRT Category A+ Credits:** 1.50

**Sun, Nov 30 10:45 AM - 12:15 PM  Location: S403B**

**Participants**

**Moderator**

Willi A. Kalender PhD : Consultant, Siemens AG Consultant, Bayer AG Founder, CT Imaging GmbH Scientific Advisor, CT Imaging GmbH CEO, CT Imaging GmbH

**Moderator**

Xiaochuan Pan PhD : Research Grant, Koninklijke Philips NV Research Grant, Toshiba Corporation

**Sub-Events**

**SSA19-01**

**Physics Keynote Speaker: State of the Art, Recent Advances and Applications of CT**

Willi A. Kalender PhD (Presenter): Consultant, Siemens AG Consultant, Bayer AG Founder, CT Imaging GmbH
SSA19-03

High Performance Cone Beam CT Imaging of Acute Traumatic Brain Injury

Alejandro Sisniega PhD (Presenter): Research Grant, Carestream Health, Inc; Wojciech Zbijewski PhD: Research Grant, Carestream Health, Inc; Hao Dang: Research Grant, Carestream Health, Inc; Jennifer Xu: Research Grant, Carestream Health, Inc; Joseph Webster Stayman PhD: Research Grant, Varian Medical Systems, Inc; John Yorkston PhD: Employee, Carestream Health, Inc; Nafi Aygun MD: Nothing to Disclose; Vassilis Koliatsos MD: Nothing to Disclose; Jeffrey H. Siewerdsen PhD: Research Grant, Siemens AG Consultant, Siemens AG Research Grant, Carestream Health, Inc Royalties, Elekta AB

PURPOSE

CT is sensitive to the detection of fresh blood in the brain (30-50 HU contrast) and is a front line modality for diagnosis of traumatic brain injury (TBI). Benefit to early detection of TBI would be gained from imaging at the point-of-care immediately following suspected injury. We report dedicated cone-beam CT (CBCT) system with image quality sufficient for detection of mild-moderate TBI (e.g., 1-4 mm fresh blood) suitable to point-of-care deployment.

METHOD AND MATERIALS

CBCT image quality requires novel system design, high-quality reconstruction, and high-fidelity artifact correction, including x-ray scatter, image lag, veiling glare, and beam hardening. Scatter correction uses a fast Monte Carlo (MC) simulator combining GPU parallelization, variance reduction, and denoising to provide corrections in less than 5 min. Detector lag is corrected by deconvolution with a measured temporal response function. Off-focal radiation and veiling glare are mitigated by deconvolution with the long tails of the detector point spread function. Beam hardening is compensated using the Joseph-Spital approach. The framework was tested on CBCT data of a head phantom including simulated brain and hemorrhages (~40 HU) ranging 2-10 mm diameter. The system design included a flat-panel detector with source-axis and source-detector distance of 58 and 80 cm, respectively, and acquisition protocol 100 kVp, 285 mAs (13.4 mGy).

RESULTS

Uncorrected CBCT data exhibited non-uniformity (NU) of 165 HU and contrast-to-noise ratio (CNR) of 1.38 (blood-to-brain) with numerous major artifacts. Scatter correction improved the uniformity to NU = 48 HU and increased CNR by 84%. Lag and off-focal glare correction improved uniformity (NU = 46 HU) without increase in noise (CNR = 2.42). Beam hardening correction further improved non-uniformity to 10 HU, particularly at the skull base and peridural periphery. PL reconstruction reduced noise compared to FBP without loss in resolution, yielding CNR = 2.81.

CONCLUSION

Multi-component artifact correction was essential to achieving CBCT image quality suitable to low-contrast soft-tissue imaging of the brain. Initial results support the development of a novel system for point-of-care TBI detection.

CLINICAL RELEVANCE/APPLICATION

Advanced CBCT artifacts correction techniques allow detection of subtle microhemorrhages in the brain, enabling point-of-care imaging of mild-moderate traumatic brain injury.

SSA19-04

Implementation of an Open Data Format for CT Projection Data

Xinhui Duan PhD (Presenter): Nothing to Disclose, Cynthia H. McCollough PhD: Research Grant, Siemens AG

PURPOSE

Lack of access to projection data from patient CT scans is a major limitation for development and validation of new reconstruction algorithms for dose reduction. To meet this critical need, we are developing a freely-available library of reference patient data sets, which will include image and projection data. To accomplish, we sought to develop and validate a standardized, vendor-neutral format for CT projection data, which will be used in our reference patient library.

METHOD AND MATERIALS

The framework for the projection data format was developed by Battelle Memorial Institute as a proposed extension to current DICOM standards. In this framework, five groups of newly-defined Information Object Definitions were included as DICOM tags, containing essential information about data acquisition necessary for image reconstruction. For this work, only a subset of these tags was needed. Projection data were stored as binary data in a pre-defined order and format. To validate the implementation, CT projection data were acquired from two CT scanners (Siemens Definition Flash and GE Discovery 750HD), where the ACR phantom was scanned in axial and helical modes. After decoding (by us for Siemens, by the manufacturer for GE), the projection data were converted to the DICOM format. An off-line CT reconstruction was performed using only the information stored in the converted data file.

RESULTS

The implementation is flexible and compatible with DICOM standards while providing the essential data required for formulating new reconstruction algorithms.
First Measurements of Projection DQE on Photon Counting Silicon-based Spectral CT System

Moa Yveborg MSc (Presenter): Stockholder, Prismatic Sensors  
Cheng Xu: Nothing to Disclose, Mats Persson: Nothing to Disclose, Staffan Karlsson: Nothing to Disclose, Hans Bornefalk MS: Nothing to Disclose, Ben Huber: Nothing to Disclose, Suejin Liu: Nothing to Disclose, Mats Danielsson PhD: Stockholder, Prismatic Sensors AB President, Prismatic Sensors AB  
Stockholder, Innovicum AB President, Innovicum AB Research Grant, Koninklijke Philips NV Stockholder, Bivoca International AB Board Member, Bivoca International AB

PURPOSE

Indicative research have shown electronic noise to be a limiting factor in low-dose clinical computed tomography (CT) using energy integrating x-ray detectors. We are developing a photon-counting silicon detector with 8 energy bins and 0.2x0.3 mm^2 detector elements at the isocenter for clinical CT applications. The purpose of this work is to measure the detective quantum efficiency (DQE) in the projection domain of our silicon detector when mounted in a Philips iCT gantry and show that the electronic noise has little impact on the measured signal.

METHOD AND MATERIALS

The detector module consists of a diode array on a silicon substrate with a thickness of 0.5 mm. One module contains 50 strips constituting the detector elements, each with a cross-section of 0.2x0.3 mm^2 at the isocenter transverse to the beam direction. For this work, we have tested the first modules of a full photon counting CT system mounted in a Philips iCT gantry. We measure the pre-sampled MTF of the silicon detector by scanning a single pixel using a narrow slit source of x-rays and taking the Fourier transform of the resulting projection data. We use GATE (Geant4 Application for Emission Tomography) to simulate the photon interaction in a model of the silicon detector and compare the results to corresponding physical measurements.

RESULTS

The results of the measurements demonstrate the electronic noise to have little impact on the measured signal. The simulation model is validated using physical measurements and the estimated DQE of the final detector configuration presented.

CONCLUSION

The first modules of a full photon counting CT photon-counting silicon detector with eight energy bins has successfully been mounted and tested in a Philips iCT gantry. Measurements of the MTF, NPS and DQE is presented, demonstrating a dose-reduction potential in low-dose clinical CT applications compared to conventional energy integrating detectors.

CLINICAL RELEVANCE/APPLICATION

A typical application is low dose CT imaging, such as lung cancer screening and pediatric imaging.

3D Imaging of the Foot and Ankle Using a Dedicated Extremity Cone-Beam CT Scanner


PURPOSE

A prototype cone-beam CT (CBCT) scanner has been developed with capability for imaging of the weight-bearing (or non-weight-bearing) lower extremities. This work reports the first investigation of image...
quality and dose in relation to imaging of the foot and ankle.

**METHOD AND MATERIALS**

The technical performance of the new clinical CBCT scanner was assessed in terms of spatial resolution, soft-tissue contrast resolution, and radiation dose. Clinical performance in imaging of the foot and ankle was assessed in a prospective IRB-approved study of 11 patients (8 female, 3 male; 32-62 yo, mean 43 yo) with ankle pathologies including fracture, tendonitis, osteoarthritis, and rheumatoid arthritis. Image quality was evaluated by a musculoskeletal radiologist and orthopedic surgeon in visualization tasks pertinent to each pathology. Patients with foot and/or ankle fracture were imaged longitudinally to characterize fracture healing, detect non-union, and quantify bone remodeling patterns in high-resolution 3D images.

**RESULTS**

The scanner exhibited spatial resolution of ~15-17 lp/cm (~0.5 mm) and contrast resolution sufficient for visualization of cartilage, ligament, tendons, and muscles. Radiation dose was less than that measured in conventional multi-detector CT protocols (CTD1w = 9 mGy, SSDE = 13 mGy for an 8 cm diameter ankle, compared to 25 mGy, SSDE = 35 mGy). The images provided clear visualization of numerous pathologies in the foot and ankle, including cartilage loss, soft tissue edema, bone cysts, erosions, subtle fractures, and non-union. The high spatial resolution enabled quantification of fracture healing patterns, including bridging trabeculae and cortical remodeling.

**CONCLUSION**

The prototype scanner exhibited spatial and contrast resolution sufficient for a broad range of diagnostic imaging tasks in the foot and ankle. The capability for weight-bearing imaging could offer a valuable tool for diagnosis and treatment assessment in various ankle pathologies including flat foot, osteoarthritis, and fracture nonunion.

**CLINICAL RELEVANCE/APPLICATION**

CBCT of the foot and ankle can provide functional information and precise morphological analysis in cross sectional imaging not achieved by radiographs.
The Feasibility of 2D Fluence Field Modulated CT Using Attenuating Filters

Timothy Peter Szczykutowicz PhD (Presenter): Equipment support, General Electric Company Research Grant, Siemens AG, Charles Anthony Mistretta PhD: Founder, Mistretta Medical Intellectual Property Licensing Activities Research, Siemens AG

PURPOSE

The purpose of this study is to compare the gains in tissue compensation and dose reduction possible when using a 2D fluence field modulator compared to a 1D modulator and bowtie filtration.

METHOD AND MATERIALS

A 2D fluence field modulator was simulated assuming two continuous 1D modulators could be placed orthogonal to each other. This produces an additively separable 2D fluence field. A 1D modulator was also simulated. Two different size bowtie filters were also simulated, one optimized for the head, and one optimized for the body. Comparisons were made for chest, thorax, abdomen, pelvis, and head anatomical regions. The ability to compensate for tissue was quantified by calculating the standard deviation of the sum of the attenuation from the patient anatomy and the 2D/1D modulator or bowtie. Dose comparisons were made by first setting the mA such that peak variance was minimized. The x-ray fluence incident onto the anatomy was summed and used to make relative dose comparisons between the various modulators. Lastly, a piecewise constant modulator was simulated for the 2D modulator using realistic numbers of wedges as have been previously experimentally implemented.

RESULTS

As expected, in terms of dose reduction and tissue compensation, the best modulation design was 2D, followed by 1D, and then bowtie filter respectively. The largest benefit from 2D modulation relative to 1D modulation was in the thorax, the smallest in the head. On average, the 2D modulated allowed for a dose reduction of 3.7 and 21 times relative to 1D and bowtie filter modulation respectively. The average increase in tissue compensation for 2D modulation was 1.2 and 3.25 times relative to 1D and bowtie modulation respectively.

CONCLUSION

2D modulation does provide large advantages over 1D tissue compensation and would likely benefit FFMCT, especially wide cone angle CT like that found on c-arm and some MDCT systems. Large dose reductions for large cone angle systems as z-axis dose modulation is not possible with traditional bowtie filtration/mA modulation methods for these systems.

CLINICAL RELEVANCE/APPLICATION

Fluence field modulated CT (FFMCT) allows for another stride along the path of patient specific imaging dose tailoring to be realized; switching from 1D to 2D FFMCT can be done at half the dose.

Task-Driven Image Acquisition and Reconstruction in Cone-Beam CT for Interventional Guidance

Grace Jianan Gang (Presenter): Nothing to Disclose, Joseph Webster Stayman PhD: Research Grant, Varian Medical Systems, Inc, Sarah Ouadah: Nothing to Disclose, Tina Ehtiati PhD: Employee, Siemens AG, Jeffrey H. Siewerdsen PhD: Research Grant, Siemens AG Consultant, Siemens AG Research Grant, Carestream Health, Inc Royalties, Elekta AB

PURPOSE

New interventional cone-beam CT systems offer considerable freedom in source-detector positioning in addition to prior knowledge of the patient anatomy and intended imaging task. Such systems offer new opportunities to improve image quality and reduce dose. This work reports an optimization framework that identifies patient- and task-specific imaging protocols that maximize task performance and thereby reduce dose.

METHOD AND MATERIALS

We employ a mathematical model of the imaging chain to compute task-specific detectability index (d') for given patient anatomy as a function of the acquisition protocol (including source, detector, and orbit) and reconstruction method (algorithm and parameters therein). Using detectability index as the objective function, an optimization framework was established to identify protocols best suited for a given task. Tube current, parameterized by a scalar, was optimized via exhaustive search keeping total dose within a predefined constraint; using the optimal, reconstruction parameter [e.g., cutoff frequency (f0) in filtered-backprojection (FBP)] was optimized exhaustively for each view. The source-detector trajectory was optimized using a greedy algorithm that successively finds the next best view (angle/obliquity) for maximum improvement in d'. Task-driven current + kernel modulation was applied to a line pair detection task in an elliptical phantom. Trajectory optimization was performed for an intracranial hemorrhage detection task and compared with a circular orbit. Experiments were performed on an experimental CBCT bench.

RESULTS

At the same total mAs, the line pair pattern was conspicuous for task-driven (current + kernel) modulation case but barely distinguishable in the unmodulated and AEC cases. Task-based trajectories designed for hemorrhage detection successfully avoided highly attenuating rays associated with the embolization coils and skull base, yielding reconstructions with major reduction of noise and artifacts.
CONCLUSION

Compared to conventional acquisition and reconstruction, a task-driven imaging approach tailored to specific patient anatomy and imaging tasks demonstrates the potential for improved image quality and reduced dose.

CLINICAL RELEVANCE/APPLICATION

The task-driven framework synergizes advances in image quality modeling, advanced C-arm systems (e.g., Zeego), and model-based reconstruction to achieve improved image quality and reduced dose.

SSA20

Physics (Non-Conventional Techniques)

Scientific Papers

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Sun, Nov 30 10:45 AM - 12:15 PM Location: S404AB

Participants

Moderator
Guang-Hong Chen PhD: Research funded, General Electric Company Research funded, Siemens AG Research funded, Varian Medical Systems, Inc Research funded, Hologic, Inc

Moderator
Rebecca Fahrig PhD: Research Grant, Siemens AG Research Consultant, Siemens AG

Sub-Events

SSA20-01 Patient-tailored IV Contrast Injections for CT: A Feasibility Study

Walter Coudyzer (Presenter): Nothing to Disclose, Dirk Vanbekevoort MD: Nothing to Disclose, Federica Zanca PhD: Nothing to Disclose, Adriana Dubbeldam: Nothing to Disclose, Geert Maleux MD, PhD: Speakers Bureau, Merit Medical Systems, Inc Speakers Bureau, W. L. Gore & Associates, Inc Speakers Bureau, Medtronic, Inc

PURPOSE

Volume adapted IV contrast injections for specific CT examinations are in the benefit of many adult patients. The majority of these patients receive less IV contrast than with most of the fixed standard procedures, which are commonly used in many radiology departments worldwide. The reduction of this contrast volume should have no or limited influence on the image quality and should result in a positive effect on the effective radiation dose for the patient.

METHOD AND MATERIALS

A recently in house developed software tool (injection calculator) was installed on a Nemoto Dual Shot Alpha CT contrast injector (Nemoto-Kyorindo, Tokyo, Japan), and used to calculate a patient-tailored contrast volume for qualified CT examinations. This calculation is based on the patient's BSA, heart rate and the used iodine concentration. One hundred patients planned for a thorax-abdominal or abdominal CT were scanned. The resulting CT images were scored by two experienced radiologists who performed an objective scoring (HU densities) and a subjective scoring (visual anatomical observation). A separate clinical study was designed to monitor the relation between the injected contrast volume, the patient’s effective radiation dose and CT dose modulation.

RESULTS

Image analysis of the patient-tailored CT examinations with an adapted contrast volume showed that a good or adequate image quality was retained. The majority of these patients had the benefit of a contrast volume reduction. A minority of the patients, obese with high heart rate, received a higher contrast volume compared with our standard fixed procedure (120 ml).

CONCLUSION

It is possible to lower the injected contrast volume for a number of CT examinations in the majority of adult patients. Nevertheless, the combination of obesity and a high heart rate resulted in an increase of the contrast volume. This injection calculator was created to stimulate the awareness and if possible to change fixed procedures and is open for modification and fine tuning.

CLINICAL RELEVANCE/APPLICATION

The possibility to reduce the injected amount of IV contrast is in the patient’s benefit.
Adapting Injection Protocols for CT Imaging at Low kV: Benefits and Risks

Johannes Georg Korporaal PhD (Presenter): Employee, Siemens AG, Hatem Alkadhi MD: Nothing to Disclose, Michael Marcus Lell MD: Research Grant, Siemens AG Speakers Bureau, Siemens AG Research Grant, Bayer AG Speakers Bureau, Bayer AG Research Consultant, Bracco Group, Hubertus Pietsch PhD: Employee, Bayer AG, Gregor Jost PhD: Employee, Bayer AG, Bernhard Schmidt PhD: Employee, Siemens AG, Thomas G. Flohr PhD: Employee, Siemens AG

PURPOSE

Low kV imaging is an emerging trend in clinical CTA and new scanners enable examinations below 100kV also for adults. This gives radiologists the opportunity to reduce the contrast agent dose instead of the radiation dose. This study shows how injection protocols can be adapted for low kV, and what benefits and risks come with it.

METHOD AND MATERIALS

With a phantom, the iodine enhancement at 70 and 120kV (reference) was determined. From the relative iodine enhancement at 70kV, the reduction in total iodine dose (TID) was calculated with preservation of the CNR.

We used the arterial impulse responses of 72 patients (median age 62y (range 31-81), median body weight 83 kg (range 61-125)) to simulate the contrast enhancements at 70 kV and 120 kV.

The reference injection protocol at 120kV was 0.3gI per kg body weight, 300mgI/ml and an iodine delivery rate (IDR) of 1.5gI/s. Two alternative injection protocols with lower TID were simulated at 70kV: A) with reduced volume and IDR to obtain the same injection duration, and B) with reduced volume and the initial IDR of 1.5gI/s and thus shorter injection duration.

RESULTS

The TID at 70kV could be reduced by 47.5% resulting in a reduction in volume of 83.3±14.9ml at 120kV to 43.7±7.8ml at 70kV. With protocol A, the IDR was lowered to 0.8gI/s, resulting in the same injection duration of 16.7±3.0s and identical curve shape and amplitude in each patient. With protocol B, the injection duration decreased to 8.7±1.6s and resulted in narrower enhancement curves, indicating that scan timing becomes more critical. Simultaneously, protocol B leads to higher peak enhancement (+44.0±13.2%), indicating even further potential for TID reduction.

CONCLUSION

The conservative way to adapt injection protocols for low kV imaging is to adapt the TID based on the change in kV, maintain the injection duration of the reference injection protocol and adjust the IDR. Even further TID reduction is possible by using shorter injection times, but scan timing will become more critical.
MR-compatibility of Peripheral Self Expanding Nitinol Stents for 1.5 T and 3.0 T: Measuring RF Induced Heating and MR-artifact according to ASTM Standard F2182-11a and F2119-07


PURPOSE

The purpose of this study is to measure artifacts in MR-images and radiofrequency-induced heating at 1.5T and 3T for modern and most commonly used stents in vascular angiography according to standardized test methods of the American Society for Testing and Materials (ASTM). Furthermore, the MRI-based measurability of the lumen was assessed.

METHOD AND MATERIALS

Currently, 36 peripheral self-expanding nitinol stents with a diameter between 5-8mm and a length between 30-250mm from seven manufacturers (Biotronik, Boston Scientific, Gore, IDEV, Medtronic, OptiMed, Terumo) for peripheral arterial disease were compared on a 1.5T and 3T MRI (Magnetom Avanto and Trio, Siemens, Erlangen, Germany). The signal loss was measured according to ASTM F2119-07 for a TSE (TR/TE 500/26ms) and GRE (TR/TE 100/15ms) sequence. The visualization of lumen was determined the same way. The stents were placed parallel and perpendicular to the static magnetic field (B0). For safety aspects, the radiofrequency-induced heating was measured according to ASTM F2182-11a with aTrueFISP (TR/TE 3.04/1.52ms, scan time 15min).

RESULTS

There are significant differences in visibility of lumen for the stent models. For the TSE sequence, the visualization of lumen varies between 15.59±15.16% and 99.78±5.78% (parallel to B0) respectively 0.00±0.00% and 88.21±10.63% (perpendicular to B0) as well as for the GRE sequence between 0.00±0.00% and 76.50±2.74% (parallel) respectively 0.00±0.00% and 68.12±3.35% (perpendicular). For a B0 of 1.5T and 3T, the visualization of lumen differs between 0.00% and 43.12%. The maximum signal loss above the actual diameter was 4.30±0.80mm (TSE) and 8.50±1.00mm (GRE). The maximum change in temperature caused by induced heating varies between 1.70±0.10°C and 13.90±0.10°C. Only two stent models show no significant heating.

CONCLUSION

The MR-based lumen depends besides MR-sequence and orientation to B0 on material, dimension and structure of stent model. Also the RF-induced heating depends on these stent characteristics, however the dimension in dependence of field strength is the decisive factor for the heatability.

A Standard for Mechanical Compression in Mammography?

Jerry E. De Groot. MS : Nothing to Disclose, Woutjan Branderhorst. PhD (Presenter): Employee, SigmaScreening BV, Mireille Broeders PhD: Nothing to Disclose, Cornelis A. Grimbergen PhD : Founder, Sigmascreening Employee, Sigmascreening Board Member, Sigmascreening Patent holder, Sigmascreening, Gerard J. den Heeten MD, PhD : Founder, Sigmascreening

PURPOSE

In mammography, mechanical compression often causes discomfort and pain in Europe. Depending on the individual technician, the compression force is typically adjusted to breast size, composition, skin tautness and pain tolerance. Prior research showed that this leads in practice to a large variation in pressure, ranging from <3 kPa (23 mmHg) to >30 kPa (225 mmHg). We developed a device that displays the average pressure during compression, to standardize the pressure on current mammographic devices that only display force. We aim to study the effects of standardizing pressure on absorbed glandular dose (AGD), the number of required retakes and reported pain, and compare it with standardizing force as the best available alternative.

METHOD AND MATERIALS

A double-blinded randomized controlled trial was performed on 433 asymptomatic women scheduled for screening mammography. For each participant, three of the four compressions were standardized to a target force of 14 daN. One randomly assigned compression was standardized to a target pressure of 10 kPa (75 mmHg). Participants scored pain on a numerical rating scale. Three experienced breast screening radiologists indicated which images required a retake.

RESULTS

The average AGD and proportion of required retakes were in the normal range for the 10 kPa compressions. Average AGD values were 0.5% (MLO, not significant) - 3.2% (CC, p<0.001) lower for the 10 kPa protocol despite an average increase in breast thickness. The reader study showed no degradation of image quality; the proportion of retakes required for the 10 kPa compressions was 4.2% versus 1.4% (95% C.I. [0.4-4.4%]) for the 14 daN compressions. Average pain scores were 10% (MLO) - 24% (CC) lower in the 10 kPa protocol (p<0.001) and the proportion of women experiencing severe pain (NRS >= 7) was 27% (MLO) - 46% (CC).

CLINICAL RELEVANCE/APPLICATION

Lowering the total iodine dose with low kV imaging is important for patients with impaired kidney function - however, injection protocols should be adapted in a structured way as well as scan timing parameters.
CONCLUSION

Mammographic compressions can be standardized to 10 kPa pressure without compromising radiation dose and apparent image quality, while being less painful than standardizing to 14 daN force which could substantially reduce complaints. Further research is required whether 10kPa (under arterial blood pressure) is the optimal target pressure.

CLINICAL RELEVANCE/APPLICATION

For the millions of mammograms obtained yearly this study shows that a large amount of unnecessary pain can be avoided without adversely affecting radiation dose or the proportion of required retakes.

SSA20-06

X-ray Fluorescence Computed Tomography Induced by Photon, Electron, and Proton Beams

Magdalena Bazalova (Presenter): Nothing to Disclose , Lei Xing PhD : Research Grant, Varian Medical Systems, Inc , Rebecca Fahrig PhD : Research Grant, Siemens AG Research Consultant, Siemens AG

ABSTRACT

Purpose/Objective(s): X-ray fluorescence CT (XFCT) has shown promise for molecular imaging of probes containing high atomic number elements, such as gold nanoparticles. Up to date, XFCT has been induced by kilovoltage photon beams due to the high photoelectric effect interaction probability. Here we compare XFCT imaging induced by photon, electron, and proton beams of two energies. Materials/Methods: A digital 2-cm diameter phantom with four 5 mm cylindrical vials with gold solutions of 10-50 mgAu/mL was built in TOPAS, an MC simulation tool based on GEANT4. The phantom was imaged with XFCT induced by 81 keV and 10 MeV photon, 10 MeV and 100 MeV electron, and 100 and 250 MeV proton beams. First-generation CT geometry with 1×1 mm pencil beams of 5×105 particles with 0.5-mm translation and 2°-rotation steps was modeled using the GEANT4 time feature. Scattered x-rays were detected on an idealized 5 cm-diameter spherical detector with 0.5 keV energy bins. XFCT images were reconstructed with filtered back-projection using the net count of Kα (67.2 and 69.0 keV) gold x-rays determined by linear interpolation of the neighboring energy bins. Results: For a single pencil beam position, the number of detected gold Kα x-rays induced by the 81 keV photon beam was ~35 and ~150 times higher than for the electron and proton beam induced fluorescence, respectively. However, the signal-to-background ratio for the proton beam induced fluorescence was by a factor of 1.3 to 3.4 higher than for the 81 keV photon beam induced fluorescence due to the low x-ray contamination in the proton-induced x-ray spectra. As summarized in Table 1, XFCT gold imaging sensitivity was the highest in the 81 keV x-ray images (0.9 mgAu/mL) and it was the lowest in the 10 MeV x-ray images (52.3 mgAu/mL). The detection limits were 4.7 and 8.5 mgAu/mL for 100 MeV electron and 250 MeV proton XFCT images, respectively. The mean imaging dose was approximately 2-3 orders of magnitude higher in electron and proton XFCT compared to 81 keV x-ray XFCT (Table 1). Conclusions: Our Monte Carlo study demonstrates that XFCT imaging of small objects achieves the best performance when induced with kilovoltage x-ray beams. Due to the high imaging dose, electron and proton induced XFCT might be a feasible ex-vivo imaging technique. Acknowledgements: We would like to thank Jan Schuemann and Joseph Perl from TOPAS collaboration for their help with proton fluorescence simulations.

Table 1: XFCT detection limits (mgAu/mL) and mean imaging dose (mGy) for the studied protocols.

<table>
<thead>
<tr>
<th>Protocols</th>
<th>Detection limit (mgAu/mL)</th>
<th>Imaging dose (mGy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>81 keV photons</td>
<td>0.9</td>
<td>0.1</td>
</tr>
<tr>
<td>10 MeV photons</td>
<td>52.3</td>
<td>1.2</td>
</tr>
<tr>
<td>10 MeV electrons</td>
<td>9.7</td>
<td>56.6</td>
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<tr>
<td>100 MeV electrons</td>
<td>4.7</td>
<td>56.1</td>
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<tr>
<td>100 MeV protons</td>
<td>12.1</td>
<td>238.5</td>
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<tr>
<td>250 MeV protons</td>
<td>8.5</td>
<td>118.8</td>
</tr>
</tbody>
</table>

SSA20-07

Effect of KV on CT Radiation Dose: Internal Organ Dosimetry in a Human Cadaver

Diego Alfonso Lira MD : Nothing to Disclose , Ranish Deedar Ali Khawaja MD : Nothing to Disclose , Atul Padole MD (Presenter): Nothing to Disclose , Alexi Otrakji MD : Nothing to Disclose , Sarabjeet Singh MD : Research Grant, Siemens AG Research Grant, Toshiba Corporation Research Grant, General Electric Company Research Grant, Koninklijke Philips NV , Mannudeep K. S. Kalra MD : Nothing to Disclose , Bo Liu PhD : Nothing to Disclose , Da Zhang PhD : Nothing to Disclose , George Xu PhD : Nothing to Disclose

PURPOSE

To measure point organ doses at different tube potential (kV) using fixed and automatic exposure control (AEC) techniques in a human cadaver experimental study. We also compared the measured organ doses to the estimated organ doses from a commercially available dose tracking software.

METHOD AND MATERIALS

An 88 year-old male cadaver (height, 183cm and weight, 67kg, BMI 20 kg/m2) was acquired for this experiment from an accredited organization. Six thimble dosimeters were surgically placed in following locations: (i) stomach, (ii) urinary bladder (iii) ascending colon, (iv) liver, (v) pancreas, and (vi) left kidney. The cadaver was...
iso-centered in the gantry and scanned on a 128 slice dual source MDCT (Siemens Definition Flash CT) at 8 different settings - 4 with AEC (at constant CTDIvol 2.5mGy) and 4 with fixed mA (at constant CTDIvol 4mGy). Scans were performed at 80, 100, 120 and 140 kV with mA values changed to achieve the aforementioned CTDIvol for each kV. Scans were repeated 3 times for each of the 8 scanning protocols. All image series were exported to a dose tracking software (Xposure, Bayer) to obtain absorbed organ doses for comparison. Image noise was measured in the liver and pelvic fat. ANOVA and Pearson correlation coefficients were used for analysis.

RESULTS
At constant CTDIvol, there was a significant fluctuation in measured organ doses with changes in the applied kV with lower kV associated with lower point doses. There were significant differences in measured and estimated (from software) organ doses at constant CTDIvol at different kV settings (p < 0.005). At constant CTDIvol, mean point dose measurements increased with kV ranging from 10-34% for fixed mA and 20-30% for AEC protocol. Urinary bladder had the highest point organ dose at all tube potentials compared to other organs while kidney point dose was the lowest (p < 0.001). Compared to measured point dose measurements, there was 8-33% overestimation (stomach, liver, intestine) and 11-19% underestimation by the dose tracking software (kidney, bladder, colon).

CONCLUSION
At constant CTDIvol, both measured and calculated (with software) organ doses fluctuate substantially with changing kV, with lower kV settings associated with lower dose in both fixed and modulated mA.

CLINICAL RELEVANCE/APPLICATION
CT at lower kV settings is associated with lower organ doses even at constant CTDIvol.

SSA20-08

CT Image Contrast of Seven High-Z Elements within a 32 cm Phantom and Using Various Additional X-ray Filters

PURPOSE
High-Z element contrast agents could improve x-ray imaging efficacy and become a better-tolerated alternative to conventional materials for use in clinical imaging. We sought to obtain reliable empirical data in order to compare the performance of candidate elements and assess their potential imaging benefits versus iodine.

METHOD AND MATERIALS
We measured the HU of 7 candidate elements (I, Ba, Gd, Yb, Ta, Au, Bi), NaCl and water in a CT phantom using rigorous methods, with and without additional x-ray filters. Samples were formulated at 10 mg active element/mL in distilled water, and concentrations were confirmed by elemental analysis. Samples were placed in 19 mm diameter vials within a modified 32 cm CTDI phantom. Scans were performed on a GE LightSpeed VCT scanner, at 80, 100, 120, and 140 kV, with 0, 0.2, 0.5, and 1.0 mm added Cu filter. HU was measured in a 10 mm ROI and averaged over 16 slices. Data were corrected for measured concentration and Cl content, and contrast relative to water (net HU) was calculated.

RESULTS
The k edge of the active element is the key determinant of net HU. Elements (I, Ba, Gd) whose k edge is below the mean energy of the spectra exhibit a monotonically decreasing net HU with increasing kV and filtration. Among these, Gd provides the highest net HU; I the lowest. Elements (Yb, Ta) whose k edge is near the mean energy of the spectra exhibit net HU that’s more constant with kV and filtration. Yb provides a slightly higher net HU than Ta, and peaks at 80 or 100 kV, depending on filtration; Ta peaks at 100 kV. Elements (Au, Bi) whose k edge is above the mean energy of the spectra exhibit a lower net HU. Au net HU peaks at 120 kV; Bi has a notch at 100 kV, peaks at 140 kV, and is strongly dependent on filtration.

CONCLUSION
Of the elements we tested, Gd provides the highest net HU per mg of active element; Au and Bi produce the lowest net HU. Concerns for Gd side effects at the high doses needed to produce good HU, and the high cost of Au make these elements more challenging to develop as clinical CT contrast agents. At 100 kV and higher, Yb and Ta produce ~30-90% higher net HU than I under the same conditions and merit further consideration, including tests for patient safety. This work was supported by NIH grant RO1EB015476. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

CLINICAL RELEVANCE/APPLICATION
Compared to conventional iodine agents, contrast agents based on high-Z elements may offer improved image quality in diagnostic x-ray and CT imaging and could potentially reduce clinical side effects.

SSA20-09

Numerical Investigation of the Potential for MR-induced Temperature Increase to Affect Distributions of Temperature, Metabolic Rate, and FDG Uptake in MR/PET
CONCLUSION

Though MRI-induced temperature increase should not dramatically affect qualitative appearance of PET images such as used in locating metastatic masses, it may cause enough increase in metabolic rate to affect results of quantitative, dynamic studies. Thus, in these studies use of low-SAR sequences should be advised until conclusive experiments regarding the quantitative effects of MR-induced temperature increase on PET signal can be performed.

Background

With the recent introduction of multimodality MR/PET imaging systems, it is technically possible that RF heating (SAR) from MRI could cause temperature increase resulting in metabolic change affecting uptake of metabolism-specific radiotracers (such as FDG) and thereby influencing the PET image.

Evaluation

We performed advanced numerical simulations of the 3D human body in an MRI system and the resulting SAR, temperature distribution, and metabolic rates throughout the body before and after application of an MRI sequence reaching "normal mode" limits on SAR for a period of 40 minutes.

Discussion

Distributions of metabolic rate (Q) before and after application of a high-SAR sequence for 40 minutes show little qualitative difference to the eye, but quantitative maps of the difference and percent difference between them show notable increase in metabolic rate in some high-metabolism organs (e.g., approaching 20% in thyroid), and even greater percent increase in some low-metabolic rate tissues (e.g., approaching 45% in muscle at rest in some high-SAR locations).

SSA21

Physics (Ultrasound)

Evaluation of Liver Viscoelasticity using Multi-frequency Transient Elastography: A New Approach Based on Fractional Power Law Behaviour

Maelle Dejobert (Presenter): Nothing to Disclose, Patat Frederic MPH, MD: Nothing to Disclose, Jean-Pierre Remenieras: Nothing to Disclose

CONCLUSION

This project is a feasibility study of in vivo shear wave velocity measurements with a new processing algorithm.

Background

Non-alcoholic fatty liver disease (NAFLD) is emerging as a major cause of liver disease. The accurate assessment of the type of NAFLD is crucial for prognostic evaluation. The only parameter classically measured by the existing US elastography method is the stiffness of liver tissue. Elastographic analysis of excised liver tissues have demonstrated that the complex shear modulus G* follows, as a function of frequency, a power law in biological tissue. The goal of this study was to estimate the speed of shear wave dispersion using a modified Fibroscan® in vivo.

Evaluation

Our work is a pilot study involving 10 healthy volunteers. We used a modified Fibroscan® research prototype based on transient elastography (Echosens company, France) to record shear wave dispersion at successive and different low frequency vibrations (25, 50, 75 and 100 Hz), and elastogram processing by using a new algorithm. For each volunteer, 40 transient vibrations were applied. We estimated the phase velocity dispersion cs(ω) of the shear wave as a function of the frequency in a 20-120 Hz bandwidth. The underlying premise for this work was to formulate the results with a fractional power law model cs(ω)= kcs*ω^γcs for which, the exponent coefficient γcs is a structure parameter of the liver, which is governed by viscosity and kcs is linked to elasticity. The comparison between experimental data and this fractional behaviour allowed us to determine...
these two biomechanical parameters of the liver, by solving an inverse problem. The measurement of \(cs(\omega)\) was highly reproducible. For example, \(cs(50\text{Hz})\) returned 1.44±0.20 m/s.

**Discussion**

No simple biomechanical model (like the Voigt model) could be used to explain the frequency dispersion of \(cs(\omega)\). Therefore, the challenge is still to determine the most suitable parameters \(\kappa_{cs}\) and \(\gamma_{cs}\) through fitting with our data. A prospective study is currently underway to determine whether analysis of the phase velocity dispersion can be used as a reliable tool for the diagnosis of NAFLD.

**SSA21-02**

**Thermoacoustic Imaging of Fresh Prostate Specimens – Preliminary Comparison to Histology**

Sarah Kathryn Patch PhD (Presenter): Nothing to Disclose, David Hull MD: Nothing to Disclose, Majorca Thomas: Nothing to Disclose, Stephanie Gripp: Nothing to Disclose, Kenneth Jacobsbohn MD: Nothing to Disclose, William See MD: Nothing to Disclose

**CONCLUSION**

If results of a larger study also support the hypothesis that the contrast mechanism is sensitive to cancer then development of a clinical prototype for *in vivo* imaging will be warranted.

**Background**

Prostate cancer is a good application for thermoacoustic imaging for several reasons. Mechanical properties of healthy and cancerous prostate tissue are well matched, so the assumption of constant sound speed is accurate. Measurements represent integrals of the thermoacoustic source term over spheres centered at the transducer focus. Signal production by very high frequency irradiation is proportional to ionic content, and ionic content of prostatic fluids produced by healthy tissue in the peripheral zone is approximately three times higher than in blood and plasma whereas cancer suppresses ionic content. Signal strength is therefore expected to decrease with extent of cancerous involvement.

**Evaluation**

To test this hypothesis we imaged fresh human prostate specimens *ex vivo* and compared to the gold standard, histology. Over two-dozen specimens were imaged immediately after radical prostatectomy performed as part of normal care. Irradiation pulses with carrier frequency 108 MHz ensured excellent electromagnetic depth penetration. 700 ns pulses with power exceeding 20 kW propagated 20-25 mJ into a benchtop imaging system. 2.25 MHz focused single element transducers received the thermoacoustic pulses, which were amplified by 54 dB and signal averaged 64 times before recording to disc. Spatial encoding was performed in step-and-shoot mode, with 1.8-degree rotations between views and 3 mm translation between acquisition slices. Approximately 20 slices were acquired per specimen. Reconstruction was performed by filtered backprojection after extensive preprocessing. The peripheral zone was subdivided into regions of interest corresponding to tissue type (Gleason grade, HGPIN, inflammation, etc), as annotated on histology slides from three cases.

**Discussion**

Reconstructions revealed some common features: the verumontanum and urethra are frequently visualized. Mean reconstruction values in cancer-free regions were four times greater than in regions with high percentage of cancer.

**SSA21-03**

**Visualization of Breast Lesion Vasculature Using Three-dimensional (3D) Subharmonic Parametric Maps**


**PURPOSE**

To investigate the feasibility of using contrast-enhanced 3D subharmonic ultrasound imaging (SHI) to visualize tumor vascularity, evaluate vascular heterogeneity and develop quantitative 3D parametric maps of vascularity in breast lesions.

**METHOD AND MATERIALS**

Patients \(n = 134\) identified with breast lesions on mammography were scanned using power Doppler imaging (PDI), contrast-enhanced 3D harmonic imaging (HI) and 3D SHI on a modified Logiq 9 scanner (GE Healthcare, Milwaukee, WI) equipped with a 4D10L probe. The contrast agent Definity (Lantheus Medical Imaging, N Billerica, MA) was administered as a bolus of 0.25 ml for HI and as 20 μl/kg for SHI. All lesions were subsequently biopsied. A region-of-interest (ROI) corresponding to ultrasound contrast agent (UCA) flow was identified using 4D View (GE Healthcare) and mapped onto the raw slice data to generate a map of the time-intensity curve (TIC) for the lesion volume. Time-points corresponding to baseline, peak intensity and complete washout of UCA were identified to generate vascular heterogeneity plots of the lesion volume. This was subsequently broken down into central and peripheral lesion sections. Finally, 3D parametric volumes were produced for perfusion (PER) and area under the curve (AUC).

**RESULTS**
There were a total of 99 benign and 35 malignant lesions. Vascular activity was observed with PDI in 82 lesions (61 benign and 21 malignant). UCA flow was observed in 8 (5 benign and 3 malignant) lesions for 3D HI and 68 (49 benign and 19 malignant) for 3D SHI. Analysis of vascular heterogeneity in 3D SHI volumes showed benign lesions to have a significant difference in vascularity between central and peripheral sections (1.71 ± 0.96 vs. 1.13 ± 0.79, p < 0.001) whereas malignant lesions showed no significant difference (1.66 ± 1.39 vs. 1.24 ± 1.14, p = 0.24), indicative of more vascular coverage, which was validated by the vascular visualization in the PER and AUC parametric volumes.

CONCLUSION

Our preliminary results suggest that 3D SHI has improved sensitivity to UCA in vascular lesions compared to 3D HI based on difference in the overall number of cases with UCA activity. Furthermore, 3D SHI is able to detect variations in vascular heterogeneity.

CLINICAL RELEVANCE/APPLICATION

Quantitative evaluation of vascular heterogeneity combined with vascular visualization of parametric volumes could aid in characterizing breast lesions.

SSA21-04 FITC-polyactide Nanoparticles Loaded on Albumin-coated Microbubbles: Preliminary In Vivo Observations

Marianne Gauthier PhD (Presenter): Nothing to Disclose , Edward J. Roy PhD : Nothing to Disclose , William D. O’Brien PhD : Nothing to Disclose

PURPOSE

We tested in vivo a newly designed protocol to produce FITC-polyactide (PLA) nanoparticles (NPs) loaded on microbubble (MB) surfaces by comparing the fluorescent uptake in tumors after injecting NP-loaded MBs or NPs only in mice, and then imaging with ultrasound (US) at high mechanical index (MI).

METHOD AND MATERIALS

MBs (3.6 × 10^8 MB/mL, 1 mL) were produced from the sonication (70 s, 450 W) of a 5% bovine serum albumin and 15% dextrose solution. NPs (5 mg/mL, 1 mL) were produced by mixing FITC-PLA and PLA-PEG-COOH conjugates and covalently linking them to the surface of the pre-produced MBs via the carbodiimide technique. Three BALB/c mice were subcutaneously injected with 4T1 breast tumor cells (10^5 cells) on both flanks. Each mouse was injected with 150 µL of NP-loaded MBs and NPs only, respectively, on right and left flanks. Each injection was followed by a 1-min US exposure at MI=1.0. Then, mice were euthanized and liver, and right and left tumors were snap-frozen in OCT medium for cryosectioning and immunostaining. 5-µm cryosections were fixed in cold 95% ethanol and blocked using Superblock. Sections were incubated with, respectively, collagen IV and Cy-5 labeled donkey anti-rabbit IgG as primary and secondary antibodies, and then analyzed by fluorescence microscopy. For each mouse, tumors were imaged at 200x using FITC, DAPI and Cy-5 filters.

RESULTS

For each mouse, images showed the presence of the NPs in both tumors. However, right tumors (NP-loaded MBs) always exhibited a much higher NP concentration than the corresponding left tumors (NPs only). In addition, from the collagen IV stain, it appeared that NPs detected from the right tumor were not only confined to the blood vessels but also spread to the surrounding tissues.

CONCLUSION

We tested in vivo our newly designed NP-loaded MBs. While undergoing high MI ultrasound, NP-loaded MBs exhibited a higher NP release into the tumor than NPs only: attaching NPs to the MB surface improved the local release of the NPs in tumors opening thus the way for future drug delivery techniques. This work was supported by NIH R37EB002641.

CLINICAL RELEVANCE/APPLICATION

Newly designed FITC-PLA NPs loaded on albumin-coated MBs undergoing high MI ultrasound improves the local release of NPs in tumors.


Laure Delphine Boyer (Presenter): Nothing to Disclose , Stephen Randall Thomas PhD : Nothing to Disclose , Ingrid Leguerney : Nothing to Disclose , Nathalie Brigitte Lassau MD, PhD : Speaker, Toshiba Corporation Speaker, Bracco Group Speaker, Novartis AG Speaker, Pfizer Inc Speaker, F. Hoffmann-La Roche Ltd , Stephanie Pitre-Champagnat : Nothing to Disclose

CONCLUSION

NM with the Fluent software was validated to study blood and CA dynamics in simple geometries. Results obtained with realistic vascular networks composed of 25 to 137 vessels of 30 to 100µm diameter will be presented.

BACKGROUND

Dynamic Contrast-Enhanced Ultrasonography (DCE-US) is a particularly attractive method to assess tumor microvasculature from the quantification of ultrasound contrast agents (CA) within lesion. This method does not yet benefit methodological tools imported from physics to characterize the ability of the quantification methods to evaluate tumor microcirculation. In this context, we developed the first numerical modeling (NM) based on
Computational Fluid Dynamics software to study the quantification methods to describe the tumor perfusion in a complex vascular network and to apprehend their variations according to tumor growth. The aim of this study was to validate this approach in comparison with DCE-US experiments on few characteristic geometries configurations and to extend to more realistic geometries of vascular network.

Evaluation

NM was performed with Fluent software (ANSYS, France), which modeled blood and CA flows in vascular network with laminar flow described by Poiseuille's law. Three geometries of numerical and experimental phantoms were a 2mm diameter tube representing respectively a single vessel, a bifurcation towards 2 parallel tubes and a serpentine. Volume of injected CA was 0.1mL with a blood flow of 41mL/min. Realistic injection of CA by bolus was implemented in NM. DCE-US experiments were performed with an Apio scanner (Toshiba, Japan) and a 12MHz probe with SonoVue® (Bracco, Italy) as CA.

Discussion

Numerical time-concentration of CA curves were similar to those obtained experimentally for the three geometries.
gold enhances the PA signal and SPIOs provide negative contrast on MRI. PA images were acquired on a Vevo LAZR (FUJIFILM VisualSonics Inc., Toronto, Ontario) PA-ultrasound small-animal imaging system (21MHz) operating at 710nm. MRTI experiments were performed using a 6-channel flex coil (GE Healthcare, Waukesha, WI) on a 3T MRI scanner (Discovery MR750, GE Healthcare, Waukesha, WI) using a fast multi gradient echo acquisition (16 echoes, 128x128 acquisition matrix, 25.6x25.6cm field of view, 3mm slice thickness, 60ms TR, 20° flip angle, 2.9ms minimum TE and 1.6ms echo spacing). The accuracy and spatio-temporal resolution of PA thermography was cross-validated with both MRTI and a fluoroptic temperature sensor (LumaSense Technologies, Santa Clara, CA) in the custom-designed phantom.

RESULTS
A thermally stable, dual-modality phantom was created for cross-validation of PA thermography and MRTI. PA thermography was characterized for thermal therapy guidance and compared to clinically-accepted MRTI techniques and fluoroptic probe measurements. The PA signal was shown to change linearly across a temperature range of 35°C-55°C, within the limits of typical ablation temperature. Axial and lateral resolutions of PA images were sub-millimeter with a temporal resolution of 0.2s, which will accommodate precise real-time guidance and monitoring.

CONCLUSION
The sub-millimeter resolution and centimeter-order penetration depths achievable with PAUS imaging have the potential to deliver active monitoring of both a targeted tumor microenvironment and nearby healthy tissue during thermal ablation.

CLINICAL RELEVANCE/APPLICATION
The development of photoacoustic thermography as a precise, real-time technique for image-guidance and monitoring of thermal ablations will facilitate adaptive planning that may improve treatment efficacy.

SSA21-08
Methods of Measurement of Stiffness Value within a Thyroid Nodule on Shearwave Elastography
Manjiri K. Dighe MD (Presenter): Research Grant, General Electric Company, Jeff Thiel: Nothing to Disclose, Daniel S. Hippe MS: Research Grant, Koninklijke Philips NV Research Grant, General Electric Company

PURPOSE
To assess the difference in measurement of stiffness values within a thyroid nodule using Shear-Wave elastography with various regions of interest methods.

METHOD AND MATERIALS
After IRB approval, elastograms were obtained by Shear-wave elastography from 77 individuals, with a total of 88 thyroid nodules. Elastography data was acquired without any external compression using the Supersonics Aixplorer machine. 1 reader blinded to the cytopathology or the final histopathology results was asked to draw regions of interest (ROIs) in the nodule. These included a 3mm ROI on the stiffest part of the nodule as seen on the elastogram image (3mm), ROI covering the whole nodule (WN), ROI covering the whole nodule and the margin of the nodule (WNM) and a circular ROI over the edge of the nodule (EN). The stiffness values were recorded for each of these measurements. Each nodule had multiple elastography images taken and an average value of the measurements (mean and max) for each nodule was calculated for various methods of measurement (3mm, WN, WNM and EN). Results were compared between the FNA + surgery and only surgery group as shown in the table

RESULTS
In the FNA + surgery group, the area under the curves (AUC) were similar for the various methods of measurement for both the mean and max kPa values. For the surgery only group, whole nodule ROI and whole nodule and the margin of the nodule ROI had marginally better AUCs compared to the 3mm ROI and the edge ROI.

CONCLUSION
Our study indicates that measuring the stiffness in the whole nodule would be better than measuring the stiffest area since the variability in measurement would be less. This is likely because the reproducibility of measuring the ROI in the whole nodule would be better than picking out the stiffest area in the nodule.

CLINICAL RELEVANCE/APPLICATION
Decreasing the variability in measuring the stiffness within a nodule in thyroid elastography is important since the results would be much more accurate and more reproducible.

SSA21-09
O-mode Ultrasound, A New Novel Technique
Richard Gary Barr MD, PhD (Presenter): Consultant, Siemens AG Consultant, Koninklijke Philips NV Research Grant, Siemens AG Research Grant, SuperSonic Imagine Speakers Bureau, Koninklijke Philips NV Research Grant, Bracco Group Speakers Bureau, Siemens AG Consultant, Toshiba Corporation Research Grant, Esaote Spa, Alex Lomes PhD: Stockholder, Orcasonix Ltd, Mati Shirizly PhD: Shareholder, Orcasonix Ltd

PURPOSE
Conventional US limitations and artifacts are related to the need for beam forming. O-mode introduces a novel approach that does not require a beam former, provides constant lateral resolution independent on depth of penetration and significantly decreases the shadowing from small pockets of gas allowing for new imaging windows to be utilized. The Doppler effect is evoked artificially by transmitting US signal from a “moving”
transducer. Such transmitting scheme creates echo with different RF frequency shifts coming from different scatterers, which are located at the same depth, but at different lateral positions. This method provides exact lateral localization by exchanging the traditional focusing procedure (along line-of-sight) to signal processing of frequency-modulated signals coming from each depth, maintaining constant lateral resolution and improved shadowing performance. This is a pilot study to evaluate O-mode in a clinical setting.

METHOD AND MATERIALS

10 patients participated in an IRB approved, HIPPA compliant study to evaluate the possible potential advantages of the O-mode imaging. Patients received a complete abdominal exam on a conventional ultrasound system (Esaote, My Lab Twice, Genoa, IT; Philips IU22, Bothell, Wa, or Siemens S3000, Mountain View, Ca) in addition to the Orcasonix O-mode system. Comparison of the images was performed by visual inspection by a board certified Radiologists with 20 years experience in ultrasound imaging. Images were scored as to depth of penetration, shadowing artifacts, and overall acceptability of image quality.

RESULTS

In all 10 cases O-mode was able to visualize deep structures equally or better than conventional B-mode. In areas of shadowing from ribs or small pockets of gas O-mode was able to visualize structures deep to the bone or gas which were able to be visualized on B-mode.

CONCLUSION

Preliminary clinical validation of O-mode imaging is promising. Additional post processing is required to improve O-mode image quality. O-mode imaging has several advantages over B-mode imaging including increased deep visualization, marked decreased shadowing and refractive artifacts. Without the need for a beam former smaller lighter ultrasound systems are possible.

CLINICAL RELEVANCE/APPLICATION

O-mode imaging can improve ultrasound imaging by significantly decreasing artifacts seen in B-mode imaging. The lack of a beam former allows for smaller ultrasound systems.

SSA22
ISP: Radiation Oncology & Radiobiology (Lung Cancer)

Scientific Papers

AMAPRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Sun, Nov 30 10:45 AM - 12:15 PM Location: S104A

Participants

Moderator
Jing Zeng MD : Nothing to Disclose
Moderator
Matthew M. Harkenrider MD : Nothing to Disclose

Sub-Events

SSA22-01 Radiation Oncology & Radiobiology Keynote Speaker: New Developments in Personalized Radiotherapy for Primary Lung Cancer

Jaap Doeke Zindler MD (Presenter): Nothing to Disclose

ABSTRACT

Outcome of treatment in locally advanced non-small lung cancer (NSCLC) needs improvement. Surprisingly, the RTOG 0617 did not show benefit from dose escalation. Potential causes are now under investigation. In the last years further technologic improvements in radiotherapy equipment have made advanced dose painting possible and achievable. Several new strategies are under investigation from which these patients may do benefit. One such strategy is targeted isotoxic dose escalation only on the high FDG uptake region of the primary tumour prior to treatment with relatively sparing of mediastinal structures, such as the heart: the PET boost trial. Other strategies are the application of new radiosentizers, hypoxia modulators, and proton therapy. Furthermore, in early stage NSCLC with stereotactic ablative radiotherapy (SABR) high rates of local control are achieved comparable to surgery. Favorable results with SABR are also achieved in oligometastatic NSCLC in spinal metastases, lung metastases, brain metastases, and adrenal gland metastases. Randomized trials in NSCLC are needed to determine which patients do benefit from these new strategies. With the availability of advanced radiotherapy techniques, treatment in NSCLC will be more personalized in which the patient makes a more conscious choice between tumour control and toxicity with radiotherapy, systemic therapy, or surgery, or a combination of these treatments.

SSA22-02 Stereotactic Body Radiotherapy with Volumetric-Modulated Arc Therapy for Lung Metastases

Maria Antonia Gomez (Presenter): Nothing to Disclose

ABSTRACT

Stereotactic Body Radiotherapy With Volumetric Modulated Arc Therapy For Lung Metastases

PURPOSE:
To evaluate efficacy and tolerability of Stereotactic Body Radiotherapy (SBRT) with Volumetric Modulated Arc Therapy (VMAT) in pulmonary metastases in a cohort of patients treated between 2011-2013 in our institution.

METHODS:
A total of 64 patients with lung metastases were included in our study. Thirty-three patients received 66Gy in 8 fractions, 29 a dose of 55Gy in 5 fractions and 2 a dose of 54Gy in 3 fractions. Primary tumor was lung cancer in 65% of patients, colorectal in 21% and others in 14%. Four-dimensional CT was used for each patient to determine internal gross tumor volume (IGTV) to account to respiratory motion. VMAT treatment was delivered with two or four coplanar arcs. Daily Cone-Beam images were used for patient positioning verification. Primary end-point was local control (LC). Secondary end-points were acute toxicity, quality of life (QOL) and survival. Acute toxicity was scored following CTC criteria and QOL with EORTC-QLQ-LC13.

RESULTS:
After a mean follow up interval time of 13 months, LC was 98.44% (1 of 64) and survival 93.75%. Acute toxicity was insignificant with only one case of grade 2 esophageal toxicity. Other types were grade 1. EORTC-QLQ-LC 13 showed improvement in: dyspnea, pain and dysphagia. No changes in cough and hemoptysis were observed.

CONCLUSION:
Our early results in terms of local control and toxicity for patients treated with SBRT-VMAT demonstrated the efficacy of this technique. Further follow-up is required to assess overall survival and late toxicity.

SSA22-03 Stereotactic Body Radiation Therapy For Single Post-pulmonary Lobectomy Lung Metastasis Of Thoracic Tumor: Survival And Side-effects

Weijie Xiong (Presenter): Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Stereotactic body radiotherapy (SBRT) has emerged as an alternative treatment for patients with early stage or medically inoperable non-small cell lung cancer (NSCLC). However, for single post-pulmonary lobectomy lung metastasis (PPLLM) of thoracic tumor, the outcomes of SBRT have not been reported. Materials/Methods: A retrospective search in thoracic SBRT database was conducted in three hospitals. The objects analyzed were local control, progression-free survival (PFS), overall survival (OS) and the treatment-related side-effects. Results: Totally, 23 patients with single PPLLM treated with SBRT were identified and the median follow-up time was 14 months (range: 6.0-47.0 months). The local recurrences were observed in 2 patients during follow-up and the 1-year local control rate was 91.3%. Median PFS and OS for the studied cohort were 10.0 months (95% CI 5.1-14.9 months) and 21.0 months (95% CI 11.4-30.6 months), respectively. Grade 2 and higher acute radiation-induced pneumonitis (RIP) were observed in 21.7% (5/23) and 13.0% (3/23) patients, respectively. Other treatment-related toxicities included chest wall pain (4.3%, 1/23) and acute esophagitis (8.7%, 2/23). By Pearson correlation analysis, the PTV volume and the V5 of ipsilateral lung (IpV5) were significantly related to the acute grade 2 or higher RIP in present study (p<0.05). The optimal threshold of the PTV volume and IpV5 to predict acute grade 2 or higher RIP were 59 cm3 and 51%, with their sensitivity/specificity of 75.0%/80.0% and 62.5%/80.0%, respectively. Conclusions: In present study, SBRT for single PPLLM was effective and well tolerated. The major reason of disease progression was metastasis to other sites but not local recurrence. The PTV volume and IpV5 might be the predictors of acute grade >=2 RIP and should be considered in treatment planning among such patients.

<table>
<thead>
<tr>
<th>Irradiation dose delivered</th>
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<tbody>
<tr>
<td>12 Gy x 4 fractions daily</td>
<td>11 (47.8%)</td>
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<tr>
<td>10 Gy x 5 fractions daily</td>
<td>9 (39.1%)</td>
</tr>
<tr>
<td>8 Gy x 7 fractions daily</td>
<td>3 (13.0%)</td>
</tr>
<tr>
<td>PTV volume (cm3) Median/range</td>
<td>48.4 (26.0-110.2)</td>
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<tr>
<td>Total lung volume (cm3) Median/range</td>
<td>2301.4 (1983.4-2950.5)</td>
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SSA22-04 Clinical Outcomes of NSCLC Oligometastatic Patients Treated with Stereotactic Ablative Body Radiotherapy (SABR) with Flattening Filter Free (FFF) Mode

Pierina Navarria (Presenter): Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Literature data suggest the existence of oligometastatic disease, a state in which metastases are limited in number and site. Different kinds of local therapies have been used for the treatment of limited metastases and in the recent years reports on the use of Stereotactic Ablative radiotherapy (SABR)
are emerging and the early results on local control are promising. The aim of this study is the evaluation of local control, toxicity and overall survival in NSCLC oligometastatic patients underwent SABR. **Materials/Methods:** Between October 2010 and May 2013, 36 NSCLC patients for 58 lung lesions were treated at our Institution. SABR was performed in case of controlled primary tumor, long interval time from the first diagnoses (greater than 6-12 months), exclusion of surgery, and number of metastatic sites. **Results:** Radiological response was obtained in the vast majority of patients. The local control at 1, 2 and 3 years was 100%, 95% and 95% respectively. No pulmonary toxicity G3-G4, chest pain or rib fracture occurred. The median follow up was 38 months (range 6-57 months). Overall Survival (OS) at 1, 2 and 3 years was 90%, 84% and 82% respectively. **Conclusions:** SABR is feasible with limited morbidity. We believe that the discussion within a multidisciplinary team is of pivotal importance to select patients with better prognosis.

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**SSA22-05**

**Technical Success and Safety of Transbronchial versus Percutaneous Fiducial Placement for CyberKnife Radiotherapy of Lung Tumors**

Deidre E. Moran MBCh (Presenter): Nothing to Disclose, Robert G. Sheiman MD: Nothing to Disclose, Olga Rachel Brook MD: Research Grant, Guerbet SA, Maryellen Ruth Morris Sun MD: Investigator, Bracco Group Investigator, Glaxo SmithKline plc, Anand Mahadevan MD: Nothing to Disclose, Bettina Siewert MD: Nothing to Disclose

**PURPOSE**

To evaluate the technical success and safety of transbronchial (bronchoscopic) versus percutaneous (CT-guided) fiducial placement for CyberKnife radiotherapy of lung tumors.

**METHOD AND MATERIALS**

From September 2005 to January 2013, we retrospectively reviewed 272 fiducial marker placements in 248 patients with lung tumors who subsequently underwent Cyberknife radiation therapy. The study was IRB-approved, HIPAA-compliant and was performed at a single tertiary institution. Procedure-related complications were documented. Technical success was defined as implantation enabling adequate treatment planning with computed tomographic simulation. Fisher exact probability test was used to compare proportions of complications and repeat procedures between two groups.

**RESULTS**

221/272 (81.2%) fiducial markers were placed transbronchially and 51/272 (18.8%) were placed using a transbronchial technique. 15/51 (29%) fiducial placements with transbronchial approach were unsuccessful, as discovered at radiotherapy planning session, and required a repeat procedure. 9/15 of repeat procedures were performed percutaneously, 5/15 were placed during repeat bronchoscopy, and 1/15 was placed at transesophageal endoscopic ultrasound. No repeat fiducial placements were required for patients who had the fiducials placed using a percutaneous technique (p<0.001), with a technical success rate of 100%.

Pneumothorax was seen in 73/221 (33%) of percutaneously placed fiducials and in 4/51 (7.8%) in the transbronchial placements (p<0.001). Nevertheless, no significant difference was seen in the rate of thoracostomy tubes placements: 18/221 (8.1%) of percutaneously placed fiducials and 2/51 (3.9%) of transbronchially placed fiducials (p=0.39).

**CONCLUSION**

Transbronchial fiducial marker placement has a significantly higher rate of failed placements requiring repeat procedures in comparison to percutaneous placement, while the rate of pneumothorax requiring thoracostomy placement is similar between the two approaches.

**CLINICAL RELEVANCE/APPLICATION**

Fiducial placements for lung tumors should be preferentially performed using a percutaneous approach, as it has a higher technical success rate with a similar clinically significant complication rate as compared to transbronchial fiducial placement.

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**SSA22-06**

**Hybrid VMAT for Patients with Large-size Stage III Non-small Cell Lung Cancer**

Nobuki Imano (Presenter): Nothing to Disclose

**ABSTRACT**

Purpose: To avoid the rapid growth of lung cancer, radiotherapy should be started as soon as possible after diagnosis. Three-dimensional conformal radiotherapy (3D-CRT) is commonly used in Japan; however, lung cancer with vertebral invasion or lymph node metastasis to the bilateral mediastinum cannot be completely cured using 3D-CRT considering the dose constraints for the spinal cord. Therefore, we developed hybrid volumetric modulated arc therapy (hVMAT), a combination of 3D-CRT and VMAT, for patients with large-size stage III non-small-cell lung cancer (NSCLC). Here, we assessed its utility. **Methods:** Eleven patients with large-size stage III NSCLC who underwent hVMAT between May 2010 and August 2013 were enrolled in this study. All patients, to maintain the spinal cord with dose constraint (maximum dose of <50 Gy in 25 fractions) used for 3D-CRT was impossible. The median total dose and fractionations were 74 Gy and 37 fractions, respectively. A dose of up to 36-40 Gy was used for 3D-CRT, and a dose of up to 30-38 Gy was used for VMAT. The dose constraint for the lung, defined as the percentage of the total lung volume irradiated with 5 Gy and 20 Gy, was less than 50% and 30%, respectively. Nine patients received concurrent chemotherapy, and two received only radiotherapy. We evaluated the following: 1) Adverse effects in patients who underwent hVMAT, 2) Simulated comparison of 3D-CRT and VMAT with hVMAT for PTV D95, lung V5, V20, and mean lung dose (MLD). Results: Only one patient had grade III radiation pneumonitis (RP) during the median 7-month follow-up period, whereas grade I and II RP were observed in 4 and 6 patients, respectively. The mean total values for lung V5, V20, and MLD in patients with grade I or II RP were significantly higher compared with those in patients with grade I RP (48.9% vs. 28.0%, p = 0.027 for V5; 27.0% vs. 14.4%, p = 0.035 for V20; 16.4 Gy vs. 9.0 Gy, p = 0.024 for MLD). No other non-hematological toxicities of more than grade III were observed. PTV D95 for hVMAT was equal to that for VMAT (89.7% vs. 90.8%, p = 0.736) and superior to that for 3D-CRT (89.7% vs. 69.5%, p < 0.001). The total lung dose for hVMAT and VMAT was also equivalent (41.3% vs. 40.2%, p = 0.104 for V5; 22.4% vs. 22.3%, p = 0.856 for V20; 13.7 Gy vs. 14.1 Gy, p = 0.284 for
**SSA22-07**

**Thymic Tumors: A Retrospective Review of the 10-Year Experience @ a NCI-Designated Cancer Center**

Charles R. Thomas MD (Presenter): Nothing to Disclose

**ABSTRACT**

**Purpose/Objective(s):**

TT are rare and poorly understood tumors. TT are often asymptomatic until advanced stage, causing significant morbidity and treatment-related complications. Outcomes vary depending on the clinical stage and histologic subtype of TT. The specific aim was to describe the clinical outcomes of patients (pts) with thymic tumors (TT) evaluated at a NCI-Designated Cancer Center over a ten-year period.

**Materials/Methods:**

The study design as a retrospective case-series of thymic malignancies treated at a NCI-Designated Cancer Center treated at our institution over a 10 year period, including disease presentation and treatment response to inform potential future research in TT. All pts, eighteen years old or older, with TT seen at OHSU between January 1, 2001 and June 30, 2011 were used in this analysis. Subjects were eligible for inclusion if they were seen during this period and diagnosed with any malignancy arising from the thymus gland, irrespective of histologic subtype. Using a case series design, data were collected in a retrospective manner. The medical record was systematically reviewed for pre-specified variables, including demographic data, tumor histology and stage, treatment history, and survival data.

**Results:**

Twenty-eight pts were identified with a TT treated at during the defined decade. The mean age at diagnosis was 55 yrs. 17 pts had thymoma (61%), 8 had thymic carcinoma (29%), and the remainder had other TT. Of the total cohort, the majority were male (61%), lifetime never smokers (61%), and Caucasian (96%). Nine pts had myasthenia gravis symptoms (32%). Symptoms at presentation were varied but many experienced chest discomfort/pain, dyspnea, cough, and/or fatigue. The majority were treated with surgery (93%) and radiation therapy (60%) with a mean dose of 54.2 Gy, while 54% received at least one type of chemotherapy (range 0-5). The median OS was 110 months for thymoma, and 52.5 months for the other thymic tumors. The median OS has not been reached for the group of pts.

**Conclusions:**

Using a retrospective design, we were able to capture the clinical course of pts with TT treated at our tertiary care institution over a ten-year period. Pts were treated with standard therapies, and survival (both disease-free and overall) is similar to historical reports. In addition to longer follow-up, these data suggest additional research should be undertaken to better characterize associated causes of TT. Future research should evaluate for tumor genetic abnormalities potentially amenable to targeted interventions which may improve DFS and OS, especially for aggressive variants of TT.

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**SSA22-08**

**Is 18F-FDG PET/CT a Valid Non-invasive Predictor for Regression Grade after Neoadjuvant Treatment in Patients with NSCLC Stage III?**


**PURPOSE**

To evaluate the role of molecular remission as detected by 18F-FDG/CT and regression grade according to Junker et al. after neoadjuvant treatment of patients with NSCLC stage III, findings in 58 patients were analyzed retrospectively.

**METHOD AND MATERIALS**

For 58 patients with NSCLC stage IIIA (44%) / IIIB (56%) received neoadjuvant treatment consisting of chemotherapy and radiation therapy. Documentation of involved lymph node stations as detected by PET and lymph node sampling during surgery according to the IASLC lymph node mapping (2009). Evaluation of histological regression grade (RG) according to Junker et al. (2001) and correlation with PET for primary tumor and each lymph node station. Calculation of disease free survival using Kaplan-Meier estimates and log rank tests.

**RESULTS**

Actuarial tumor specific survival for the 32 patients with concomitant chemoradiation: complete vs. incomplete metabolic remission after 60 months: 40% vs. 24% (p = .018), RG III/IIb (no/less than 10% of vital tumor cells) vs. RG IIA/I (more than 10% vital tumor cells) after 60 months: 46% vs. 15% (p < .006). 18/32 (56%) patients with RG III/IIb, 8/32 (25%) patients with regression grade III. 1/8 pts. with RG III were in the 18F-FDG PET/CT false positive, 10 pts. with RG IIb (i.e. all pts. with RG IIb) were in the 18F-FDG PET/CT false negative, 1 pts. with RG IIA was in the 18F-FDG PET/CT false negative: Hence, the cut-off level in detecting vital tumor cells by 18F-FDG PET/CT after neoadjuvant chemoradiation for NSCLC is about 10%. Actuarial tumor specific survival for the 26 patients with sequential chemoradiation or chemotherapy as a sole neoadjuvant treatment: RG III vs. RG IIb/IIa/I after 60 months: 50% vs. 16%. 05/26 (19%) patients with RG III.

**CONCLUSION**

Molecular remission in mediastinal lymph nodes as detected by 18F-FDG PET correlates well with regression grade as proposed by Junker et al. and both may predict (long-term) therapeutic outcome in patients with stage III NSCLC. The cut-off level in detecting vital tumor cells by 18F-FDG PET after neoadjuvant chemoradiation for NSCLC is about 10%. Our preliminary data of 58 patients suggest that intensification of
neoadjuvant treatment may lead to an higher amount of complete remission resulting in an increased survival. However this hypothesis has to be tested in prospective trials.

**CLINICAL RELEVANCE/APPLICATION**

18F-FDG PET/CT is a non-invasive tool for treatment stratification

**SSA22-09**

**Longitudinal Computed Tomography Monitoring of Carbon-Ion Radiation Induced Pulmonary Fibrosis in Mice in Correlation to the Radiation Therapy Oncology Group (RTOG) Classification**

Sebastian Bickelhaupt (Presenter): Nothing to Disclose, Peter Peschke PhD: Nothing to Disclose, Juergen Debus MD, PhD: Nothing to Disclose, Peter Ernst Huber MD, PhD: Nothing to Disclose

**PURPOSE**

Particle radiotherapy including Carbon ion irradiation is of increasing interest for tumor treatments yet its side effects are barely investigated, especially for radiosensitive organs such as the lung. We investigated the pulmonary toxicity of carbon ion irradiation in mice lungs and the correlation of computed tomography imaging in correlation to the Radiation Therapy Oncology Group (RTOG) scores and histopathology.

**METHOD AND MATERIALS**

All animal procedures were IRB/GRB approved. Thoraces of female C57BL/6 mice were irradiated with a single dose of 11Gy Carbon ions (C12), non-irradiated animals served as controls. Computed tomography monitoring using a SOMATOM multi-slice CT scanner (Siemens) (120kV,100mAS, whole thoracic, 0.5-mm slice-thickness, acquisition time 0.5 s) was performed every 2/4 weeks in a longitudinal manner until week 24. Hounsfield Units (HU) with 3D-intrapulmonal homogeneity analyses and pulmonary changes according to the radiological RTOG (Radiation Therapy Oncology Group) scores were measured and correlated. Further lung histology and morphometric analyses were performed and integrated into the analysis. Statistics were calculated using Student’s-t-test, Spearman’s correlation coefficient and log-rank tests.

**RESULTS**

Lung density in mice progressively increased after 12 weeks until 22 weeks after irradiation from about -480 HU (SEM+-4.25) to -300 HU (SEM+-26.0) in a homogeneous pattern with no significant (p>0.05) difference between the intrapulmonal lung regions. Similarly RTOG scores increased from mean 0 to 2.96 (SEM+-0.25) in week 22, both measurement tools indicated significant (p<0.05) pulmonary changes to controls 16 weeks after irradiation. A high correlation was found between the RTOG Scores and the HU measurements (p=0.0046, r=-0.89). All findings showed a high correlation to the histopathological examinations presenting lung remodeling indicative of fibrosis that was lethal in all irradiated animals at week 24.

**CONCLUSION**

Carbon ion irradiation induced lethal pulmonary toxicity in a homogeneous pattern with computed tomography monitoring showing a high correlation between the Hounsfield Units increase and the RTOG scores. Both methods seem appropriate for monitoring carbon ion radiotherapy induced pulmonary toxicity.

**CLINICAL RELEVANCE/APPLICATION**

Hounsfield values and the RTOG scores are a valuable tool for preclinical studies as a translational approach in monitoring pulmonary toxicity after irradiation.
PURPOSE

To develop and validate an instrument to rapidly discriminate between renal cancer neoplastic subtypes and normal core biopsy tissue using elastic light scatter spectroscopy.

METHOD AND MATERIALS

We performed an Institutional Review Board approved prospective study of surgically resected kidney tumors with a clear pathologic diagnosis from 1/2013 - 2/2014. Visible tumors and surrounding normal kidney were biopsied using 18G side-notch core needles. Core biopsy specimens were analyzed using a specialized light spectroscopic scatter device that rapidly scans (less than 1 minute) core needle biopsy samples while still on the needle. Spectra were normalized and distributed against geometrical means and outliers were rejected. The spectral data was decomposed into 25 principal components and a machine learning algorithm was used to differentiate between tumor subtypes and normal tissue. Receiver operating characteristic (ROC) curves were generated using pathology as the gold standard for all samples.

RESULTS

Fifty-three kidneys were biopsied during the study period resulting in 3076 usable spectra after outlier rejection (1272 normal and 1804 tumor samples). The final pathologic diagnoses included clear cell carcinoma (1130/1804, 63%), papillary carcinoma (248/1804, 14%), chromophobe carcinoma (226/1804, 13%) and oncocytoma (200/1804, 11%). Principal component analysis using the Random Forest algorithm resulted in a sensitivity of 92.6%, specificity of 93.3%, 95.2% PPV, and 89.9% NPV. Despite overall high accuracy for renal tumor subtyping, the device performed least well differentiating papillary from clear cell carcinoma and normal renal tissue from chromophobe carcinoma.

CONCLUSION

Rapid tissue-preserving optical spectroscopy analysis of core biopsy samples is feasible and can successfully differentiate renal tumor subtypes with a high degree of classification accuracy. This instrument offers the potential to improve on-site biopsy assessment.

CLINICAL RELEVANCE/APPLICATION

Automated workflow-integrated pathologic assessment of core needle biopsies using optical spectroscopy is possible and has the potential to improve on-site biopsy assessment.

SSA23-02

Intra-procedural Low-dose 18-Fluoro-deoxyglucose PET/CT-guided Biopsy Leads to Increased Accuracy in Poorly Visualized Lesions

François Cornelis MD (Presenter): Nothing to Disclose, Haruyuki Takaki MD: Nothing to Disclose, Jeremy C. Durack MD: Nothing to Disclose, Joseph Patrick Erinjeri MD, PhD: Nothing to Disclose, Constantinos Thasos Sotofcleous MD, PhD: Consultant, Sirtex Medical Ltd, Robert H. Siegelbaum MD: Nothing to Disclose, Heiko Schoder MD: Nothing to Disclose, Stephen Barnett Solomon MD: Research Grant, General Electric Company Research Grant, Angiodynamics, Inc Consultant, Johnson & Johnson Consultant, Covidien AG Director, Devicor Medical Products, Inc Director, Aspire Bariatrics, Inc

PURPOSE

To report the accuracy of percutaneous biopsies performed under intra-procedural 18-Fluoro-deoxyglucose (FDG) positron emission computed tomography (PET-CT) guidance.

METHOD AND MATERIALS

The IRB approved this retrospective study with a waiver of written informed consent. We reviewed 105 consecutive patients from 2011 to 2013 who had clinically indicated percutaneous PET-CT guided biopsies of 106 masses (mean size, 3.3 cm; range, 0.7-15.9 cm; SD, 2.9 cm) in bones (n=33), liver (n = 26), soft tissues (n = 18), lung (n = 15) and abdomen (n=14). Recommendation for PET-CT guidance was based on existing image review and challenges anticipated using CT, MR or ultrasound modalities for procedural guidance. The biopsy procedures were performed following injection of 6.9mCi in mean (range, 3.9-13.2; SD, 2) of FDG. Maximal standardized uptake value (SUV) of lesions was 8.8 in mean (range, 1.9-44.4; SD, 6.3). A systematic review of the histopathological results and outcomes was performed. Descriptive statistics were used to summarize the results.

RESULTS

Biopsies were positive for malignancy in 76 (71.7%, 76/106) cases and for benign tissue in 30 cases (19.8%, 30/106). Immediate results were considered as adequate for 100 PET-CT biopsies (94.3%, 100/106), and for the 6 others (5.7%, 6/106) benign diagnoses were confirmed after surgery (n=4) or follow-up (n=2). Accuracy, sensitivity and positive predictive value (PPV) of biopsies were all 100%, with a 95% confidence interval of [95.2-100] for PPV. Complications occurred after 4 biopsies (3.7%, 4/106).

CONCLUSION

Intra-procedural PET-CT guidance appears is a safe and effective method and allows high accuracy of
percutaneous biopsies for metabolically active lesions. For purposes of biopsy guidance, half of the typical FDG activity is sufficient for target visualization.

**CLINICAL RELEVANCE/APPLICATION**

PET-CT imaging guidance can be used to biopsy metabolically active lesions not well visualized on other modalities with an excellent specificity and positive predictive value.

### SSA23-03

**Safety and Outcomes Following Percutaneous Biopsy of Hepatic Adenomas**

**Derrick Arnold Doolittle** MD (Presenter): Nothing to Disclose, **Thomas Duncan Atwell** MD: Nothing to Disclose, **Taofic Mounajjed**: Nothing to Disclose, **David Maitland Hough** MD: Nothing to Disclose, **Grant D. Schmit** MD: Nothing to Disclose, **Anil Nicholas Kurup** MD: Nothing to Disclose

**PURPOSE**

Until recently, MRI with gadoxetate disodium (Eovist) was used to distinguish benign FNH from hepatic adenoma, the latter neoplasm having a small but real propensity for both spontaneous hemorrhage and malignant degeneration. Recently, an inflammatory variant of hepatic adenoma has been described which may demonstrate MRI imaging features similar to FNH, precluding diagnostic differentiation of these tumors. Given the implications of the different pathologies, there is a resurging interest in the role of biopsy in differentiating FNH and hepatic adenoma. The purpose of this project was to determine the safety and outcomes following biopsy of hepatic adenomas.

**METHOD AND MATERIALS**

We performed a retrospective review of all patients at our institution over a 14 year interval with a confirmed biopsy proven diagnosis of hepatic adenoma. The biopsy procedure and complications of the biopsy were evaluated. Pathology-specific outcomes related to the diagnosis of adenoma were assessed.

**RESULTS**

Sixty-four patients were identified (56 females and 8 males, average age of 41.5 years) with an average follow up of 883 days after biopsy. Four (6%) patients had RF ablation the same day as the biopsy and complications were not assessed for these patients. Nine of the remaining 60 (15%) patients had a minor complication. There were no major complications. Three (5%) of our 64 biopsy-proven adenomas revealed focal nodular hyperplasia upon surgical resection. One biopsy proven adenoma was rebiopsied 3 months later, with result showing well differentiated hepatocellular carcinoma.

**CONCLUSION**

Complications of biopsy proven hepatic adenomas are rare. Although rare, discordant pathology results from biopsy and surgical resection may occur.

**CLINICAL RELEVANCE/APPLICATION**

Biopsy of hepatic adenoma is safe with rare discordant results.

### SSA23-04

**Radiation Exposure of Medical Staff during Percutaneous Soft Tissue Interventions on a Phantom Using a Multi-axis Interventional C-arm CT System with 3D Laser Guidance**

**Nils Rathmann** MD (Presenter): Nothing to Disclose, **Michael Kostrzewa** MD: Nothing to Disclose, **Uwe Haeusler**: Nothing to Disclose, **Stefan Oswald Schoenberg** MD, PhD: Institutional research agreement, Siemens AG, **Steffen J. Diehl** MD: Nothing to Disclose

**PURPOSE**

The purpose of this study was to investigate absolute radiation exposure values for interventional radiologists during 3D laser guided soft tissue interventions using a multi-axis interventional C-arm CT system with 3D laser guidance (Artis Zeego, Siemens Healthcare Sector, Germany).

**METHOD AND MATERIALS**

3D, laser supported, fluoroscopic guidance (syngo (Guide) of the Siemens Artis Zeego intervention system was used to puncture sixteen lesions at different angles with a 20G biopsy-needle. The lesions were identified in a triple modality 3D abdominal phantom (model 057A, CIRS, Norfolk, VA, USA). Two 20l water containers were placed adjacent to the phantom to increase its volume. One C-arm CT (syngo DynaCT) was performed for planning of the intervention and one DynaCT was performed for post procedural evaluation to properly identify the needlepoint within the lesion. Laser supported fluoroscopy was used for needle guidance. For each intervention three thermoluminiscent dosimeters (TLDs) placed on an i.v. pole at the level of the eyes, the umbilicus and the ankles were used to collect representative radiation exposure values of the interventionalist. The i.v. pole was placed next to the phantom analogue to the position of the interventionalist without lead shielding for the entire duration of the intervention.

**RESULTS**

Sixteen interventions were analyzed. For proper positioning of the needle within each target lesion mean fluoroscopy time was 4.1s and mean overall procedural duration was 904s. Mean radiation value of all TLDs was $189\pm 59$ (range 100 - 423). Mean radiation value of the TLDs at the level of the eye lens was $177\pm 59$.
CONCLUSION
Our results suggest that proper lead shielding during the interventions and leaving the intervention suite during DynaCT is of critical importance to minimize radiation exposure for the medical staff. Furthermore, these results have to be systematically compared to CT-guided interventions for which lower values of radiation exposure have been reported for medical staff.

CLINICAL RELEVANCE/APPLICATION
These results indicate that even with modern navigation tools without lead shielding relative high radiation doses for medical staff can occur during biopsy with a clinical robot-arm assisted intervention system.

SSA23-05

Image-guided Needle Aspiration versus Percutaneous Catheter Drainage in the Management of Complex Pyogenic Liver Abscesses Caused by Klebsiella Pneumonia

Sivasubramanian Srinivasan MD, FRCR (Presenter): Nothing to Disclose, Hui Seong Teh MBBS: Nothing to Disclose, Manickam Subramanian MD, FRCR: Nothing to Disclose

PURPOSE
Our aim was to compare the effectiveness of percutaneous needle aspiration with percutaneous catheter drainage in the management of liver abscesses caused by Klebsiella pneumonia.

METHOD AND MATERIALS
64 patients (42 males, 22 females; 25-85 years, mean 74 years) with culture proven Klebsiella liver abscess underwent either percutaneous needle aspiration (n=28, size 3-10 cm, mean 7.2 cm) or catheter drainage (n=36, size 3-15 cm, mean 9.5 cm) along with appropriate antibiotic treatment. The abscesses were graded into four grades according to the liquefaction and loculations (grade 1- unilocular abscess, 4 - solid appearing complex abscess with scanty liquefaction). In grade 4 abscesses, percutaneous aspiration was performed with 18G needle in multiple locules to aspirate the contents. For catheter drainage, 8- to 12-French catheters were inserted into the abscess cavity by the Seldinger technique under imaging guidance. Outcome was assessed with clinical and lab parameters and sonographic monitoring of size of the abscesses.

RESULTS
Percutaneous procedures were technically successful in all patients (64/64, 100%) and clinical success was achieved in 62 patients (62/64, 96%). Percutaneous needle aspiration was successful in first attempt in 22 (22/28, 79%) patients after one aspiration and six patients (21%) needed a second procedure whereas 12 (12/36, 33%) patients in the drainage group needed a second procedure. The need for second procedure, especially in grade 4 abscesses was significantly lower in the aspiration group (p < 0.05) compared to the drainage group. Four patients with air forming Klebsiella liver abscess, were hemodynamically unstable due to septic shock had to undergo catheter drainage and one (1/4, 25%) of them could not recover from the septic shock.

CONCLUSION
Percutaneous aspiration is more effective in Klebsiella abscesses with scanty liquefaction compared to catheter drainage. However, emergent catheter drainage is necessary in patients with air-forming Klebsiella abscesses who usually present with hemodynamic instability due to septic shock.

CLINICAL RELEVANCE/APPLICATION
In Klebsiella pneumonia liver abscesses, especially in cases with scanty fluid component, needle aspiration should be considered as a first line of management with antibiotic coverage. However, in patients with air-containing Klebsiella pneumonia abscesses, emergent catheter drainage will be necessary because of severe sepsis.

SSA23-06

Image-guided Percutaneous Drainage for Treatment of Post-surgical Anastomotic Leak in Patients with Crohn’s Disease

James Donald Byrne BS (Presenter): Nothing to Disclose, Ari Joel Isaacson MD: Nothing to Disclose, Ryan Stephens MD: Nothing to Disclose, Hyeon Yu MD: Nothing to Disclose, Charles Thomas Burke MD: Nothing to Disclose

PURPOSE
Anastomotic leaks are a common complication after bowel surgery in Crohn’s patients. Image-guided percutaneous drainage is an attractive alternative to reoperation because of decreased morbidity and hospital stay. Because data for this specific population is scarce, we aimed to determine the safety and efficacy of image-guided percutaneous drainage in the management of anastomotic leak in Crohn’s patients by retrospectively reviewing cases at a single academic institution.

METHOD AND MATERIALS
The medical records of 41 patients with Crohn’s disease who underwent percutaneous drain placement for the treatment of anastomotic leak from September 2004 to November 2013 were reviewed. CT imaging was also reviewed to determine the number, size and locations of the drained fluid collections. Local treatment failures and complications were evaluated for all patients.

RESULTS
The mean volume of the abscesses resulting from anastomotic leak was 167.2 cm³ (median 59.5 cm³; range 1.8-1173.1 cm³), and the mean number of targeted fluid collections per patient was 1.5 (median 1; range 1-4); 15 of 41 (38.1%) patients were treated for multiple abscesses. The mean duration between surgery and percutaneous drain placement was 18.5 days (median 14 days; range 6-60 days), and the median drain size
was 10 French, with a range of 8-16 French. Overall, the mean duration of drainage was 70.4 days (median 29 days; range 2-732 days). The mean number of drain manipulations/exchanges was 1.2 (median 0; range 0-14). One of 41 (2.4%) patients experienced minor complications from drain placement, injury to a superficial abdominal artery, and no major complications occurred. Two of 41 (4.9%) patients required repeat surgeries.

CONCLUSION

Image-guided percutaneous drainage for the treatment of post-surgical anastomotic leaks in Crohn’s patients is effective and safe with low rates of complications and reoperations.

CLINICAL RELEVANCE/APPLICATION

Image-guided percutaneous drainage of anastomotic leaks after bowel surgery in Crohn’s patients is a safe and effective alternative to surgical intervention, reducing morbidity and hospital stay.

SSA23-07

Comparison of Unilateral versus Bilateral Biliary Drainage in Patients with Malignant Biliary Obstruction: A Prospective Study

Tezbir Singh MBBS (Presenter): Nothing to Disclose, Shivanand Ramachandra Gamanagatti MBBS, MD: Nothing to Disclose, Raju Sharma MD: Nothing to Disclose, Deepnarayan Srivastava: Nothing to Disclose

PURPOSE

This study evaluated the efficacy of unilateral versus bilateral percutaneous transhepatic biliary drainage in the palliation of these patients in terms of improvement of quality of life and reduction of serum bilirubin levels

METHOD AND MATERIALS

A prospective, single-center study was conducted in a cohort of 49 patients with malignant biliary obstruction. The primary confluence was blocked in 33 patients and patent in 16 patients. A single, unilateral internal-external catheter or metallic stent was placed in 44 patients. Bilateral catheter or stent insertion was done in 5 patients in whom the primary confluence was blocked and contrast had opacified the contralateral duct during the procedure to prevent cholangitis. In total 28 patients (57.1%) had unilateral biliary drainage and in the rest of 21 (42.9%) unilateral drainage was achieved. Patients were evaluated at one month after the procedure and, thereafter every 3 months. We studied the impact of amount of biliary drainage on the change in the European Organisation for Research and Treatment of Cancer QOL questionnaire (EORTC QLQ-C30) (version 3) scores and by liver function tests.

RESULTS

Mean serum bilirubin level was 19.85 mg/dl prior to the procedure and at one month was 6.02 mg/dl after the procedure, and at 6 months was 3.84 mg/dl, which was statistically significant (p < 0.001). There was a significant improvement in all the QOL parameters (Functional, Symptomatology and Global). The mean increase in the Functional parameter at one month was 19.35 (percentage increase was 46.19%). The mean decrease in the Symptomatology parameter was 21.47 (percentage reduction was 38.5%). The mean increase in the Global parameter was 25.8 (percentage increase was 85.8%). We found that there was no statistically significant difference in the reduction of the serum bilirubin levels (p = 0.136), and also QOL scores between the patients treated with unilateral versus bilateral drainage.

CONCLUSION

Unilobar biliary drainage is safe, feasible, and achieves adequate drainage in the great majority of patients with unresectable malignant biliary obstruction in terms of improvement of quality of life and bilirubin levels as compared to bilobar biliary drainage.

CLINICAL RELEVANCE/APPLICATION

Unilateral percutaneous deployment of catheters or metal stents has a high clinical success rate that provides adequate palliation and improves Quality of Life substantially.

SSA23-08

Wall Suction-assisted Image-guided Therapeutic Paracentesis: A Safe Alternative to Evacuated Bottles

Tatiana Kelil MD (Presenter): Nothing to Disclose, Paul B. Shyn MD: Nothing to Disclose, Loraine Eng Wu MD: Nothing to Disclose, Ramin Khorasani MD: Consultant, Medicalis Corp, Stuart G. Silverman MD: Author, Wolters Kluwer nv

PURPOSE

Because evacuated bottles are expensive and in short supply, we assessed the safety of using wall suction to drain and collect large amounts of fluid during image-guided paracentesis procedures.

METHOD AND MATERIALS

This retrospective quality improvement project was HIPAA-compliant and did not require IRB approval. In a hospital-based practice, 551 image-guided paracenteses were performed in 191 consecutive patients (61 males and 130 females, ages 21-94, mean 61) over a 10-month period, using wall suction to collect the fluid. Each patient underwent 1 to 40 (mean 8.3) procedures. The two most common primary diagnoses were malignancy in 142 (74.3%) patients and cirrhosis in 36 (18.8%) patients. Paracenteses were performed using ultrasound (n =542) or CT (n = 9) guidance, 5-French centesis catheters, extension tubing (3 m long, 5 mm diameter), and
RESULTS
The volume of fluid removed ranged from 35 to 11,965 ml (mean 3541 ml). Four (0.72%) complications occurred in 551 procedures; a rate similar to historical controls. Grade I complications included prolonged ascites leak (n = 1). Grade III complications included infection (n = 1), hypotension (n = 1) and atrial fibrillation (n = 1). All four complications were unrelated to the use of wall suction, and were treated successfully; no grade II, IV or V complications occurred. The small number of complications precluded adequate statistical power for comparisons to historical controls.

CONCLUSION
The use of wall suction when performing image-guided therapeutic paracentesis is a safe alternative to collecting fluid with evacuated bottles.

CLINICAL RELEVANCE/APPLICATION
The current shortage of evacuated bottles has prompted the safe use of wall-suction to facilitate image-guided therapeutic paracentesis.

The Effectiveness of Image-guided Peritoneal Dialysis Catheter Placement in a Community Hospital

Paul Erik Dybbro MD (Presenter): Nothing to Disclose, Todd Ellis Drasin MD, MPH: Nothing to Disclose

PURPOSE
Minimally invasive image-guided techniques allow placement of peritoneal catheters into traditionally excluded patients including acutely uremic patients, patients with low cardiac output and/or recent myocardial infarctions, and patients with hepatorenal or cardiorenal syndrome. The following study measures the effectiveness of a community-based minimally invasive image-guided interventional radiology peritoneal dialysis catheter placement service.

METHOD AND MATERIALS
The clinical electronic medical records of 100 consecutive image-guided peritoneal dialysis catheter placements were reviewed at a community-based hospital. Cases were performed between July 2012-March 2013. The referral based included low, medium, and high-risk patients. Cases were a random mix of elective, urgent, and emergent procedures. Two interventional radiology physicians performed all the procedures. Procedures were performed in an interventional radiology suite usually under procedural sedation; a few selected patients received local anesthesia. Ultrasound was utilized to achieve safe peritoneal entry and creation of a rectus muscle tunnel to provide catheter stability. Fluoroscopy was utilized to achieve deep mid line pelvic positioning of the curl tip portion of the catheter.

RESULTS
Initial catheter placement success rate was 92%. There were no complications. Mechanical catheter malfunction-free rates were calculated, and were 94% (78/83) at 3 months, 91% (67/74) at 6 months and 85% (44/52) at 1 year. Excluded from the calculations were cases of peritoneal dialysis loss from psychosocial issues, infections, peritoneal membrane failure, migration to transplant status, hydrothorax, hernia formation, and patient death.

CONCLUSION
Image-guided peritoneal dialysis catheter placement achieves comparable survival rates as laparoscopic catheter based services. Minimal invasive image guided techniques have documented cost advantages to laparoscopic techniques. By expanding the pool of eligible patients for peritoneal dialysis, the imaged guided techniques can increase the utilization of peritoneal dialysis in this country.

CLINICAL RELEVANCE/APPLICATION
Medicare costs for peritoneal dialysis average $20,000 less/patient/year compared to hemodialysis. Increasing utilization rates of peritoneal dialysis as a renal replacement therapy can result in significant cost savings.
Non-enhanced (TOF) MRA versus Ultra-low-Dose Contrast-enhanced MRA at 7T

Thomas C. Lauenstein MD (Presenter): Nothing to Disclose, Anja Fischer MD: Nothing to Disclose, Michael Forsting MD : Nothing to Disclose, Mark E. Ladd PhD: Nothing to Disclose, Stefan Maderwald PhD, MSc : Nothing to Disclose, Lale Umutlu MD : Consultant, Bayer AG

PURPOSE

With recognition of a potential side effect, by the name of Nephrogenic Systemic Fibrosis, there has been a shift towards MR angiography techniques with reduction or complete omission of Gadolinium-based contrast agents. Hence, the aim of this trial was to compare the diagnostic ability of non-enhanced (TOF) versus ultra-low-dose contrast-enhanced renal MRA at 7 Tesla.

METHOD AND MATERIALS

12 healthy subjects were examined on a 7T MR system (Magnetom 7T), utilizing a custom-built 8-channel RF body coil. Time-of-flight (TOF) MRA was obtained with a voxel size of 1.0 x 2.0 x 2.5 mm3. Corresponding ultra-low-dose contrast-enhanced (ce) 3D FLASH datasets were acquired with a voxel size of 1.0 x 1.5 x 1.0 mm3, obtained in unenhanced and in arterial phase after the application of 0.025 mmol/kg BW Gadobutrol (Bayer Healthcare). Image subtraction was performed subsequently. Contrast ratios (CR) were measured in the corresponding datasets in the aorta and both renal arteries in correlation to adjacent psoas major muscle. Qualitative analysis with regard to delineation of the renal arterial vasculature was performed by two radiologists using a five-point-scale (5=excellent to 1= non diagnostic).

RESULTS

Both MRA techniques offered a robust and homogenous hyperintense vessel signal of the assessed vasculature. Qualitative analysis revealed comparable results of vessel conspicuity in subjective ratings for TOF MRA (mean left renal artery = 4.5) and subtracted contrast-enhanced datasets (mean left renal artery = 4.6). Background suppression in subtracted datasets was superior to background suppression of TOF-images, reflected in superior contrast ratio values for subtracted datasets (mean aorta =0.7) compared to TOF-MRA (mean aorta = 0.4).

CONCLUSION

Our results demonstrate the successful facilitation and comparable diagnostic ability for vessel assessment in TOF-MRA and ultra-low-dose renal MRA at 7T, while preserving high quality vessel assessment.

CLINICAL RELEVANCE/APPLICATION

Preservation of high-quality vessel assessment while facilitation of significant reduction, or respectively complete omission of contrast agent, may be of high diagnostic value for MR angiographic examinations in patients with renal insufficiency.

Ultra-high-Resolution Imaging of the Intracranial Arteries at 7T: TOF MRA versus Non-enhanced MPRAGE

Lale Umutlu MD (Presenter): Consultant, Bayer AG, Nina Theysohn MD : Nothing to Disclose, Soren Johst : Nothing to Disclose, Michael Forsting MD : Nothing to Disclose, Marc U. Schlamann : Nothing to Disclose, Karsten Wrede : Nothing to Disclose

PURPOSE

The purpose of this study was to intraindividually compare the delineation of intracranial arterial vasculature utilizing ultra-high-resolution TOF MRA versus non-enhanced MPRAGE at 7 Tesla.

METHOD AND MATERIALS

40 subjects were examined on a 7 T whole-body MR system (Siemens Healthcare) utilizing a 32-channel transmit / receive head coil (Nova Medical). TOF MRA was performed with a voxel size (vs) of 0.2 x 0.2 x 0.2 mm3, non-enhanced MPRAGE with a vs of 0.7x0.7 x0.7mm3. For qualitative analysis, two readers assessed the delineation of the following arteries and segments: (1) internal carotid artery [cervical segment, petrous segment, cavernous segment], (2) anterior cerebral artery [A1, A2], (3) anterior communicating artery, (4) middle cerebral artery [M1, M2, M3], (5) posterior communicating artery, (6) posterior cerebral artery [P1, P2], (7) basilar artery. Additionally, (1) overall image quality, (2) vessel sharpness, (3) vessel to background contrast and (4) image impairment due to artifacts was assessed. For qualitative analysis a five-point-scale was utilized for rating (5 = excellent image quality to 1 = non-diagnostic). For quantitative analysis contrast-ratios of the middle cerebral artery in correlation to surrounding grey matter were measured in both sequences. For statistical analysis a Wilcoxon signed rank test was applied.

RESULTS

Both sequences enabled high quality delineation of all assessed vessel segments with superior depiction of the vessels of the anterior circulation (meananterior circulation MPRAGE=4.6 TOF MRA=4.4) compared to the vessels of the posterior (circulation meanposterior circulation MPRAGE=4.1 TOF MRA=3.8). While TOF MRA yielded superior vessel sharpness over MPRAGE (meanvessel sharpness MPRAGE 4.3 TOF MRA 4.6), MPRAGE MRI yielded superior vessel to background contrast (meanvessel contrast MPRAGE=4.6 TOF MRA=4.2), also
reflected in higher CR values for MPRAGE MRI.

CONCLUSION

Our results demonstrate the high diagnostic value of both non-enhanced MRA techniques, with overall superiority of MPRAGE MRI, offering a robust and artifact-free high-resolution delineation of the intracranial vasculature.

CLINICAL RELEVANCE/APPLICATION

7T MPRAGE MRI may serve as a high quality diagnostic tool for high-resolution assessment of the intracranial vasculature, particularly for recurrent radiation-free follow-up imaging.

SSA24-03

Contrast-enhanced Magnetic Resonance Angiography (MRA) vs. Digital Subtraction Angiography (DSA): Grading of Stenosis and Therapy Planning in Peripheral Artery Occlusion Disease (PAOD)

Thomas Josef Vogl MD, PhD (Presenter): Nothing to Disclose, Clemens Wurz BA: Nothing to Disclose, Stefan Zangos MD: Nothing to Disclose, Axel Thalhammer MD: Nothing to Disclose, Thomas Schmitz-Rixen MD, PhD: Nothing to Disclose

PURPOSE

To compare contrast-enhanced magnetic resonance angiography (MRA) with conventional digital subtraction angiography (DSA) for detecting stenoses and planning of therapy in patients with peripheral artery occlusion disease (PAOD).

METHOD AND MATERIALS

In this retrospective study 71 patients (20 women / 51 men; mean: 68 years) with established PAOD underwent both imaging modalities in a maximum interval of 40 days. DSA was the standard of reference. The pelvic and leg arteries were divided into 31 anatomic segments, which were graded on a scale from 1-4 (1=no stenosis; 2=stenoses < 70%; 3=stenoses≥70%; 4=occlusion). The pelvic and leg vessel systems were categorized with the TASC II-score into five grades (none, TASC-A, TASC-B, TASC-C, TASC-D) for detecting whether the therapeutic consequences would be the same for both imaging modalities.

RESULTS

Evaluation was possible for 1,937 vessel segments. MRA and DSA agreed in the grading of 1,802 segments (93.03%), and differed in 69 cases in one category, in 28 cases in two and in 38 cases in three categories. In discriminating between hemodynamically relevant (≥70% / occlusion) and non-hemodynamically relevant findings (< 70% / nonstenosis) MRA achieved a sensitivity of 90.59% and a specificity of 96.61%. Evaluation of TASC II-classification for the aorto-iliacal region was possible in 56 patients. In 52 patients TASC II-class was the same for DSA and MRA (92.86%; κ=0.88), for the femoral-popliteal region the result was nearly the same, the evaluation of 56 patients showed agreement in 52 patients (92.86%; κ=0.90).

CONCLUSION

There was almost perfect agreement between MRA and DSA in the TASC classification. Thus, the therapeutic consequences are predominantly the same, irrespective of the modality used.

CLINICAL RELEVANCE/APPLICATION

Contrast-enhanced MRA is a valid method for detecting and grading stenoses in patients with PAOD.

SSA24-04

FGF-23 a Predictive Parameter in Patients with Non-occlusive Mesenteric Ischemia (NOMI)

Peter Minko MD (Presenter): Speaker, Straub Medical AG Consultant, Straub Medical AG, Matthias Klingele: Nothing to Disclose, Jonas Stroeder MD: Nothing to Disclose, Heinrich Groesdonk: Nothing to Disclose, Arno Buecker MD: Consultant, Covidien AG Speaker, Covidien AG Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG, Hans-Joachim Schafer MD: Nothing to Disclose, Marcus Katoh MD: Consultant, Straub Medical AG Consultant, Medtronic, Inc

PURPOSE

To correlate angiographic findings with kidney specific parameters and to investigate the predictive value of angiography with respect to the outcome in patients with NOMI.

METHOD AND MATERIALS

In this prospective study 63 consecutive patients (mean age: 73±8 years) suspected of NOMI after cardiac or major thoracic vessel surgery underwent catheter angiography of the superior mesenteric artery. Images were assessed by two experienced radiologists on consensus basis using a previously published standardized reporting system (Homburger-NOMI-Score). These data were correlated to kidney specific parameters: FGF-23, cystatin, cystatin C, creatinin and glomerular filtration rate (GFR) and outcome data (death, acute renal failure) using linear and logistic regressions, as well as nonparametric test and ROC-analysis.

RESULTS
Significant correlations were found between FGF-23 and the overall NOMI-score (consisting of five categories namely vessel morphology, reflux of contrast medium into the aorta, contrast enhancement and distension of the intestine, as well as the time to portal vein filling; p=0.05) as well as the modified NOMI-score (consisting of three categories namely vessel morphology, reflux of contrast medium into the aorta and time to portal vein filling; p=0.02). No significant correlation was found for creatinin (p=0.07), cystatin (p=0.27), cystatin C (p=0.83) and GFR (p=0.23). Logistic regression revealed a significant correlation between death and the overall NOMI-score (p=0.006) as well as the modified NOMI-score (p<0.001). No significant correlation was found for the development of acute renal failure (p=0.268).

**CONCLUSION**

FGF-23 significantly correlates with the development of NOMI. Furthermore the applied scoring system allows to predict fatal outcome in NOMI patients.

**CLINICAL RELEVANCE/APPLICATION**

FGF-23 plays a predictive value for the development of NOMI and correlates significantly with the Homburger-NOMI-Score.

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### SSA24-05

**Clinical Routinization of Spectral CT with Individualized Scan Protocol in Abdomen: Image Quality and Radiation Dosage Comparison with Conventional 120kVp Scans**

Chen Xiaoxia MMed (Presenter): Nothing to Disclose, Lei Yuxin MMed: Nothing to Disclose, Tian Qian MMed: Nothing to Disclose, Jia Yongjun MMed: Nothing to Disclose, Tian Xin MMed: Nothing to Disclose

**PURPOSE**

To evaluate the feasibility of routinizing spectral CT in abdominal application with individualized scan protocol by comparing image noise and radiation dose of conventional 120kVp scans.

**METHOD AND MATERIALS**

Prospectively randomized 39 patients (BMI: 23.08±3.58) who require contrast-enhanced CT scans in the abdomen to 2 groups: group 1 (n=20) with 120kVp for the plain phase and spectral CT for the enhanced portal venous phase (VP); group 2 (n=19) with spectral CT for plain phase and 120kVp for VP. For the 120kVp scan, the tube current (mA) was automatically adjusted to achieve noise index (NI) of 10, and for spectral CT, a mA was selected based on the average of the min and max mA from the 120kVp mA table for NI=10. Scan ranges were 250mm for both groups. CT dose index (CTDI) and effective dose was recorded. Images of 5mm thickness were reconstructed with 50%ASIR in both groups. Image standard deviation (SD) for the liver parenchyma, erector spinae, fat and portal vein on the conventional 120kVp polychromatic images and 70keV monochromatic images from spectral CT was measured and compared with t-test.

**RESULTS**

The CTDI and effective dose were (13.32±1.19mGy and 6.19±0.55mSv) for spectral CT, about 10% lower than the respective value of (14.35±4.66mGy and 6.68±2.17mSv) for the 120kVp CT. The SD values (in HU) in the spectral CT images were 5.01±0.48, 4.93±0.77, 5.16±0.93 and 5.81±1.14 for the liver parenchyma, erector spinae, fat and portal vein, respectively. These values were statistically lower than the respective values of 6.69±0.85, 6.05±1.86, 5.74±1.09 and 7.44±1.31 in the conventional 120kVp images (p<0.01).

**CONCLUSION**

With individualized scan protocol, spectral CT provides monochromatic images with lower image noise at the same or lower radiation dose in comparison with the conventional 120kVp scans. The lower dose scan protocol makes it feasible to routinize spectral CT in abdominal applications.

**CLINICAL RELEVANCE/APPLICATION**

Spectral CT with individualized low dose scan protocol can be routinely used in abdominal applications.

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### SSA24-06

**Prediction of Renal Function Impairment of Donors after Kidney Transplantation: Analysis by Using Abdominal Aortic Calcification under Propensity Score Matching**

Min-Yung Chang MD (Presenter): Nothing to Disclose, Sung Yoon Park: Nothing to Disclose, Young Eun Yoon: Nothing to Disclose, Woong Kyu Han: Nothing to Disclose, Dae Chul Jung: Nothing to Disclose, Young Taik Oh MD: Nothing to Disclose

**PURPOSE**

To analyze whether the presence or amount of abdominal aortic calcification (AAC) could predict renal function impairment of donors after kidney transplantation.

**METHOD AND MATERIALS**

Between 2010 and 2013, 287 donors undergoing nephrectomy were enrolled. The calcium score (CS) of AAC was quantitatively measured with Agatston score on CT angiography. The donors were divided into AAC (CS>0, n=238) and non-AAC (CS=0, n=49) groups. The propensity score matching was conducted in terms of age, sex, and body mass index. The estimating glomerular filtration rate (eGFR) was measured before, and 1-week,
1-month, 3-month, and 6-month after transplantation. Between two groups, pre- and postoperative eGFRs were compared before and after propensity score matching, respectively.

RESULTS
The mean CS was 185.5 ± 263.3 in ACC and 0 in non-ACC (p<0.05). Before propensity score matching, all of pre- and postoperative eGFRs were different between two groups (p<0.05). After propensity score matching, those differences of eGFR disappeared (p>0.05). The presence of AAC was not an indicator for predicting renal function impairment under propensity score matching (p>0.05). However, among AAC group, CS more than 100 was related to renal function impairment as compared to CS of 100 or less (p=0.035). In multivariable analysis, CS more than 100 (OR=12.4, p=0.017) and preoperative eGFR (OR=0.829, p=0.001) were associated with the occurrence of chronic kidney disease (CKD; eGFR<60mL/min/1.73 m² at 6-month postoperatively)

CONCLUSION
The calcium score more than 100 of abdominal aorta may be a predictor of CKD occurrence after kidney transplantation although the presence of abdominal aortic calcification itself may not be related to postoperative renal function impairment.

CLINICAL RELEVANCE/APPLICATION
In renal donors, preoperative CT evaluation in terms of abdominal aortic calcification may help predict renal function impairment after kidney transplantation, which information may allow clinicians to plan the follow-up strategy for donors

SSA24-07
Non-invasive Ultrasound Elastography: Feasibility of Using Shear Stress and Axial Deformation as Parameters to Discriminate between Symptomatic and Asymptomatic Carotid Plaques

Yang Ju MD (Presenter): Nothing to Disclose, Cyrille Naim MD: Nothing to Disclose, Marie-Helene Roy-Cardinal PhD, BEng: Nothing to Disclose, Marie-France Giroux MD: Research Grant, Johnson & Johnson Research Grant, BIOTRONIK GmbH & Co KG Stockholder, Abbott Laboratories, Guy Cloutier PhD: Nothing to Disclose, Gilles P. Soulez MD: Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Cook Group Incorporated Research Grant, Object Research Systems Inc

PURPOSE
To evaluate the ability of non-invasive vascular elastography (NIVE) shear stress and axial deformation parameter analysis to discriminate between symptomatic and asymptomatic carotid plaques.

METHOD AND MATERIALS
A total of sixty-four subjects including 18 women (28.1%) and 46 men (71.9 %) ages from 49 to 86 years (average of 70) with 50% or greater carotid stenosis (average of 68.8%; range from 50 to 100%) underwent doppler imaging of internal carotid arteries. A subgroup of 24 patients had neurological symptoms within three months prior to one year after initial examination and were considered as symptomatic; the remainder 40 patients were considered as asymptomatic. Carotid plaques were segmented on ultrasound images and elastograms over multiple heart cycles were computed with NIVE. The axial shear and deformation values were then estimated. Association between shear stress and deformation with symptomatology were estimated using Mann-Whitney for non-normal distribution of data.

RESULTS
The analysis of maximum axial shear strain showed a statistically significant difference between symptomatic and asymptomatic plaques (0.36 ± 0.17 vs 0.44 ± 0.17; P = 0.020). There was also a statistically significant difference between symptomatic and asymptomatic plaques when we compared the following parameter: Minimum Axial Deformation (-0.44 ± 0.24 vs -0.58 ± 0.23; P = 0.012), Maximal Axial Deformation (0.42 ± 0.23 vs 0.57 ± 0.20; P = 0.001), Range of Cumulated Axial Deformation (1.32 ± 0.82 vs 1.84 ± 0.75; P = 0.005) and Minimum Strain Rate (-1.56 ± 0.70 vs -2.27 ± 1.30; P = 0.016).

CONCLUSION
Ultrasound NIVE is feasible in patients with significant carotid stenosis and could be used as a tool to discriminate symptomatic from asymptomatic patients using such parameters as shear strain and axial deformation.

CLINICAL RELEVANCE/APPLICATION
Non-invasive vascular ultrasound could be a useful complementary tool in the identification of patients with significant carotid stenosis who could benefit from surgical treatment.

SSA24-08
Ultrasound Examination after Creation of Dialysis Arteriovenous Grafts Forecasts Their Lifespan

Jan Malik (Presenter): Nothing to Disclose, Jaroslav Kudlicka: Nothing to Disclose

PURPOSE
The patency of arteriovenous grafts (AVG) for hemodialysis is mostly limited by stenoses. They decrease the blood flow, with the risk of dialyzed blood recirculation and of thrombosis with access failure. Some risk factors for shorter AVG lifespan are already known and include diabetes mellitus, history of repeated interventions and others. Identification of further risk factors could identify subjects, which would profit from AVG surveillance programs. We hypothesized that abnormal ultrasound (US) finding just after AVG creation would determine
METHOD AND MATERIALS

We examined our AVG subjects within 40 days after AVG creation and followed them up for years with US surveillance every 3 months and recorded interventions. According to US finding the AVGs were divided into three groups: 1. normal finding, 2. non-significant stenosis and 3. hemodynamically significant stenosis. The primary endpoint of the study was cumulative AVG patency that is the time interval since creation until final AVG loss. The data were analyzed by Log-rank (Mantel-Cox) test and Student's t-test and visualized by survival graphs.

RESULTS

Overall, we included 360 AVGs. Median follow up was 565 days. Normal ultrasonographic finding was in 265 cases (78%), non-significant stenosis was found in 46 (13%) cases and significant stenosis in 29 (9%) cases. The longest cumulative patency was observed in patients, which had normal US findings at inclusion and it was significantly longer than in non-significant stenosis (p = 0.04); the latter group had longer patency than significant stenosis patients (p=0.03). Survival of normal findings and nonsignificant stenosis groups differed significantly after 443 days (p=0.03) in favor of normal findings as well as the mean time of the first intervention [(334 vs. 147 days after AVG creation (p<0.0001), respectively]. Non-significant and significant stenosis groups differed in AVG survival after 453 days (p=0.04) in favor of the former group, which also had longer intervention/free interval (147 vs. 82 days, p=0.05).

CONCLUSION

Early US examination of AVGs identifies subjects at higher risk of access loss. Further research is needed to find out if more frequent surveillance or re-do surgery could prolong the AVG lifespan of these patients.

CLINICAL RELEVANCE/APPLICATION

The presence of any stenosis at early ultrasonography of AVGs is associated with poorer prognosis despite its successful therapy.


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

PURPOSE

Previous studies have demonstrated that calculated low keV monoenergetic datasets from Dual energy (DE)CT angiography of the lower extremity can significantly improve contrast-to-noise ratio (CNR) when compared to polychromatic images (PEI). However, monoenergetic ultra-low keV datasets below 60 keV did not lead to improved CNR due to the dramatic increase in image noise at lower keV levels. The recently introduced frequency-split technique combines the lower spatial frequency stack at low keV for high contrast with the high spatial frequency stack for image noise at high keV levels to calculate noise-reduced images at ultra-low keV levels below 60 keV. The aim of this study was to evaluate the objective image quality of ultra-low keV virtual monoenergetic images (MEIs) calculated from lower extremity DECT angiography data.

METHOD AND MATERIALS

20 patients (15 male; mean age 73±13 years) who underwent DECT angiography of the lower extremity were retrospectively included in this study. MEIs from 40 to 120 keV were reconstructed using the frequency-split technique. Signal intensity, noise, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were assessed in external iliac, femoral, popliteal, and lower leg arteries. Comparisons between MEIs and PEIs were performed using a Mann-Whitney U test.

RESULTS

120 arteries were evaluated. 60, 50 and 40 keV images resulted in the greatest improvements in vessel attenuation (+26%, +85%, +180% all p < 0.05) and SNR (+53%, +48%, +48%, all p < 0.05) compared to PEIs. The highest CNR values were found in 50 keV MEIs (18.6 ± 10.4 averaged over all arteries), which were significantly higher compared to PEI (11.7 ± 6.9 averaged over all arteries, all p < 0.05).

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

With a frequency split approach, 40, 50 and 60 keV MEIs provide improved objective image quality in DECT lower extremity angiography compared to standard PEI and should therefore be considered for clinical use when DECT angiography of the lower extremity vessels is performed.
**Sub-Events**

**VSPD11-01  **Congenital Spinal Anomalies  
Erin Simon Schwartz MD (Presenter): Nothing to Disclose  
**LEARNING OBJECTIVES**  
1) To review the relevant developmental embryology and an easily implemented clinico-radiological classification system for improvement in the understanding and diagnosis of congenital spinal anomalies  
**ABSTRACT**  
Disruption of the process of neurulation of the developing spinal cord and its surroundings results in an array of dysmorphology. An understanding of the embroyological processes, and the variety of appearances that result when they occur abnormally, will allow the radiologist to more confidently and accurately diagnose spinal dysraphism. Clinico-radiological classification systems will be reviewed in detail, with specific case examples from both pre- and postnatal imaging.

**VSPD11-02  **Improving Fractional Anisotropy Measurements and Gray Matter/White Matter Differentiation in DTI of the Pediatric Spinal Cord Using Rigid Body Motion Correction  
Devon M. Middleton : Nothing to Disclose , Scott Hunter Faro MD (Presenter): Nothing to Disclose , Mary Jane Mulcahey : Nothing to Disclose , Feroze B. Mohamed PhD : Nothing to Disclose  
**PURPOSE**  
Spinal cord diffusion tensor imaging (DTI) is a relatively new field of research that may lead to better understanding of physiologic changes in many spinal cord pathologies. Physiological motion can create problems in DTI of the spinal cord. Spinal cord DTI is complicated by oscillation and pulsation of the cord, and by noise introduced by cardiac and respiratory motion. If motion is not corrected for, results of DTI analysis are impacted, including, false decrease in white matter fractional anisotropy (FA), poor delineation of the cord/CSF interface, and poor gray/white matter differentiation. The purpose of this work was to show efficacy of rigid body motion correction techniques in improving cord/CSF conspicuity and gray/white matter definition.  
**METHOD AND MATERIALS**  
DTI data was collected for five healthy pediatric subjects on a Siemens Verio 3T MRI scanner using an inner field of view EPI sequence with 2DRF excitations. Imaging parameters were: TE = 110 ms, TR = 7900 ms, Voxel 0.8 x 0.8 x 6 mm3, 20 diffusion directions, 3 av, 6 b0, b = 800 s/mm2. Prior to correction, a mask was applied to the center of the image to eliminate data beyond the spinal canal. First, b0 acquisitions were co-registered by rigid body transformation and averaged to create a mean b0 using SPM8. All DW images were registered to the mean b0 image using a rigid body registration method implemented in the ACID toolbox. For each subject, ROIs were drawn on FA maps for 3 adjacent axial slices to include lateral and posterior white matter and exclude gray matter. FA values were examined for both corrected and uncorrected images.  
**RESULTS**  
Clear improvements were visible in cord/CSF delineation and in gray/white matter definition in FA maps after motion correction. In some cases, improvement was dramatic, making initially unusable data clear. In all cases, corrected images showed higher FA values for white matter ROIs compared with uncorrected, ranging from 3-38% increases.  
**CONCLUSION**  
Rigid body motion correction led to an increase in FA values for white matter ROIs in the corrected data of the pediatric spinal cord. Additionally, there was improved definition of cord/CSF interface and gray/white matter differentiation.  
**CLINICAL RELEVANCE/APPLICATION**
Rigid body motion correction showed an increase in FA values for white matter ROIs and improved cord/CSF interface and gray/white matter differentiation in DTI of the healthy pediatric spinal cord.

**VPD11-03**  
**Imaging Findings of Limited Dorsal Myeloschisis: Comparison with Congenital Dermal Sinus**

**So Mi Lee MD (Presenter): Nothing to Disclose, Jung-Eun Cheon MD: Nothing to Disclose, Younghun Choi MD: Nothing to Disclose, In-One Kim MD: Nothing to Disclose, Hyun-Hae Cho MD: Nothing to Disclose, Su-Mi Shin MD: Nothing to Disclose, Ji Young Kim MD: Nothing to Disclose, Sun Kyoung You MD: Nothing to Disclose**

**PURPOSE**

Limited dorsal myeloschisis (LDM) is characterized by fibroneural stalk that links the midline cutaneous lesion to the underlying cord. That is a distinctive form of spinal dysraphism, similar radiologic appearances with congenital dermal sinus (CDS). The aim of this study was to compare the neuroimaging findings between these two disease entities.

**METHOD AND MATERIALS**

We retrospectively reviewed the MR and US findings in 22 patients (12 LDM and 10 CDS) with surgically proven LDM (M: F = 2: 10, age range 15 days - 4 years) and CDS (M: F = 6: 4, age range 7 days - 16 months) from January 2012 to March 2014. The following imaging features were evaluated: location of the skin lesion, visibility of the tract along its subcutaneous and intrathecal course, ending point of the tract in the spinal canal, change in the cord location and shape, and presence of an intradural abscess or a dermoid-epidermoid tumor.

**RESULTS**

All of the skin lesions in both groups were located at the lumbosacral region. In ten (83%) of twelve patients with LDM, both subcutaneous and intrathecal portion of the tract were clearly visualized, while in nine (90%) of ten patients with CDS, the tract was indistinct in the intrathecal portion. In all 12 LDM patients, the tracts ended with attachment to the spinal cord just above the conus, while in eight patients with CDS, the tract ended within the spinal canal; dermoid-epidermoid tumors (n=5), filum terminale (n=1), conus medullaris (n=2). In the remaining two patients with CDS, the tract did not extend into the spinal canal: ended at the dura without passing through it (n=1), end blindly in the subcutaneous fat layer (n=1). In the LDM group, the conus medullaris was lying below L2 in nine (75%) patients and the cord showed dorsal tenting at the level of the tract attachment in ten (83%) patients. The level of the conus medullaris in the CDS was obscured by an intraspinal abscess or an infected dermoid-epidermoid in four (40%) patients and was low-lying in three (30%) patients with CDS. None of the LDM patients had an intradural infection or a dermoid-epidermoid tumor.

**CONCLUSION**

LDM showed a clearly visible intrathecal tract that was attached to the spinal cord just above the conus and dorsal tenting of the cord at the tract attachment site. LDM was not associated with an intradural infection or a dermoid-epidermoid, unlike CDS.

**CLINICAL RELEVANCE/APPLICATION**

MRI can be helpful in differential diagnosis of LDM and CDS.

**VPD11-05**  
**Amide Proton Transfer (APT) Imaging of Brain Infection in Children**

**Hong Zhang MD (Presenter): Nothing to Disclose, Na Xu Zhao PhD: Nothing to Disclose, Jinyuan Zhou PhD: Nothing to Disclose, Yun Peng MD: Nothing to Disclose**

**PURPOSE**

The study was performed with the aim of characterizing infectious lesions of different aetiology using protein-based APT imaging.

**METHOD AND MATERIALS**

Children with brain infection (one with tuberculous abscess (TA), one with pyogenic abscess (PA); and three with viral encephalitis (VA)) that were diagnosed on the basis of laboratory, clinical, and radiologic findings were recruited in this study. MRI data was acquired using a Philips 3T MRI scanner, including multiple MRI scans, T1-weighted, T2-weighted, isotropic apparent diffusion constant (ADC), Gd-T1w, and APT-weighted. APTw MRI imaging was based on the single-slice, single-shot TSE (saturation time = 800 ms; saturation power = 2 μT). The APT effect was quantified using an MT-ratio asymmetry analysis at the offset of 3.5 ppm: MTrasym(3.5ppm), and displayed using a window of -4% to 4%. The Gd-T1w image was used as the reference of ROI analysis.

**RESULTS**

Both TA and PA demonstrated clear gadolinium enhancement. The APTw signal was high in the gadolinium-enhancing rim of the lesion (2.30±0.07% in TA and 2.27±0.17% in PA), compared to peripheral edema (0.58±0.07% in TA and 0.91±0.03% in PA) and contralateral normal-appearing brain tissue (0.37±0.03% in TA and 0.45±0.03% in PA). This hyperintense rim on APTw MRI may be due to the inflammatory cellular infiltrate and granulomas, leading increased content of cellular proteins and peptides. Most non-enhancing areas on T1w may be liquefactive necrosis of the lesion, showing APTw iso-intensity. The portion inside the center of the lesion showing an APTw hyperintensity may be due to a large amount of
neutrophils and proteins, which are released in the necrotic cavity. For VE, T2w showed a symmetric hyperintense lesion in the basal ganglia. The lesion shows no enhancement on Gd-T1w and iso-intensity on APTw, which may mainly be associated with vasogenic/interstitial collection of fluid. Thus, APT-MR imaging may help better distinguish the heterogeneous portions of infectious lesions.

CONCLUSION

These initial data show that APT-MR imaging is an important technique for the detection and characterization of infectious lesions of different aetiology.

CLINICAL RELEVANCE/APPLICATION

APT-MRI may be a more sensitive biomarker in pediatric brain infection.

VSPD11-07

**Evaluation of the Hippocampus in Survivors of Bilirubin Encephalopathy**

Li-tal Pratt MD (Presenter): Nothing to Disclose, Prakash Muthusami MBBS, MD: Nothing to Disclose, Aideen Moore: Nothing to Disclose, William Halliday: Nothing to Disclose, Adrian James: Nothing to Disclose, Blake Papsin: Nothing to Disclose, Susan I. Blaser MD: Nothing to Disclose

PURPOSE

Abnormal signal and volume loss within globi pallidi and subthalamic nuclei reflective of neuronal apoptosis are present on MRI studies of chronic bilirubin encephalopathy (BE) patients. Although hippocampal signal changes and atrophy are uncommonly reported, we noted that the hippocampus is frequently abnormal as well. We retrospectively evaluated MRI studies of patients with chronic BE, providing qualitative/quantitative in vivo hippocampus assessment and imaging/pathologic specimens illustrations. We also assessed interval volumetric MRI hippocampal measurements between neonatal and post-neonatal periods.

METHOD AND MATERIALS

We reviewed 79 MRI studies of 44 children with a history of neonatal BE. The patients were divided into two groups: (1=acute disorder) Neonates (<1 month old) with increased bilirubin levels or encephalopathy (mean/SD age, 39/3 weeks GA) and (2=chronic disorder) Infants (≥1 month old) and children imaged for movement disorders or auditory neuropathy in whom features of BE were found (mean/SD age, 27/30 months). Imaging studies were evaluated qualitatively for hippocampal size and signal by two reviewers (consensus for final results); and quantitatively, by performing volumetric measurements of the hippocampi using a computerized segmentation method (Analyze 11.0). Comparison of hippocampal volumetric measurements was performed with 61 age-matched control patients imaged for unrelated skin lesions or headaches.

RESULTS

Hippocampal atrophy was observed in 34/57 (60%) of group 2 patients. Abnormal T2 hyperintense hippocampal signal was observed in 31/57 (54%), while hippocampal signal was normal in controls. Hippocampal volumes in group 1 neonates were similar to age-matched controls (mean/SD 939/201 and 983/185 respectively, P=0.35). Comparison between group 2 patients and age-matched controls measurements over time demonstrated a decrease in hippocampal volume (mean/SD 1559/446 and 2360/522, respectively, P<0.01).

CONCLUSION

Hippocampal involvement in BE is common, leading to sclerosis (chronic volume loss and signal abnormalities) in group 2 patients, suggesting progression of hippocampal atrophy over time in this population.

CLINICAL RELEVANCE/APPLICATION

Bilirubin encephalopathy (BE) has an impact on learning and memory, quantitative and qualitative hippocampal assessment on MRI studies may provide additional tools for cognitive evaluation in BE survivors.

VSPD11-08

**Glutamate, Aspartate and GABA are Reduced during Therapeutic Hypothermia in Neonates with Hypoxic-ischemic Encephalopathy**

Roberto Llorens Salvador (Presenter): Nothing to Disclose, Stefan Bluml PhD: Nothing to Disclose, Jessica Lee Wisnowski PhD: Nothing to Disclose, Tai-Wei Wu: Nothing to Disclose, Aaron Jordan Reitman DO: Nothing to Disclose, Robert Giesler RN: Nothing to Disclose, Claire McLean: Nothing to Disclose, Philip Friedlich: Nothing to Disclose, Eugenia Ho MD: Nothing to Disclose, Ashok Panigrahy MD: Nothing to Disclose, Marvin Dale Nelson MD: Nothing to Disclose, Istvan Seri MD, PhD: Grant, Covidien AG

PURPOSE

Therapeutic hypothermia (TH) aims to mitigate the effects of hypoxic-ischemic injury (HIE) in neonates by exerting favorable effects on multiple pathways contributing to brain injury such as energy metabolism and excitatory amino acid metabolism. Here we explored (a) the feasibility of quantifying excitatory and inhibitory neurotransmitters in patients undergoing TH in vivo and (b) the impact of TH on neurotransmitter concentrations.

METHOD AND MATERIALS

15 newborns (mean gestational age = 38.9±1.9) with moderate (m)-HIE (n=12) and severe (s)-HIE (n=3), based on Sarnat staging, were examined by MR spectroscopy (MRS) during and after TH. The study during TH
typically occurred between 24-48 h into 72 hours of hypothermia treatment at 33.5 °C. Hypothermia was maintained using a Blanketrol system (CSZ Medical; modified with extension tubing) and continuously monitored with a rectal temperature probe. Post-HT studies were carried out 3-5 days after rewarming. MR spectra were obtained using a single voxel PRESS sequence (echo time =35ms, repetition time =2000ms) with regions of interest localized to the basal ganglia, thalamus and medial parietal grey matter. Absolute concentrations were quantitated using LCModel (V6.3-1C, Stephen Provencher Inc.). All studies were performed on a Philips 3.0T Achieva scanner using a neonatal SENSE coil. Paired t-tests were used to compare concentrations during and after TH while non-parametric tests (Mann-Whitney U) were used to compare neonates with s-HIE and m-HIE (SPSS v.21, IBM Corporation).

RESULTS
Spectra of high quality during and after TH were obtained for all patients. Glutamate, aspartate and GABA concentrations were reduced by 20%, 11% and 24%, respectively during TH compared to afterwards (all p < 0.5). However, aspartate was reduced by 17% among neonates with s-HIE (p < 0.02). Glutamine was elevated to 178% during TH among neonates with s-HIE (p < 0.02).

CONCLUSION
Therapeutic hypothermia, now widely implemented for neuroprotection in neonatal HIE, is associated with reduced concentrations of excitatory and inhibitory neurotransmitters. However, glutamine concentrations remain elevated among neonates with s-HIE, indicating ongoing excitotoxicity and glutamate detoxification by conversion to glutamine.

CLINICAL RELEVANCE/APPLICATION
Early MRI/S may aid in the management of neonatal HIE and suggests an adjuvant role for glutamate receptor antagonists in neonates with s-HIE.

VSPD11-09 Imaging of Neurovascular Conditions in the Pediatric Spine
Richard Lee Robertson MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To understand the unique imaging characteristics of neurovascular disorders affecting the pediatric spine and spinal cord

ABSTRACT
This discussion will focus on neurovascular conditions that are unique to children as well as pediatric manifestations of spinal vascular disorders seen in both children and adults. There are a variety of neurovascular conditions affecting the spine and spinal cord in children. Neurovascular disorders in children may be syndromic or non-syndromic and, depending on the nature of the abnormality, may result in ischemic or hemorrhagic injury to the spinal cord. Recognition of the unique features of these conditions is essential in optimal imaging evaluation of the lesions. Often, non-invasive imaging is sufficient to establish a diagnosis although conventional, catheter-based angiography may be required for a complete diagnostic evaluation or as part of an endovascular approach to treatment.

Technical Exhibits Grand Opening Ceremony

ABSTRACT
The technical exhibits will open with a ceremony where leaders from RSNA and industry partners will celebrate a century of the technology and innovation that changed the world of radiology.

RCA11
Data Management and Analysis with Excel for Research and for Practicing Quality Improvement - A Hands-On Tutorial

Refresher/Informatics

IN

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

Participants
Jaydev Kardam Dave PhD, MS (Presenter): Nothing to Disclose
Raja Gali MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Describe techniques for creating a spreadsheet to allow trouble-free data analysis. 2) Demonstrate key data management
skills. 3) Describe tools for performing basic descriptive statistics. 4) Identify how to perform simple statistical tests and perform these tests with a sample dataset. 5) Understand how bad data (or bad data acquisition techniques) may corrupt subsequent data analyses. 6) Practice data plotting/representation techniques. 7) Identify differences between a spreadsheet and a database. 8) Identify statistical tasks that require more sophisticated software. Pre-requisites: Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed.

ABSTRACT

A spreadsheet program is commonly employed to collect and organize data for practicing quality improvement, for research, and for other purposes. In this refresher course, we will demonstrate to a user, familiar with Microsoft Excel environment, how this spreadsheet program may be used for such purposes. The course will begin with describing efficient approach for data acquisition and highlight key data management skills; and with reviewing common errors that may be avoided during data logging. Then we will provide a brief introduction on basic descriptive tests before proceeding with a hands-on tutorial using a sample dataset to calculate basic descriptive statistics, and to perform basic statistical tests like t-test, chi-square test, correlation analysis, etc. Effect of corrupted data on such analysis will also be demonstrated. The final hands-on component for this course will include data plotting and representation including the use of pivot tables. The course will conclude with a discussion on identifying differences between a spreadsheet and a database, limitations of a spreadsheet program and avenues where a dedicated statistical software program would be more beneficial. A list of some of these dedicated statistical software programs for analyses will also be provided. Pre-requisites: Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed.

RCB11

Mobile Computing for Decision Support and Learning While You Work (Hands-on)

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 11:00 AM - 12:30 PM  Location: S401CD

Participants

Michael Patrick D'Alessandro MD (Presenter): Nothing to Disclose
Jeffrey R. Galvin MD (Presenter): Nothing to Disclose
James J. Choi MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Learn to perform decision support on a mobile device at the point-of-care to answer questions that arise during clinical work and thus tie learning to practice and receive point-of-care CME for it. 2) Learn to read Ebooks and educational apps on a mobile device. 3) Learn to stay up-to-date with radiology journals and society news on a mobile device. 4) Learn to manage a library of journal articles on a mobile device. 5) Learn to view podcasts and vodcasts on a mobile device. 6) Learn to maintain a learning portfolio / teaching file on a mobile device.

ABSTRACT

Acquiring and maintaining competency in the practice of radiology requires a program of continuous learning. This continuous learning would be most effectively performed during clinical work, when it has the greatest potential for modifying physicians' knowledge, attitudes, and behaviors as well as positively affecting patients' care, outcomes, and lives. The advent of mobile computing, and the rich assortment of authoritative radiology resources it allows easy access to, now allows this dream to become reality. This course will be a hands-on, state-of-the-art review that will teach the radiologist how to use mobile computing to perform continuous learning while you work. The Apple iOS, Google Android and Microsoft Windows Phone platforms will be covered. Participants will be encouraged to bring their own mobile phone or tablet to the course and will be asked before the course to download into their mobile device several free apps that will be demonstrated, so they can follow along during the session. These free apps are listed on the course handout at http://www.radiologyebooks.com/rsna.html

URL's

http://www.radiologyebooks.com/rsna.html

RCC11

Fundamentals of 3D Printing

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 11:00 AM - 12:30 PM  Location: S501ABC

Participants

Moderator
Vincent B. Ho MD, MBA : In-kind support, General Electric Company
Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation

Sub-Events

RCC11A

Uses of 3D Printing in Radiology Practice: An Overview

Vincent B. Ho MD, MBA (Presenter): In-kind support, General Electric Company

LEARNING OBJECTIVES

1) To list potential opportunities for 3D printing in Radiology. 2) To describe requirements for a 3D printing service.
ABSTRACT
Radiology departments are uniquely positioned to perform 3D printing. In this presentation, a practical overview of this emerging technology and its opportunities will be discussed.

RCC11B

3D Printing Technologies
Peter Constantine Liacouras PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the basic principle of Additive Manufacturing (3D Printing) and how it differs from subtractive technology. 2) Understand the principles of the software needed to convert medical images into three-dimensional printed models and what factors contribute to the quality of each model. 3) Become familiar with the different types of Additive Manufacturing (3D Printing) technologies.

ABSTRACT
This presentation will provide a novice to Additive Manufacturing the general knowledge applicable to the medical field. The basic principles of additive manufacturing (3D Printing) will be discussed along with the different technologies which encompass the field. The steps of converting radiographic images into three-dimensional printable files and the differences between the multitude of additive manufacturing techniques will be the primary focuses.

RCC11C

3D Printing Software
Timothy Mueller (Presenter): Nothing to Disclose

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

ABSTRACT
1. Identify the application of basic anatomic, pathologic, and physiologic principles to specific disease processes, and diagnostic and therapeutic procedures. 2. Apply the physics of particular imaging and therapeutic modalities to improve quality and efficacy while minimizing patient risk. 3. Analyze imaging and therapeutic techniques and apply this knowledge to protocol development, patient management/safety, and cost. 4. Demonstrate understanding of the influence of socioeconomic issues on current and future practice patterns. 5. Compare indications and contraindications of specific image-guided procedures.

RCC11D

Techniques for Current 3D Printing Applications
Gerald Thomas Grant DMD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Introduce the current use of 3D Printing in support of patient care, restoration, and rehabilitation. 2) Identify the requirements for use of 3D Printing technologies in support of patient care.

ABSTRACT
Additive manufacturing technologies, commonly known as 3D printing, have proven to be ideal technologies to produce medical models, surgical guides, custom implants, as well as support for occupational health and prosthetics. This presentation will review the current of 3D Printing techniques in the development and application in support of reconstruction and rehabilitation of Wounded Warriors.

URL’s
http://www.wrnmmc.capmed.mil/ResearchEducation/3DMAC/SitePages/home.aspx

RCC11E

Implementing 3D Printing into a Clinical Practice
Frank John Rybicki MD, PhD (Presenter): Research Grant, Toshiba Corporation

LEARNING OBJECTIVES
1) To review sets of clinical images that will be amenable for 3D printing. 2) To establish within this group a set of clinical images that would be expected to be of clinical benefit with a 3D model "in hand".

ABSTRACT
Roughly 10 years ago, the "3D Lab" in diagnostic radiology was created to implement 3D visualization tools that, at the time, were highly innovative. At present, these software packages to view anatomy, pathology, and
to perform advanced image post-processing are fundamental to the practice and success of radiology. In fact, much of the work of the 3D lab 10 years ago is now part of individual thin clients that are part of routine workflow as opposed to a separate "lab" for a radiology practice. The next generation 3D Lab will center around 3D printing. This is based on the increased utilization of 3D printing, and the growing need for these models. This need is largely, but not exclusively, for planning interventions. This lecture addresses the implementation of these devices to our practice and is intended as an adjunct to the 3D printing hands-on workshops.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx
PURPOSE
To evaluate the diagnostic performance of lesion-to-fat elasticity ratio (Eratio) according to the location of the reference area in shear-wave elastography (SWE) for the diagnosis of breast cancers.

METHOD AND MATERIALS
A total of 257 breast masses in 250 women who underwent SWE before core biopsy or surgery from February 2013 to August 2013 were retrospectively analyzed. For each mass, multiple quantitative Eratios were measured with a fixed region of interest (ROI) for the mass along with multiple ROIs for the surrounding normal fat in different locations. Logistic regression analysis with random effect was used to determine that Eratio was independently associated with breast cancers considering the location of ROI for the fat (depth, laterality, the actual or vertical distance from lesion, and the actual or vertical distance from the ROI of lesion). Quantitative mean (Emean) and maximum (Emax) elasticity values of the reference fat were divided into 4 groups according to their 25th percentile, median, and 75th percentile. Diagnostic performance of each group was evaluated using the area under the ROC curve (AUC).

RESULTS
At logistic regression analysis, Eratio showed a significant difference between benign and malignant lesions (P<0.0001), irrespective of the location of ROI for the fat (depth, laterality, the actual or vertical distance from the lesion, and the actual or vertical distance from the ROI of lesion). The 25th percentile, median, and 75th percentile of elasticity values of fat were 11.5 kPa, 16.9 kPa, and 25.3 kPa for Emean and 16.3 kPa, 24.7 kPa, and 35.7 kPa for Emax, respectively. The AUC of each group (<25th percentile, 25th percentile~median, median~75th percentile, and ≥75th percentile) was 0.973, 0.982, 0.967, and 0.954 for Emean and 0.977, 0.967, 0.966, and 0.957 for Emax, respectively. There was no significant difference in AUC among different 4 groups.

CONCLUSION
Eratio was independently associated with breast cancers when considering the location of the reference area. Eratio showed good diagnostic performance which was not influenced by the difference in elasticity value of reference fat.

CLINICAL RELEVANCE/APPLICATION
Eratio in SWE can be expected to reduce the effect of precompression. Eratio was useful for the diagnosis of breast cancers with good performance independent of the location of reference area.

Tumor Stiffness on Sonoelastography and the Risk of Recurrence in Early Breast Cancer Patients
(Station #2)
Ann Yi MD, PhD (Presenter): Nothing to Disclose, Woo Kyung Moon: Nothing to Disclose

PURPOSE
To evaluate whether the breast cancer stiffness according to the immunohistochemistric (IHC) subtypes is associated with the risk of recurrence in early breast cancer patients.

METHOD AND MATERIALS
Between January, 2006 and December, 2009, 164 consecutive women (mean age 50.5 years; range 27 - 78 years) who underwent ultrasound (US), sonoelastography and surgery for clinically T1-2 (mean US size 2.1 mm; range 5 - 40 mm), N0 breast cancers. Prospectively recorded elasticity scores of tumor (EST) were correlated with histopathology including IHC subtypes (luminal [ER+ and/or PR+], HER2 [ER- and PR-, HER2+], triple negative [ER-, PR-, and HER2-]) using Fisher's exact test. Cox proportional hazards model was used to calculate adjusted hazard ratio (HR) of EST for recurrence after controlling for clinicopathologic variables including age, menopausal status, tumor size, tumor histology, nuclear grade, nodal status, lymphovascular invasion status, resection margin status, surgery type, and adjuvant treatment. Recurrence-free survival (RFS) outcomes estimated by Kaplan-Meier curve were compared between low EST (scores 1,2, and 3) and high EST (scores 4 and 5) groups using log-rank test.

RESULTS
Among 164 patients, 116 (70.7%) had luminal, 14 (8.5%) had HER2, and 34 (20.7%) had triple negative tumors. The mean value of ESTs were significantly different between IHC subtypes (4.22±0.94 in luminal, 3.71±0.94 in HER2, 3.82±0.99 in triple negative; P = .036), whereas recurrence rates were not (2.6% [3/116] in luminal, 14.3% [2/14] in HER2, 5.9% [2/32] in triple negative; P = .108). At multivariate cox analysis, high EST was independently associated with worse RFS outcome (HR, 1.63; P = .032) in luminal subtype, whereas were not in HER2 (HR, 1.36; P = .696) and triple negative (HR, 0.75; P = .677) subtypes. 77 patients with luminal high EST tumors had 1.5 times (log rank, 1.51; P = .022) worse RFS outcome than 39 patients with luminal low EST tumors.

CONCLUSION
High elasticity score of luminal breast cancer might be a risk factor of recurrence in clinically T1-2, N0 breast cancer patients.
CLINICAL RELEVANCE/APPLICATION

Sonoelastography can be used to determine a subgroup of early breast cancer patients with a high risk of recurrence.

**BRS239**

**Do Women with an Abnormal Sonographic Axillary Lymph Node and no Breast Malignancy Need a Biopsy? (Station #3)**

Yoav Amitai MD (Presenter): Nothing to Disclose, Tehillah Menes MD: Nothing to Disclose, Orit Golan MD, PHD: Nothing to Disclose

**PURPOSE**

Abnormal axillary lymph nodes on ultrasound are not a rare finding. We examined clinical and imaging characteristics, in order to define patients who may safely be followed.

**METHOD AND MATERIALS**

Clinical, imaging and pathology data were collected for 167 consecutive patients who underwent sonographic guided needle biopsy of an abnormal lymph node between 2008 and 2013. Malignancy rates were examined for different clinical settings: palpable axillary mass; history of breast cancer; findings suggestive of a systemic disease; and those with a breast finding of low suspicion or an incidental abnormal axillary lymph node. Patients with known breast cancer and those with a highly suspicious breast mass were excluded.

**RESULTS**

Thirteen patients (8%) were found to have a malignant result (10-carcinoma; 2-lymphoma; 1-malignant spindle cell tumor). Malignancy increased with age (Mean age in those with benign pathology was 54 vs. 69 in malignancy, P<0.001). Malignancy rates varied with clinical setting: Axillary mass (8, 26%); history of breast cancer (2, 11%); systemic disease (0%) and breast finding of low suspicion or incidental abnormal lymph node on screening (1, 1%). Malignancy was associated with lymph node size and cortical thickness. Low rates of malignancy were found when the cortex was <6mm (1, 0.8%). The most important imaging finding associated with malignancy was the lack of a preserved hilum, in which case almost a third (11, 31%) of the biopsies were malignant.

**CONCLUSION**

Only 1 of 85 women with a breast finding of low suspicion or an incidental abnormal axillary lymph node, was found to have malignancy. In this case the lymph node had no hilum. In women without breast cancer or a highly suspicious breast mass, more stringent criteria should be used when evaluating an abnormal axillary lymph node on sonography, as the malignancy rates are very low (1%).

CLINICAL RELEVANCE/APPLICATION

In women being evaluated for breast findings, such as a low suspicion breast mass, and in those undergoing screening studies, the finding of an abnormal axillary lymph node does not usually require a needle biopsy as long as the lymph node has a preserved hilum and cortical thickness is under 6mm.

**BRS240**

**Reducing False Positive Biopsy Rate of Screening Ultrasound Detected Breast Masses (Station #4)**

Jennifer F. Wells MD (Presenter): Nothing to Disclose, Regina J. Hooley MD: Nothing to Disclose, Madhavi Raghu MD: Nothing to Disclose, Melissa Angeline Durand MD: Nothing to Disclose, Paul H. Levesque MD: Nothing to Disclose, Liva Andrejeva-Wright MD: Nothing to Disclose, Laura Jean Horvath MD: Consultant, Siemens AG, Liane Elizabeth Philpotts MD: Nothing to Disclose

**PURPOSE**

The positive predictive value (PPV) of biopsy of masses detected at screening breast ultrasound (SBUS) is low compared to masses at screening mammography. The purpose of this study was to determine if biopsy can potentially be avoided in some solid masses found at SBUS.

**METHOD AND MATERIALS**

An IRB approved retrospective chart review was performed on 100 BI-RADS 4 lesions in 91 patients detected only on SBUS during 10/15/2009 - 9/26/2012. Two radiologists blindly reviewed the sonographic images of each lesion, recorded BI-RADS features, and assigned each lesion a final assessment score.

**RESULTS**

The average patient age was 53 years (range 32 - 84). The average lesion size was 8.8 mm (range of 3-30). 80/100(80%) lesions were identified on a prevalence screening exam. 96 lesions were aspirated or biopsied, yielding 5 invasive ductal carcinomas and 1 DCIS for a PPV3 of 6.3%. All cancers (6/6) had indistinct, angular, or irregular margins and hypoechogenic or heterogeneous echotecture. 5/6 cancers had a non-parallel orientation. All malignancies were assessed as BI-RADS 4B or 4C, except for the one case of DCIS assessed as BI-RADS 3 by one reader. Of the 94 benign masses, 37(39%) were circumscribed, 56(60%) were hypoechogenic, 64(68%) were oval or round, 53(56%) had a parallel orientation, and 68 (72%) had enhanced or no posterior acoustic features. The negative predictive value of an oval mass with circumscribed margins was 100%, regardless of echo pattern or posterior acoustic features. 7 retroareolar lesions were associated with a dilated duct and all...
were benign. 80/99 (81%) of cases were assigned a BI-RADS 2, 3, or 4A final assessment by at least one reader. If the lower BI-RADS score was used and these lesions were not biopsied, the PPV would have increased to 37.5% and one case of DCIS would have been downgraded to BI-RADS 3.

CONCLUSION
Retrospective blinded review showed many BI-RADS 4 lesions detected on SBUS have benign features and biopsy could probably have been avoided. Most cancers detected on SBUS have suspicious US features and are correctly identified by radiologists. Solid masses detected on SBUS require careful evaluation and may benefit from double reading in order to improve specificity.

CLINICAL RELEVANCE/APPLICATION
Screening breast US is being more widely performed in the United States. Strategies are needed to improve overall diagnostic performance and decrease false positive biopsies.

BRE169

Tilting the Atlas: A Discussion of the Changes between the 4th and 5th Editions of BI-RADS (Station #5)
Sadia Choudhery MD (Presenter): Nothing to Disclose, Stephen Jacob Seiler MD: Nothing to Disclose

TEACHING POINTS
1) Provide an overview of the changes recently implemented in the 5th edition of the Breast Imaging-Reporting and Data System (BI-RADS). 2) Present a variety of cases to highlight the changes in the reporting of mammography, breast ultrasound, and magnetic resonance imaging.

TABLE OF CONTENTS/OUTLINE
1) Mammography: • Removal of percentages from breast composition • A lobular mass is now oval • Isodensity re-termed equal density • Developing asymmetry added • Calcifications are benign or suspicious, without "intermediate" or "high" probability of malignancy • Eggshell calcifications encompassed by rim calcifications • Clustered calcifications re-termed grouped 2) Ultrasound: • Inclusion of tissue composition • A lobular mass is now oval • Re-categorization of margins to circumscribed and not circumscribed • Description of breast elasticity 3) MRI: • Non-mass-like enhancement re-termed non-mass enhancement (NME) • A lobular mass is now oval • Mass margins reclassified into circumscribed and not circumscribed • Internal enhancement of a mass no longer includes enhancing septations and central enhancement • Ductal enhancement now incorporated into linear distribution of NME • Internal enhancement of NME no longer includes reticular/dendritic and stippled/punctate but clustered ring has been added 4) Uncoupling of assessment and management recommendation.

BRE109

Pre-Operative Image Guided Breast Lesion Localization - A Pictorial Review of Technique (Station #6)
Katrina Fern Lambert MD (Presenter): Nothing to Disclose, Lucy Boyd Spalluto MD: Nothing to Disclose, Erin Wyatt Kinney MD: Nothing to Disclose

TEACHING POINTS
To review indications and technique for image guided pre-operative breast lesion localization, including mammographic and sonographic guidance techniques and both standard wire localization and radioactive seed placement.

TABLE OF CONTENTS/OUTLINE
I. Review indications for wire localization
II. Illustrate technique for mammographic and sonographic guidance for wire localization with detailed photographs and diagrams to include:
   1. Documenting patient history and confirming appropriate indication for procedure
   2. Obtaining informed consent
   3. Tray set up and needle/wire demonstration
   4. Positioning patient appropriately and pre-procedural imaging
   5. Needle/wire placement
   6. Post-procedural imaging
   7. Discussion of necessary information to relay to surgeon
III. Illustrate technique for mammographic and sonographic guided radioactive seed placement with detailed photographs and diagrams to include:
   1. Documenting patient history and confirming appropriate indication for procedure
   2. Obtaining informed consent
   3. Tray set up and radioactive seed deployment device demonstration
   4. Positioning patient appropriately and pre-procedural imaging
   5. Seed placement
   6. Post-procedural imaging
   7. Discussion of necessary information to relay to surgeon
Mastering the Challenges of MRI-guided Breast Interventions; MRI-guided Biopsy and Beyond (Station #7)

Lumarie Santiago MD (Presenter): Nothing to Disclose, Mohammad Eghtedari MD, PhD: Nothing to Disclose, H. Carisa Le-Petross MD: Nothing to Disclose

TEACHING POINTS

1) Review of various types MRI guided breast interventions and their indications 2) Review the technical aspects and step by step planning of MRI guided breast biopsy 3) Describe alternate techniques for challenging MRI guided interventions and how to anticipate their utilization 4) Understanding alternate techniques that may help the radiologist troubleshoot difficult cases and prevent false negative biopsies or potential surgical biopsies

TABLE OF CONTENTS/OUTLINE

We will present a pictorial essay of our experience performing MRI guided breast interventions over the last 10 years, including management of challenging cases 1) Variable appearance of the target lesion between the diagnostic and the intervention breast MRI 2) Planning schematics generated for MRI guided interventions with and without CAD 3) When MRI guided needle localization and bracketed needle localization are indicated 4) When MRI guided marker clip placement is indicated 5) Alternate techniques addressing challenging interventions due to lesion location, presence of breast implants, multiplicity and bilaterality of lesions 5) Determination of sampling adequacy and false negatives 6) How to address clip deployment failures or migration

Radioactive Seed Localization: Why to Start a Program, the Pros and Cons of RSL vs. Wire Localization of Non Palpable Breast Lesions, How To Start a Program and How To Perform Radioactive Seed Localizations under Mammographic and Ultrasound Guidance (Station #8)

Laurie R. Margolies MD (Presenter): Consultant, FUJIFILM Holdings Corporation Consultant, Konica Minolta Group, Janet R. Szabo MD: Consultant, Siemens AG Consultant, FUJIFILM Holdings Corporation Consultant, Konica Minolta Group, Emily B. Sonnenblick MD: Nothing to Disclose, Elisa Port MD: Nothing to Disclose, Jacob Kamen PhD: Nothing to Disclose

TEACHING POINTS

1. Radioactive seed localizations are a relatively new way of localizing imaging detected breast abnormalities requiring surgical excision. They are often more convenient for the patient as well as physicians as the surgeon and radiologists schedules are uncoupled. Radioactive seed localizations also uncouple the surgeon's and radiologists pathway and multiple studies have shown a decrease in positive margin rate with seed localizations. The localization procedure is easy for the radiologist to learn. At the conclusion of this presentation the viewer will be familiar with the concept of radioactive seed localization and its pros and cons.

TABLE OF CONTENTS/OUTLINE

A. Why to consider setting up a radioactive seed localization program
B. Ins and outs of beginning a radioactive seed localization program: regulatory requirements
C. Mammographic localization
D. Ultrasound localization
E. What can go wrong, how to prevent and what to do if there is loss of a seed or transection of a seed.

Blind Spots and Pitfalls in Breast Imaging (Station #9)

Rebecca Rakow-Penner MD, PhD: Nothing to Disclose, Jade De Guzman MD (Presenter): Nothing to Disclose, Youn Jeong Kim MD: Nothing to Disclose, Ifeanyi C. Oyneacholem MD: Nothing to Disclose, Haydee Ojeda-Fournier MD: Nothing to Disclose

TEACHING POINTS


TABLE OF CONTENTS/OUTLINE

Many radiologists, specifically those without breast imaging fellowship training, are apprehensive about reading breast imaging exams due to medical legal notoriety. That being said, most breast imaging exams in the United States are still interpreted by radiologists without dedicated breast imaging training. This educational exhibit will review specific "blind spots" and common pitfalls on routine breast imaging. It will also provide a checklist for reading mammograms, breast US and breast MRI and provide an opportunity for self-assessment. 1. Introduction 2. Errors in detection v. errors in interpretation a) limited detection secondary to technical factors, b) patient factors, c) human factor 3. Blind spots by a) mammogram, b) US and c) dynamic contrast enhanced breast MRI 4. Algorithmic approach to prevent missed cancer 5. Interactive multiple-choice case review 6. Conclusion
**Clinical Implementation of an Acute Chest Pain Coronary CTA Registry ED Protocol on the Heels of the ROMICAT Trials—The ED CCTA Registry at a Tertiary Medical Center (Station #1)**


**PURPOSE**

Recent randomized controlled trials have established coronary CT angiography (CCTA) as an alternative in evaluating low- to intermediate risk ED patients with acute chest pain. We report our initial clinical experience in the MGH registry and compared quality metrics with the ROMICAT (Rule Out Myocardial Infarction with Computer Assisted Tomography) II (R-II) results.

**METHOD AND MATERIALS**

We included patients that presented to the ED with acute chest pain and were referred for CCTA to rule out significant coronary artery disease between October 2012 and December 2013. We prospectively recorded patient demographics, risk factors, and clinical presentation, radiation dose, CCTA results, disposition, time to report, additional diagnostic testing, interventions. Medical records were reviewed at 60 days after discharge. Results were compared with the multicenter, randomized, controlled R-II trial.

**RESULTS**

227 patients were included (54.2% male, mean age 51.2 ± 10.6). Per CCTA 57% had no CAD (n=130), 27% had mild CAD (n=62), 5.7% had moderate CAD (n=13), 7.9% had severe CAD (n=18), 1% had occlusive disease (n=3), and 0.4% had an inconclusive exam (n=1). Mean length of hospital stay and time to diagnosis were shorter but not significantly different as compared to R-II (21.3 ± 46.6 hours vs. 23.2 ± 37 hours; p=.59 and 9.6 ± 9.7 hours vs. 10.4 ± 12.6 hours; p=.35, respectively). Median time from CCTA to report was 54 minutes. When compared to the R-II trial, estimated effective dose (mean, mSv) was significantly lower (4.3 ± 2.8 mSv vs. 6.2 ± 3.8 mSv; p<.01) respectively, primarily achieved via more frequent prospective ECG triggering (89% vs.13%, p<.01). Invasive coronary angiography (ICA) was performed in 8%(n=18) vs.11% (n=54), nuclear myocardial perfusion imaging in 11% (n=26) vs. 10% (n=50), and exercise tolerance test in 2%(n=4) vs. 2%(n=12) patients in registry versus R-II, respectively. Importantly, the normalcy rate for ICA was lower than as compared to R-II (6% vs 20%), while no missed ACS were reported at 60 days.

**CONCLUSION**

Real world clinical data of early CCTA in the management of patients with acute chest pain confirm the results of the ROMICAT II trial with further reduction in radiation dose.

**CLINICAL RELEVANCE/APPLICATION**

Implementation of prospective CCTA protocols and strict quality metrics enabled significant reduction of radiation exposure and reduced normal ICA after CCTA while maintaining a 100% negative predictive value.
METHOD AND MATERIALS

Ninety-nine consecutive patients with a first reperfused AMI were included. Magnetic Resonance Imaging (MRI) was performed between day 1 and 7 after the AMI and after 3 months, to determine the development of ventricular remodeling. Ventricular remodeling was defined as an increase >= 20 % in end-diastolic volume (EDV).

RESULTS

Out of the 97 patients, 23 (23.7 %) had ventricular remodeling. Patients with ventricular remodeling had lower ventricular volumes at the initial MRI compared with patients without remodeling. (EDV 94.9 ± 19.1 ± 27.9 ml vs.118.8 ml, p < 0.001; ESV 48.7 ± 17.5 vs. 62.6 ± 21.4 ml, p = 0.006; and SV 46.2 ± 10.6 vs. 56 ± 15.9, p = 0.006) The EDV was an independent predictor of ventricular remodeling.

CONCLUSION

Almost a quarter of the patients with a first reperfused AMI had ventricular remodeling. Ventricular volumes calculated at baseline cMR, where lower in patients with ventricular remodeling. EDV was an independent predictor of ventricular remodeling. Further investigation about the mechanism responsible for this phenomenon should be performed. We should have in mind that the improvement in the contemporary medical treatment can modulate the remodeling process after AMI.

CLINICAL RELEVANCE/APPLICATION

To determine the variables that lead to ventricular remodeling after AMI that will allow to identify patients at risk to develop and prevent heart failure.

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Comparison of Cine MRI feature Tracking and Displacement Encoding with Stimulated Echoes MRI for the Assessment of Global and Segmental Left Ventricular Strain in Patients with Acute Myocardial Infarction (Station #3)

Yoshitaka Goto MD (Presenter): Nothing to Disclose, Masaki Ishida MD, PhD: Nothing to Disclose, Shinichi Takase: Nothing to Disclose, Mio Uno MD: Nothing to Disclose, Motonori Nagata MD, PhD: Nothing to Disclose, Kakuwa Kitagawa MD, PhD: Nothing to Disclose, Hajime Sakuma MD: Research Grant, Siemens AG Research Grant, Koninklijke Philips NV Research Grant, General Electric Company Research Grant, Bayer AG Research Grant, Guerbet SA

PURPOSE

Displacement encoding with stimulated echoes (DENSE) MRI can provide accurate quantification of myocardial strain based on displacement of myocardial tissue. The drawback of DENSE MRI is the necessity of acquiring additional image dataset in CMR study. Feature Tracking (FT) technique recently emerged as a method to quantify myocardial strain by analyzing standard cine MR images. However, accuracy of global and regional myocardial strain measured by FT has not been well established. The purpose of this study was to compare myocardial strain by FT to those derived from DENSE in patients with acute myocardial infarction (AMI).

METHOD AND MATERIALS

Twenty patients (65±13 years) with AMI underwent steady state free precession cine MRI, DENSE MRI and late gadolinium enhancement MRI on a 1.5 T MR system. Left ventricular strain maps were generated by FT analysis (cmr42) of cine MRI as well as DENSE MRI on matched 3 short-axis planes of left ventricle (basal, mid, apical). Each short axis slice was divided into 6 equal circumferential sectors. FT-derived circumferential strain was compared with that determined by DENSE MRI by adjusting cardiac phase for global and segmental level. Regional circumferential strain was compared between infarct and remote normal segments.

RESULTS

Global circumferential strain determined by FT showed a good agreement with that by DENSE MRI (Pearson’s correlation coefficient 0.85, p<0.0001; bias 0.02, limits of agreement -0.03 to 0.06; coefficient of variability 16%; intra-class correlation coefficient 0.68). For segmental circumferential strain, Pearson’s correlation coefficient between FT and DENSE approaches was 0.61 (p<0.0001) with bias and limits of agreement of 0.02 and -0.07 to 0.11, coefficient of variability of 33% and intra-class correlation coefficient of 0.55. Regional circumferential strain determined by FT in infarct segments (-0.08 ± 0.05) was significantly altered when compared with that in remote normal segments (-0.15 ± 0.05, p<0.0001).

CONCLUSION

FT measurement of global circumferential strain demonstrated good agreement with DENSE MRI measurement. FT technique allows for accurate assessment of altered regional strain in patients with AMI.

CLINICAL RELEVANCE/APPLICATION

Feature tracking technique allows for the accurate assessment of circumferential strain in patients with acute myocardial infarction without increasing CMR examination time.

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Knowledge based Iterative Reconstruction Technique for Left Ventricular Function Assessment: Comparison with Hybrid Iterative Reconstruction and Filtered Back Projection Techniques (Station #4)

Peiling Li MD, PhD (Presenter): Nothing to Disclose, Xu Ke MD: Nothing to Disclose, Yan Jiang MD: Employee, Koninklijke Philips NV, Ying Liu: Employee, Koninklijke Philips NV, Na Jiang: Nothing to Disclose, Yu Zhao: Nothing to Disclose
PURPOSE
To compare the accuracy of contrast computed tomography (CT) for left ventricular function assessment using different reconstruction techniques including filtered back projection (FBP), hybrid iterative reconstruction (iDose4, Philips Healthcare) and knowledge based iterative reconstruction (IMR, Philips Healthcare) with magnetic resonance imaging (MRI).

METHOD AND MATERIALS
A total of 16 patients (48.8±9.4 years, 9 male) with coronary artery disease prospectively underwent 256-MDCT and MRI (as reference standard) within 3 days. All CT images were reconstructed with FBP, iDose4 and IMR, respectively. End-diastolic volume (EDV), end-systolic volume (ESV), stroke volume (SV) and ejection fraction (EF) of left ventricular (LV) were measured on FBP, iDose4, IMR and MRI images. CT image quality assessment among different reconstruction techniques was performed by 2 independent readers according to the features of structure demarcation, sharpness, artifacts and noise using a 5-point scale. Pearson's correlation, Bland-Altman analysis, McNemar test and paired-t test were used for statistical analysis.

RESULTS
For 256-MDCT, on average effective dose was 8.87±0.83 mSv. IMR significantly improved image quality compared to iDose4 and FBP (4.08±0.45, 3.66±0.56, 3.21±0.52, all p<0.01). There was no significantly overestimation and underestimation of EDV, ESV and EF by IMR, iDose4 and FBP compared to MRI (all p>0.05). SV was significantly overestimated by all three reconstruction techniques (FBP 98.3±19.1, iDose4 95.4±18.7, IMR 89.8±18.8 vs MRI 82.7±19.0 ml, all p<0.01), meanwhile, SV value of IMR was significantly higher than iDose4 and FBP (p=0.03, p=0.009, respectively). All three groups of CT images showed high intraclass correlation with MRI.

CONCLUSION
CT quantitative analysis for LV function assessment showed good accuracy compared with MRI. IMR techniques improved image quality and enabled SV values more close to those acquired by MRI.

CLINICAL RELEVANCE/APPLICATION
IMR may improve the accuracy of quantitative analysis for LV function assessment by improving image quality.
Radiologists can offer 3D printed models to cardiac teams based on a patient’s cardiac CTA as an additional tool for pre-operative assessment of bioprosthetic valve size to be deployed during TAVR.

CAE107

Myocardial Infarction Complications: Radiological Findings. (Station #6)

Gabriel Carlos Fernandez MD (Presenter): Nothing to Disclose, Javier Encinas MD: Nothing to Disclose, Miguel Corral: Nothing to Disclose, Maria Velasco MD: Nothing to Disclose, Marta Repolles Cobaleda: Nothing to Disclose, Sandra Baleato Gonzalez MD: Nothing to Disclose, Daniel Agueda: Nothing to Disclose

TEACHING POINTS

To review complications of myocardial infarction from a radiologist point of view and with particular emphasis on the imaging findings by MDCT and MRI. To learn the most relevant complications after myocardial infarcts. To show as these complications can be diagnosed by imaging. To describe the physiological effects resulting from a complication after myocardial infarction.

TABLE OF CONTENTS/OUTLINE

The leading cause of hospital death in patients with myocardial infarction is heart failure, either caused by severe left ventricular dysfunction or secondary to complications of myocardial infarction. Complications can be classified as: 1- mechanical: Septum rupture; papillary muscle rupture; Cardiac rupture (ventricular wall rupture); Pseudoaneurysm (contained rupture); left ventricle failure (cardiogenic shock); right ventricle failure; ventricular aneurysm; 2- Electrical or arrhythmic. 3- Ischemic: Reinfarction. 4- Embolic: systemic embolism. 5- Inflammatory: early pericarditis; late pericarditis (Dressler syndrome).

CAE168

Pre- and Post-operative Imaging of the Aortic Root (Station #7)

Kate Hanneman MD (Presenter): Nothing to Disclose, D. Craig Miller: Nothing to Disclose, Michael Fischbein: Nothing to Disclose, R Scott Mitchell: Nothing to Disclose, Dominik Fleischmann MD: Research support, Siemens AG

TEACHING POINTS

1. Evaluation of the aortic root with ECG-gated computed tomography (CT), including multi-planar reformats and three-dimensional (3D) images, allows for accurate measurement of aortic dimensions and pre-operative evaluation of anatomy. 2. Cross-sectional imaging with CT and MRA is crucial not only in the pre-operative evaluation of patients with aortic pathologic pathology, but also assessment of post-procedural results and complications. 3. Surgical techniques include composite valve graft (CVG), Ross procedure (pulmonary autograft), cadaveric homograft, xenograft (pig-root/Medtronic freestyle), and valve sparing aortic root repair (including a variant of the Tirone David-V reimplantation technique, V-SARR).

TABLE OF CONTENTS/OUTLINE

- Etiology of aortic root pathology including atherosclerosis, genetic/congenital conditions, dissection, bicuspid aortic valve, infection/inflammation - Review of surgical anatomy: sinotubular junction (STJ), sinuses of Valsalva (SOV), and aortic anulus - Normal and abnormal dimensions of the aortic root - Imaging and post-processing techniques for pre- and post-operative evaluation - Indications for aortic root repair - Surgical techniques - Post-operative imaging findings and complications - Sample cases - Review of key learning points

CAE124

What's So Complex about Shone's Complex Anyway? (Station #8)

Christopher J.G. Sigakis MD (Presenter): Nothing to Disclose, Carlos S. Restrepo MD: Nothing to Disclose, Cylen Javidian-Nelad MD: Nothing to Disclose, Jacobo Kirsch MD: Nothing to Disclose, Daniel Ocazionez MD: Nothing to Disclose, Daniel Vargas MD: Nothing to Disclose

TEACHING POINTS

1. Review the embryological pathway and phenotypical spectrum of Shone’s complex. 2. Familiarize the radiologist with the imaging findings of the four major components of Shone’s complex and associated anomalies. 3. Discuss the role of imaging in the diagnosis, follow-up and post-operative management of these patients.

TABLE OF CONTENTS/OUTLINE


CAE007-b

Coronary Artery Anomalies: An Algorithmic Approach to Detection and Management (custom application computer demonstration)


TEACHING POINTS

Learn the imaging findings of coronary anomalies by interacting with an iPad application. Be familiar with normal coronary anatomy in all three dimensions. Answer quiz questions intended to solidify the learner's understanding of key concepts.
TABLE OF CONTENTS/OUTLINE

This is a free-standing exhibit which will utilize a web-based application for interactive learning. Users will first review normal coronary anatomy via manipulation of 3D, maximum intensity projection, and multiplanar reconstruction images. Coronary anomaly cases are then presented as unknown or known cases; the below list of cases and their variations are accessible. Diagnostic criteria and management considerations are discussed for each case. A quiz reviewing the key concepts concludes the exhibit. The list of cases includes:

- Interarterial course of left main off the right coronary artery (RCA), prepulmonic course of left anterior descending (LAD) from the right cusp, retroaortic course of left circumflex (LCx) from the right cusp, interarterial course of RCA from the left cusp
- Separate origin of LAD and LCx
- Anomalous left coronary artery from the pulmonary artery (ALCAPA)
- Myocardial bridging of LAD
- Duplication of RCA
- Transseptal course of LAD
- Coronary artery fistula
- Extracardiac termination

CHS-SUA

Chest Sunday Poster Discussions

**Scientific Posters**

**CHS234**

Small Invasive Lung Adenocarcinoma: Periostin Expression and Ground-glass Percentage Scale Predict Tumor Recurrence (Station #1)

Ryoji Iwamoto (Presenter): Nothing to Disclose, Kiminori Fujimoto MD, PhD: Nothing to Disclose, Junko Sadohara MD: Nothing to Disclose, Tatsuyuki Tonan MD: Nothing to Disclose, Shuji Nagata MD: Nothing to Disclose, Toshi Abe MD: Nothing to Disclose, Kenji Izuhara: Nothing to Disclose

**PURPOSE**

Periostin, a matrix protein, was originally identified in osteoblasts. Periostin is believed to promote various types of tumor growth, in addition to migration and epithelial-mesenchymal transition of the malignant cells. This study aimed to compare the thin-section CT features with histological assessment of small lung invasive adenocarcinoma based on the immunohistochemistry stain using periostin to determine the CT features useful for the prediction of patient outcomes.

**METHOD AND MATERIALS**

Seventy-seven consecutive patients with small lung invasive adenocarcinoma (< 3 cm in diameter) who underwent surgical resection from 2000 to 2009 were enrolled. The thin-section CT features were evaluated for 7 categories (size, contour, percentage of ground-glass attenuation scale [%GGA score], presence of air-bronchogram and/or bubble-like appearance, number of involved vessels, shape of pleural indentation, and number of pleural indentation). Two independent expert chest radiologists assessed these findings. Periostin expression was evaluated on the basis of strength and the range of staining. A univariate and multivariable analyses were performed using the Cox proportional hazards model.

**RESULTS**

There was substantial to perfect agreement between the observers for classification of each thin-section CT finding (kappa value = 0.73-1.0). Histological WHO typing, pathologic lymphatic invasion, pathologic nodal metastasis, periostin expression, and %GGA score were statistically significant for recurrence (P = 0.001, 0.032, 0.003, < 0.0001, and 0.011, respectively) on univariate analysis. Multivariable analysis revealed that both the periostin high expression and the lower %GGA score were relative risk factors for recurrence (P = 0.026 and 0.012, respectively).

**CONCLUSION**

The results of this study suggested that periostin high-expression might be a significant predictor of postoperative recurrence. Moreover, preoperative thin-section CT findings (%GGA score) could also predict the likelihood of postoperative recurrence.

**CLINICAL RELEVANCE/APPLICATION**

Evaluation of %GGA score before surgical resection and assessment of pathological periostin expression may be predictors for future tumor recurrence in patients with small invasive adenocarcinoma.
CHS235

Predicting the Metabolic Activity of Nonsolid Nodules with Low Histologic Grade Lung Cancer Based on Corrected SUV (Station #2)

Ying Liu MD (Presenter): Nothing to Disclose, Lale Kostakoglu MD, MPH : Nothing to Disclose, Lewen Stempler : Nothing to Disclose, Yu Htwe MD : Nothing to Disclose, Mary Margaret Salvatore MD : Nothing to Disclose, David F. Yankelevitz MD : Research Grant, AstraZeneca PLC Royalties, General Electric Company, Claudia I. Henschke MD, PhD : Nothing to Disclose

PURPOSE

To correct the SUV value based on CT attenuation of the nonsolid nodule

METHOD AND MATERIALS

We retrospectively evaluated 36 patients (24 female, 12 male, median age 71 year-old) with 40 nonsolid nodules who underwent both FDG-PET scanning and thin-section helical CT scanning before undergoing surgical resection. All the nonsolid nodules were adenocarcinoma, they were classified by histologic grade according to the IASLC/ATS/ERS classification (low, moderate, high). The SUVmax value was corrected based on an estimate of the proportion of soft tissue within the nodule by dividing the SUVmax by the proportion of soft tissue. The proportion of soft tissue was determined by placing an ROI within the nodule on the CT image to determine its attenuation. Based on partial voxel effects and using a 2 component model for air and soft tissue, the proportion could be calculated.

RESULTS

The average nodule diameter was 15.2 mm, 33(82.5%) were larger than 10 mm. Of the 40 nonsolid nodules, 18 had a low histologic grade and 22 had moderate or high histologic grade. The average SUVmax of the 18 nodules with low histologic grade was 1.1 and for the 22 with moderate or high histologic grade it was 1.6. The corrected SUVmax was 2.6 and 2.8, respectively. The increase from the SUVmax to the corrected SUVmax was statistically significant for both groups (P < 0.0001). Using the traditional SUV cutoff for malignancy of 2.5 for these cases, the corrected SUVmax was higher for 8 (44%) of the 18 cases with low grade histology and 13 (59%) of the 22 cases with moderate or high grade histology.

CONCLUSION

These results demonstrate that the actual cancer within the nonsolid nodule has an SUV similar to traditional cancer manifesting as a solid nodule and the corrected SUV also correlates with the degree of histologic aggressiveness.

CLINICAL RELEVANCE/APPLICATION

Corrected SUV values provide a means to evaluate nonsolid nodules according to standard PET/CT criteria.

CHS236

Clinical Significance of Solitary Lung Nodules in Patients with Breast Cancer (Station #3)

Feng Li MD, PhD (Presenter): License agreement, Hologic, Inc License agreement, General Electric Company License agreement, Toshiba Corporation License agreement, Deus Technologies, LLC License agreement, Riverain Technologies, LLC License agreement, MEDIAN Technologies License agreement, Mitsubishi Corporation, Samuel George Armato PhD : Nothing to Disclose, Heber MacMahon MD : Shareholder, Hologic, Inc Consultant, Riverain Technologies, LLC Royalties, UCTech

PURPOSE

To evaluate the clinical significance of solitary non-calcified nodules on chest computed tomography (CT) scans in patients with breast cancer.

METHOD AND MATERIALS

Of 3313 patients with breast cancer, 1377 patients had at least one chest CT scan between 2002 and 2011 at our medical center. Considering the first CT scans of these 1377 patients, 630 (46%) patients had no lung nodules, 529 (38%) patients had multiple nodules, and 218 (16%) patients had one non-calcified nodule. Of the 218 solitary nodules, the CT section thickness was 1 mm in 138 (63%) scans, 2-3 mm in 12 (6%) scans, and 3-7 mm in 68 (31%) scans. The size and pattern of these 218 solitary nodules on CT were analyzed and compared with the final diagnosis.

RESULTS

The mean dimensions of the 218 solitary nodules on CT was 3-5 mm in 160 (73%) patients, 6-10mm in 34 (16%) patients, 11-20 mm in 16 (7%) patients, and 21-40 mm in 8 (4%) patients. There were 185 (85%) solid nodules, 26 (12%) nodules with mixed ground-glass opacity (GGO), and 7 nodules with pure GGO. Final diagnosis included 100 (46%) definitely benign lesions (resolved or stable solid nodule after more than 2 years or biopsy proven), 72 (33%) benign lesions based on image features alone, 21 (10%) indeterminate or suspicious lesions, 11 (5%) primary lung cancers, and 14 (6%) nodular metastases (all solid nodules). 201 (92%) lesions were diagnosed by imaging findings alone, and only 17 (8%) lesions were confirmed by biopsy (11 lung cancers, 3 benign nodules, and 3 metastatic breast cancers). Among 160 nodules at 3-5 mm, 141 (88%) were benign lesions, 12 (8%) were indeterminate or suspicious lesions, 7 (4%) were metastatic nodules, and no primary lung cancers were found. All 7 pure GGO nodules were indeterminate or suspicious by follow-up CT scans.

CONCLUSION

CHS235
90% of 3-5 mm and 67% of 6-10 mm solitary solid non-calcified nodules in patients with breast cancer were benign, whereas 5% of 3-5 mm and 17% of 6-10 mm of such nodules were metastases.

CLINICAL RELEVANCE/APPLICATION
The detection of small solitary solid nodules on the initial CT scans of patients with breast cancer should not be a cause for alarm as the large majority are benign, and follow-up CT scans are usually appropriate to confirm benignity in such cases.

Effect of Reader Adjustments on Lung Nodule Classification in CT Lung Cancer Screening (Station #4)

Marjolein Anne Heuvelmans BSc (Presenter): Nothing to Disclose, Rozemarijn Vliegenthart MD, PhD: Nothing to Disclose, Pim A. De Jong MD, PhD: Nothing to Disclose, Willem P. Mali MD, PhD: Nothing to Disclose, Matthijs Oudkerk MD, PhD: Nothing to Disclose

PURPOSE
To evaluate the impact of radiologists’ expertise on test result decisions made in a CT lung cancer screening trial.

METHOD AND MATERIALS
In the NELSON randomized lung cancer screening trial, the baseline CT screen result was based on the lung nodule with largest volume. According to the protocol, nodule volume<50mm³, 50-500mm³ and >500mm³ led to a negative, indeterminate and positive screen result, respectively. However, the NELSON protocol allowed radiologists to manually adjust the screen result in case of high suspicion on benign or malignant nature. In this study, all participants whose baseline screen result was based on a solid nodule were included. The screen result that should have been made according to the nodule management protocol and the final baseline CT screen result were compared, to see whether the screen result was manually adjusted. Histology was the reference for diagnosis, or, to confirm benignity, stability of the nodule volume on subsequent CT scans for at least two years after baseline.

RESULTS
In 3268 participants (2759 male, median age 58.0 years), the baseline result was based on a solid nodule. In 189 participants (5.8%) the initial baseline screen result for the largest nodule was adjusted by the radiologist. The screen result was adjusted downwards from positive or indeterminate to negative in two and 118 participants, respectively, and from positive to indeterminate in 64 participants. None of these nodules turned out to be malignant, two years after baseline. The result was adjusted upwards from negative to indeterminate in one participant. No lung cancer was diagnosed in this nodule. In four participants the screen result was adjusted upwards from indeterminate to positive; two nodules were malignant (50%).

CONCLUSION
In baseline lung cancer screening, readers adjusted screen results in about one in twenty cases (97.4% downwards), leading to reduction of false-positive and false-negative test results.

CLINICAL RELEVANCE/APPLICATION
In lung cancer screening, radiologists' expertise can improve nodule classification in addition to a general nodule management protocol.

Impact of CT on Geriatric Patients Presenting to the Emergency Department with Acute Abdominal Pain (Station #1)


PURPOSE
To evaluate the diagnostic yield of abdominopelvic computed tomography (CT) in geriatric patients presenting to the Emergency Department (ED) with acute abdominal pain and effect on management.
METHOD AND MATERIALS

Medical records search from 1/2004-1/2013 identified 327 geriatric patients (> 80 yo; 248 women, 79 men) undergoing abdominopelvic CT in the ED for acute abdominal pain. Cases were reviewed for study indication and pre-CT vs. post-CT diagnoses. Report interpretations were categorized into with and without acute findings. Those with acute results were subdivided into medical and surgical diagnoses. Analysis of ED records was performed to determine whether results of the CT changed management, including medication treatment changes, referrals to a subspecialty, surgical operations and minimally invasive procedures. Anticipated admission status prior to imaging, actual disposition from the ED, and final disposition of those admitted were also recorded.

RESULTS

Of the 327 geriatric patients undergoing CT in the ED for acute abdominal pain, the most common indications for CT were small bowel obstruction (SBO) (66/327, 20%), abdominal aortic aneurysm rupture or dissection (40/327, 12%), diverticulitis (37/327, 9%), and bowel ischemia or perforation (30/327, 9%). Most common CT diagnoses were gastrointestinal ischemia (28/249, 11%), diverticulitis/colitis (23/249, 9%) and SBO (22/249, 9%). Of all patients, 214 (65%) required hospital admission, of which results of CT determined admission in 144 patients (67%). 249 of 327 patients (77%) had acute or treatable positive findings on CT (119 medical, 130 surgical). CT changed management in 92 patients (37%); 10 medically and 82 surgically. Patients with surgical issues (82/130, 62%) were treated operatively (41/82, 50%) or with minimally invasive operations/procedures (41/82, 50%).

CONCLUSION

Radiology interpretations from abdominopelvic CTs obtained in the ED have an impact on geriatric patient management, influencing primarily surgical rather than medical issues and subsequent treatment.

CLINICAL RELEVANCE/APPLICATION

The utilization of CT in the geriatric patient population will be an increasingly important issue for future health care management and cost.

ERS205

Decreased Birth Weight Associated with Administration of Intravenous Contrast for Computed Tomography during Pregnancy (Station #3)


PURPOSE

Standard guidelines recommend that iodinated contrast media be avoided during pregnancy based on in vitro and animal studies but few reports have assessed its use clinically. We examined the risk of pregnancy complications associated with the use of intravenous iodinated contrast for CT in pregnant women.

METHOD AND MATERIALS

We retrospectively reviewed charts of pregnant women undergoing CT with or without iodinated contrast at our institution between February 2005 and December 2013. We divided patients into a study group that received contrast with CT and a control group that underwent CT without contrast. Patients were only included if their CT was negative and they were followed until delivery. Demographic and clinical data was recorded and compared between the two groups using a two-tailed t-test.

RESULTS

336 pregnant women with CT during their pregnancy were recruited. 15 patients with positive CT results and 102 patients with poor follow-up were excluded. 128 patients received contrast with abdominal, pelvic, or chest CT and 91 underwent non-contrast head CT. Mean birth weight was significantly lower in the contrast administered group (2679 g) versus the control group (3055 g) (p<0.01). There were no statistically significant differences between groups regarding mean age of the mother at the time of delivery, mean gestational age at delivery, or APGAR scores at 1 and 5 minutes (p>0.05). Mean gestational age at time of CT was significantly later in the contrast group (25 weeks vs. 22 weeks; p<0.05).

CONCLUSION

Based on this preliminary retrospective study it appears that the administration of iodinated contrast for CT during pregnancy may be associated with lower birth weight. Further studies are indicated to validate and understand this association.

CLINICAL RELEVANCE/APPLICATION

Findings from this study may further substantiate the recommendations for limiting the use of iodinated contrast media for CT in pregnant patients.
ERS206

When the Appendix is not Seen on Ultrasound for RLQ Pain: Does the Interpretation of Emergency Department Physicians Correlate with Diagnostic Performance? (Station #4)

Donald Le Ly MD, BEng (Presenter): Nothing to Disclose, Seng Thipphavong MD: Nothing to Disclose, Sara H. Gray MD, FRCP: Nothing to Disclose, Anthony Edward Hanbidge MBBCh: Nothing to Disclose, Mostafa Atri MD: Nothing to Disclose, Korosh Khalili MD: Nothing to Disclose

PURPOSE

To determine the attitudes of emergency department (ED) physicians (MDs) towards non-visualization of the appendix (NVA) on ultrasound (US) scans for RLQ pain and to assess ultrasounds’ diagnostic performance.

METHOD AND MATERIALS

A survey was administered to 166 ED MDs at several academic hospitals to determine their interpretation and practice after receiving an ultrasound report with NVA. Retrospective review of three large academic EDs revealed 1672 US scans performed for appendicitis in 2012. 291 (17.4%) explicitly indicated NVA and underwent a chart review of US findings, follow-up imaging, and surgical findings to determine the negative predictive value of NVA and utility of secondary findings. Univariate analysis was performed to determine which secondary signs of appendicitis were significant (P<0.05) predictors of a positive CT scan.

RESULTS

95/166 (57%) of ED MDs completed the survey; 53% had >10 years experience. After receiving an US report with NVA, 92% indicated re-examining the patient; 79% felt further imaging was required and 61% would proceed with CT. Only 18/95 (19%) of ED MD believed that follow up CT is positive for appendicitis in less than 10% of NVA; 71% agreed that a level of certainty scale would be helpful on radiology reports for appendicitis. Of 291 US scans with NVA, 246 (85%) were female (mean age 31y). In 229/291 (79%), no alternate diagnosis was found and a CT was done in 94/229 (41%). Appendicitis was found in 13/229 (5.7%) patients with NVA and no alternate diagnosis; in 9/13 secondary signs of appendicitis were noted. Therefore negative predictive value (NPV) for NVA was 216/229 (94.3%). Inflammatory changes in RLQ (p=0.01) and focal tenderness (p=0.02) noted on US were significant predictors of a positive CT scan.

CONCLUSION

Current perceptions and practice of some ED physicians equate NVA on US as an inadequate study to exclude appendicitis. However, NVA is itself a highly predictive sign (94.3%) of absence of appendicitis when an alternate cause of pain is not seen.

CLINICAL RELEVANCE/APPLICATION

Dissemination of the high NPV of ultrasound in RLQ pain among ED MDs may lead to diminished resource utilization. Radiologists can add value to ED MDs by providing an evidence-based level of certainty scale for US findings when assessing for appendicitis.

ERE102

Bowel Pathology in Color versus Shades of Gray: Understanding Bowel Diseases with Use of Dual Energy CT and Iodine Maps (Station #5)

Urvi Pravin Fulwadhva MD (Presenter): Nothing to Disclose, Jeremy Robert Wortman MD: Nothing to Disclose, Aaron D. Sodickson MD, PhD: Research Grant, Siemens AG

TEACHING POINTS

1. Dual energy CT can help to enhance subtle tissue characteristics in the bowel in both benign and malignant disease processes (infectious, inflammatory, GI bleed, small bowel obstruction and neoplasms) with use of iodine map and iodine overlay images. 2. Use of dual energy CT protocols and post processing can be integrated in daily clinical routine to add further insights in bowel imaging.

TABLE OF CONTENTS/OUTLINE

1. Brief primer of dual energy physics with attention to three-material decomposition and calculation of iodine content for display of iodine maps and virtual noncontrast images. 2. Use of dual energy CT protocols and post processing can be integrated in daily clinical routine to add further insights in bowel imaging.

GIS-SUA

Gastrointestinal Sunday Poster Discussions

Scientific Posters

AMA PRA Category 1 Credits ™: .50

Sun, Nov 30 12:30 PM - 1:00 PM Location: GI Community, Learning Center

Participants

Moderator
**GIS325**

**Peritumoral Hyperintensity on Hepatobiliary Phase of Gd-EOB-DTPA Enhanced MRI in Hepatocellular Carcinomas: Correlation with Peritumoral Hyperplasia Showing Glutamine Synthetase Overexpression (Station #1)**


**PURPOSE**

Peritumoral hyperintensity (PH) is occasionally seen in hepatocellular carcinoma (HCC) on the hepatobiliary phase (HB phase) of Gd-EOB-DTPA enhanced MRI (EOB-MRI). However, the mechanism of PH is still unknown. A recent study showed peritumoral hyperplasia (PTH) associated with over-expression of glutamine synthetase (GS) in HCC or metastatic carcinoma. The aim of this study was to analyze the correlation between PH on the HB phase of EOB-MRI and GS expression indicating PTH.

**METHOD AND MATERIALS**

Seventy-seven surgically resected nodules (from 68 patients) were analyzed. Patients were grouped according to the degree of the peritumoral hyperintense signal on the HB phase: grade 0 (no PH), grade 1 (PH was seen on less than 50% of the tumor border), grade 2 (50-80%), grade 3 (80%-100%). Immunohistochemical staining for GS and organic anion transporter polypeptides (OATP)1B3 (uptake transporter of Gd-EOB-DTPA) was performed. In this study, PTH was defined as the peritumoral hepatocytes with high GS expression.

**RESULTS**

In the image evaluation of the HB phase of EOB-MRI, 39 nodules were classified as grade 0, 24 nodules as grade 1, 11 nodules as grade 2, and 3 nodules as grade 3. An increased expression of GS relative to the surrounding liver was observed in 3/39 grade 0 nodules (7.7%), 17/24 grade 1 nodules (70.8%), 9/11 grade 2 nodules (81.8%) and 3/3 grade 3 nodules (100%). There was significant in the incidence of PTH between grade 0 and grade 1-3 (P).

**CONCLUSION**

Peritumoral hyperintensity on HB phase of EOB-MRI in HCC may indicate peritumoral hyperplasia with GS and OATP1B3 expression.

**CLINICAL RELEVANCE/APPLICATION**

Peritumoral hyperintensity on HB phase of EOB-MRI in HCC may indicate peritumoral hyperplasia. Understanding of this finding will be useful in the accurate diagnosis of liver tumors.

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**GIS326**

**Noninvasive Assessment of Liver Fibrosis with Iodine Quantification Using Dual-energy CT in Chronic Liver Disease (Station #2)**

Nobuyuki Asato MD (Presenter): Nothing to Disclose, Masakatsu Tsurusaki MD, PhD: Nothing to Disclose, Tomoko Hyodo MD: Nothing to Disclose, Mitsuhiro Matsuki: Nothing to Disclose, Kazunari Ishii MD: Nothing to Disclose, Takamichi Murakami MD, PhD: Nothing to Disclose

**PURPOSE**

To evaluate utility of iodine quantification using GSI (Gemstone Spectral Imaging by dual-energy CT) iodine map for staging liver fibrosis in the patients with chronic liver disease by using liver biopsy as the reference standard.

**METHOD AND MATERIALS**

This study was approved by the institutional review board. Forty-eight patients who underwent dynamic CT scanning using dual-energy CT within 2-months before or after liver biopsy for suspicion of chronic liver disease. The fibrosis stage was assessed according to METAVIR scores (fibrosis stage 0 [F0], 5 patients; F1, 8; F2, 9; F3, 16; and F4, 10). All patients underwent non-contrast and contrast-enhanced CT of the upper abdomen with a fast kV switching single-source dual-energy (80 kVp and 140 kVp) using 64-slice MDCT. Iodine density on each dynamic phase was quantitatively measured by the iodine map and was correlated with the fibrosis stage. We determined the optimal cutoff value and diagnostic ability for discriminating each stage of fibrosis using receiver operating characteristic (ROC) curve analysis of iodine density quantifications between portal phase and equilibrium phase. The percentage of iodine that remains from portal phase to equilibrium phase was defined as the residual ratio.

**RESULTS**

The residual ratio increased with the stage of fibrosis: F0, 66.6±3.6%; F1, 67.4±3.4%; F2, 72.9±5.6%; F3, 74.9±5.5%; and F4, 83.8±4.7%. There was a statistically significant correlation between the residual ratio and fibrosis stage (Spearman’s Rho; r= 0.77, p < 0.001). The mean area under the ROC curve values for discriminating liver fibrosis stages were: 0.86 for stages of F1 or greater (Cutoff value=69.9%), 0.92 for stages of F2 or greater (72.2%), 0.86 for stages of F3 or greater (72.3%), and 0.94 for stage F4 (77.0%).

**CONCLUSION**

Iodine quantification using the GSI iodine map is a reliable technique for staging liver fibrosis and discriminating
liver fibrosis stage in patients with chronic liver disease.

**CLINICAL RELEVANCE/APPLICATION**

Contrast enhanced dynamic CT is the most widely used modality for the patients with chronic liver disease. Iodine quantification using dual-energy CT (iodine map) could be one of the minimally-invasive options to assess fibrous stages as well as US elastography or MR elastography.

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**GIS327**

**To Evaluate the Damage of Renal Function in CIAKI Rats by fMRI and Correlate with the Expression of AQP1 (Station #3)**

Shui Xing, Zhang MD (Presenter): Nothing to Disclose, Wen-Bo Chen BAch: Nothing to Disclose, Chang Hong, Liang MD: Nothing to Disclose

**PURPOSE**

To investigate noninvasive blood oxygen level-dependent imaging (BOLD) sequences for measuring renal function in contrast induced acute kidney injury (CIAKI) rats after the administration of iodinated contrast media (CM) and further correlate with the expression of AQP1.

**METHOD AND MATERIALS**

Thirteen male Sprague-Dawley (SD) rats with weight of 200-250 g were randomized grouped to a CIAKI group (injected with Meglumine Diatrizoate, 370mg/ml, 6 ml/kg body weight) and a control group (injected with same amount of 0.9% saline). All procedures were approved by the local Research Ethics Committee, and in accordance with the Guide of the Care and Use of Laboratory Animals published by the US National Institutes of Health (NIH Publication No. 85-23, revised 1996). BOLD sequences were performed at 24 h pre-injection and at intervals of 30 min, 12 h, 24 h, 48 h, 72 h and 96 h post-injection to assess renal relative spin-spin relaxation rate (R2*) respectively. At each time point, 3 rats were executed and the kidneys were performed immunohistochemistry (IHC) for measuring the expression of AQP1. Data were analyzed using SPSS 13.0 for Windows. One-way ANOVA test and Bivariate Correlations were used. P<0.05 was considered as statistical difference.

**RESULTS**

For the CIAKI group, the values of R2* in the outer medulla (OM) of kidneys were markedly increased at 30 min, 12 h, 24 h and 48 h (P<0.05 vs. baseline, n=6), respectively; whereas the changes at 72 h and 96 h in the OM and in the cortex and inner medulla (IM) were not statistically significant (P=NS vs. baseline). Besides, the expression of AQP1 at 30 min, 12 h, 24 h and 48 h (P<0.05 vs. baseline, n=3) were higher than control group. At 30 min to 48 h, the correlation coefficient r between R2* and AQP1 were 0.575 (P = 0.025, one-tailed).

**CONCLUSION**

The increase of oxygen level in OM were found at 30 min-48 h post-injection of iodinated CM. BOLD sequence provides means for noninvasive monitoring renal function during the first 2 days of CIAKI in clinical routine works. The AQP1 expression was positively correlated with R2*, Therefore BOLD may be a objective mean for forecasting AQP1.

**CLINICAL RELEVANCE/APPLICATION**

BOLD may provides means for noninvasive monitoring renal function of CIAKI in clinical routine works and become a objective mean for forecasting AQP1.

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**GIS328**

**Impact of a Second-Generation Virtual Monochromatic Algorithm on the Conspicuity of Hypervascular Liver Tumors Using Dual-Source Dual-Energy MDCT (Station #4)**

Daniele Marin MD (Presenter): Nothing to Disclose, Achille Mileto MD: Nothing to Disclose, Juan Carlos Ramirez Giraldo PhD: Employee, Siemens AG

**PURPOSE**

To investigate the impact of a second-generation virtual monochromatic algorithm on the conspicuity of hypervascular liver tumors and image noise, using dual-source dual-energy MDCT.

**METHOD AND MATERIALS**

A custom anthropomorphic liver phantom simulating different levels of enhancement of hypervascular lesions in three adult body sizes was imaged with a second-generation dual-source MDCT using both dual-energy (100/85/140 kVp) and single-energy acquisitions, at various energy levels (80,100,120, 140 kVp). For each phantom size, the radiation output was kept constant for all scans. Virtual monochromatic images from the dual-energy dataset were reconstructed at energy levels ranging from 40 to 140 keV, using both first-generation (Syngo DE Monoenergetic) and second-generation (Syngo DE Monoenergetic PLUS) virtual monochromatic algorithms. Noise and tumor-to-liver contrast-to-noise ratio (CNR) were calculated and compared among different reconstructed datasets, for all phantom body sizes.

**RESULTS**
On single-energy imaging, the minimum noise level was observed at 120 kVp for the small and at 140 kVp for the medium and large phantom sizes; 80 kVp yielded the highest tumor-to-liver CNR for all phantom sizes. For the first-generation virtual monochromatic algorithm, noise was lowest at 70 keV in the small and medium phantom sizes, and 80 keV in the large phantom size; an energy level of 60 keV yielded the highest tumor-to-liver CNR for all phantom sizes. For the second-generation virtual monochromatic algorithm, noise was lowest at 80 keV for the small and the medium phantom sizes, and 90 keV for the large phantom size; an energy level of 40 keV yielded the highest tumor-to-liver CNR for all phantom sizes. In the large phantom, second-generation virtual monochromatic images at an optimal energy yielded significantly higher tumor-to-liver CNR, compared to either single-energy or first-generation virtual monochromatic images (P<0.01).

CONCLUSION

Second-generation virtual monochromatic algorithm may improve the conspicuity of hypervascular liver tumors compared to single-energy and first-generation virtual monochromatic images, in larger body sizes.

CLINICAL RELEVANCE/APPLICATION

Second-generation optimal energy virtual monochromatic images may substantially improve the conspicuity of hypervascular liver tumors in larger patients.

GIS329

Magnetic Resonance Imaging (MRI) in Locally Advanced Rectal Cancer (LARC): Tumor Volume Reduction Rate (TVRR) Assessed at Mid-term Chemoradiotherapy (CRT) Predicts the Histological Tumor Response Grade (TRG) (Station #5)

Marcello Alessandro Orsi MD (Presenter): Nothing to Disclose, Francesco Aldo De Cobelli MD: Nothing to Disclose, Giulia Agostini: Nothing to Disclose, Maria Alessia Zerella: Nothing to Disclose, Paolo Passoni: Nothing to Disclose, Najla Slim: Nothing to Disclose, Alessandro Del Maschio MD: Nothing to Disclose

PURPOSE

Neo-adjuvant CRT is the standard therapeutic option in LARC. TRG is considered a trustable indicator of response and MRI is the reference technique for the evaluation of treatment response in vivo. In this study, we performed pelvic MRI before, during and after CRT to evaluate TVRR at mid-term CRT (mid-TVRR) and after CRT (late-TVRR) in correlation to histological TRG.

METHOD AND MATERIALS

32 patients affected by LARC, enrolled for preoperative CRT, underwent MRI before, during (at mid-term) and after CRT. On axial T2 images, using a dedicated software, the contour of the tumor was traced, then transformed into a 3-dimensional reconstruction, from which volumetric measurements were calculated. TRG was assessed by histopathology after surgery according to Dworak system (from 0 to 4). Patients with TRG=0-2 were considered as Non Responders (NR) and TRG=3-4 as Responders (R).

RESULTS

Based on histological TRG, 25 patients were classified R and 7 NR. Both Mid-TVRR and Late-TVRR were significantly higher in the R group than in the NR group, respectively 69±15% vs 19±16% (p<0.001; area under the ROC Curve (AUC) 0.98; cut-off value: 48%) and 86±7% vs 44±22% (p=0.002; AUC 0.99; cut-off value: 74%). In the R group, 8/25 were TRG=4 and 17/25 were TRG=3; Mid-TVRR was significantly higher in patients with TRG=4 than TRG=3 (84±7% vs 61±13%; p<0.001; AUC 0.95; cut-off value: 80); no significant difference in Late-TVRR between the two groups was found (89±5% vs 84±8%, p=n.s.).

CONCLUSION

In our study, TVRR in LARC during CRT presented a strong correlation with histological TRG. Volume reduction, both at half CRT (mid-TVRR) and after CRT (late-TVRR) can predict / differentiate R from NR. Moreover, Mid-TVRR was able to predict complete responders (TRG=4) from partial / nearly complete responders (TRG=3).

CLINICAL RELEVANCE/APPLICATION

MRI with volumetric evaluation, performed at half CRT, could early identify patients not responding to CRT, addressing them to alternative or more intense treatment. Moreover, Mid-TVRR, discriminating complete from partial responder patients, could be a powerful tool in addressing complete responders towards a conservative management.

GIS330

Dual-energy Spectral CT for Characterization of Hepatocellular Carcinoma: Initial Experience (Station #6)

Shalini Thapar Laroia MD (Presenter): Nothing to Disclose, Shiv Sarin: Nothing to Disclose

PURPOSE

To determine whether spectral CT can improve qualitative and quantitative accuracy in diagnosis of HCC in a cirrhotic liver using material iodine density.

METHOD AND MATERIALS

Routine and spectral CT (at 70-140 kVp) was performed for 3600 patients with cirrhosis over a span of 3 years.
Routine and spectral CT (at 70-140kVp) was performed for 3600 patients with cirrhosis over a span of 3 years. The indeterminate mass lesions were identified, of which few were followed up and some lesions underwent biopsy/surgical exploration. These were analyzed using gem stone imaging software at 55keV. The hepatic arterial phase (which showed maximum iodine enhancement) was used to quantify iodine concentrations from iodine-based material-decomposition images. The lesion iodine to aortic iodine concentration (normalized enhancement values- NEV) and lesion-to-normal parenchyma ratio (LNR) were obtained. Spectral HU curve, Scatter plot and the material density values of the indeterminate lesions were derived and statistically analyzed.

RESULTS
Total cirrhotic population screened = 3600 Number of patients with HCC = 142 Number of indeterminate hypervascular lesions = 82 Number of indeterminate lesions on follow up = 40 Number of indeterminate lesions underwent biopsy/hepatectomy = 42 All indeterminate lesions were studied with spectral imaging in HAP at 55keV: Number of patients with true positive HCC = 34, Number of patients with false positive HCC = 8

CONCLUSION
This study reveals that spectral imaging is an excellent add on qualitative and quantitative tool to routine CT for assessing hypervascular and indeterminate lesions in cirrhotic patients.

CLINICAL RELEVANCE/APPLICATION
1. This data suggests that spectral imaging maybe used to help characterize HCC on a single phase arterial study, thus reducing dosage of both intravenous contrast and radiation. 2. The predictability and accuracy of spectral CT in diagnosis of HCC may be able to reduce, if not completely obviate the need for biopsy in future. 3. The need for second modality confirmation using MRI/contrast ultrasound of a suspicious lesion showing hypervascularity may in future become obsolete if a standard iodine concentration value on dual energy CT for hepatocellular carcinoma can be deciphered using randomized controlled trials. 4. Predictability of tumor grading is likely to be possible with spectral imaging by assessing the material decomposition analysis. 5. Spectral CT is a functional test for liver tumours and has a potential to become an excellent Onco-imaging tool.

Abdominal Imaging Findings in Adult Patients on Extracorporeal Membrane Oxygenation (ECMO) (Station #7)
Laura Jane Steinberg MBBS (Presenter): Nothing to Disclose, Ashley Scrimshire MBBS: Nothing to Disclose, Lois Susan MacDonald MBCHIR, FRCR: Nothing to Disclose, Alan Ashworth MBChB: Nothing to Disclose, Velandhun Rudraalingham MBBS: Nothing to Disclose, Sathi Anandan Sukumar MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to: 1. Deliver an introduction to ECMO. 2. Present a pictorial review of the abdominal CT findings in adult patients on ECMO.

TABLE OF CONTENTS/OUTLINE
Introduction to ECMO Abdominal CT imaging techniques: Contrast injection and imaging protocol Pictorial Review: 1. Complications associated with ECMO; including procedural, renal and splenic infarcts, thromboses: including hepatic, renal and iliac veins and retroperitoneal haemorrhage. 2. Expected manifestations: including splenomegaly, periporal oedema, consolidation at the lung bases and ascites. 3. Primary abdominal pathologies leading to the requirement of ECMO; including pancreatitis and phaeochromocytoma. 4. Pitfalls; including dilution of contrast and changes in circulation dynamics leading to perfusional artefacts, with correlation to the operative or post mortem histology findings, where appropriate. This pictorial review will allow the Radiologist to discriminate between genuine pathology and artefact to ensure appropriate management of patients.

Practical LI-RADS Application to Focal Hepatic Lesions in Cirrhosis: Algorithmic Approach and Self-Assessment Cases (Station #10)

TEACHING POINTS
After viewing this exhibit, participants will be able to: 1. Review imaging features of suspicious focal liver lesions in the setting of cirrhosis. 2. Be familiar with the current LiRads classification of focal lesions. 3. Become familiar with a practical and stepwise algorithmic approach to using LI-RADS. 4. Test their level of understanding through case based self-assessment.

TABLE OF CONTENTS/OUTLINE

Beyond Uncomplicated Colon Diverticulitis: What the Radiologist Needs to Know (Station #11)
Ji Su Kim (Presenter): Nothing to Disclose, Hyun Cheol Kim: Nothing to Disclose, Sang Won Kim MD: Nothing to Disclose, Da mO Yang: Nothing to Disclose, Seong Jin Park MD, PhD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the diverticulitis other than colon diverticulitis. 2. To discuss the CT-based modified Hinchey classification which can provide the surgical indications of colonic diverticulitis. 3. To illustrate the various complications of diverticulitis 4. To demonstrate mimics of acute diverticulitis during CT interpretation

TABLE OF CONTENTS/OUTLINE
1. Colon diverticulitis - Pathophysiology - CT imaging findings 2. Diverticulitis other than colon - Small bowel diverticulitis - Meckel's diverticulitis - Appendiceal diverticulitis 3. The role of CT in predicting the need for surgery - Modified Hinchey classification with corresponding CT findings 4. Major complications of diverticulitis - Abscess - Fistula - Perforation - Hemorrhage - Bowel obstruction 5. Mimics of diverticulitis during CT interpretation - Colorectal cancer - Acute appendicitis - Stercoral colitis

GIE187
CT 3D Volumetry, Vascular Anatomy and Virtual Resection in Live Related Liver Donor Evaluation: A Radiologist Primer (Station #12)
Sharad Maheshwari MD (Presenter): Nothing to Disclose, Abhijit A. Raut MD : Nothing to Disclose, Yogini Nilkantha Sawant MBBS : Nothing to Disclose, Pankaj Chhatrala MBBS : Nothing to Disclose, Tejas Harish Kapadia MBBS : Nothing to Disclose, Abhisht Aggarwal MBBS : Nothing to Disclose, Jigar Aiya MBBS, DMRD : Nothing to Disclose

TEACHING POINTS
This exhibit aims to introduce the concepts of “live related donor evaluation” to radiologist and its surgical significance. Optimal vascular anatomy and its challenges due to variation has been described. 3D Volumetry and concepts in virtual resection of liver according to the vascular anatomy and its surgical significance has been described.

TABLE OF CONTENTS/OUTLINE

GUS-SUA
Genitourinary/Uroradiology Sunday Poster Discussions
Scientific Posters
GU
AMA PRA Category 1 Credits ™: .50
Sun, Nov 30 12:30 PM - 1:00 PM  Location: GU Community, Learning Center

Sub-Events
GUS100
Radiation Dose and Imaging Quality of Dual Energy CT Angiography of Renal Artery Compared with a Standard 120kVp Acquisition in Patient with Renal Mass (Station #1)
Pinggui Lei (Presenter): Nothing to Disclose, Xiaoying Wang MD : Nothing to Disclose, Yufeng Xu : Nothing to Disclose, Jianxin Liu : Nothing to Disclose, zhongxu bi : Nothing to Disclose

PURPOSE
The purpose of this study was to assess the imaging quality and radiation dose of dual energy CTA of renal artery compared with a standard 120kVp acquisition in patients with renal mass

METHOD AND MATERIALS
Twenty-nine consecutive patients performed renal artery CTA were analyzed retrospectively, and divided into DECT group and SECT group. Fifteen patients underwent DECT (tube voltages 80 and Sn140kVp) and were compared with 14 patients underwent standard SECT (120kVp) on the same dual-source scanner. CTDIvol and SSDE were recorded and calculated. Imaging quality was evaluated by two experienced radiologists. For qualitative assessment, whole quality of imaging, detail quality of imaging (sharpness of main renal artery , segmental vessels displayed in MPR and MIP, the relationship between renal lesion and vascular) were evaluated with 5 scale method (1=poor to 5=excellent). For quantitative assessment, CT values were measured in vascular lumen of aorta, renal arteries and psoas major at the almost same level. Background noise (BN) was measured as standard deviation of the surrounding air. CNR and SNR were calculated. P< 0.05 with statistical significant difference.

RESULTS
There was no significant difference for age, sex and weight. Both mean value of CTDIvol and SSDE of DECT group lower than those of SECT group [(9.15±2.20) mGy vs. (15.7±4.08) mGy, P< 0.05; (12.27±1.98) mGy vs. (21.21±4.38) mGy, P< 0.05]. Subjective evaluation for the whole quality of imaging, sharpness of vessels, the relationship between renal lesion and vascular, segmental vessels displayed in MPR and MIP between 2
groups (Z=-2.17, P>0.05; Z=-2.17, P>0.05; Z=-2.64, P>0.05; Z=-2.64, P>0.05). CT values of abdominal aorta and renal artery in DECT group and SECT group were [(237±33) HU vs. (215±42) HU, P>0.05) and [(223±31) HU vs. (197±37) HU, P<0.05). CNR and SNR were (25.38±7.94 vs. 19.02±5.25, P< 0.05) and (34.73±9.92 vs. 28.23±5.65, P< 0.05).

CONCLUSION
DE renal artery CTA was equivalent of standard SECT acquisitions and thus can be applied for routine diagnostic purpose in patient with renal mass, which provide satisfactory images with significant reduction of radiation exposure.

CLINICAL RELEVANCE/APPLICATION
Dual-source dual-energy CT can achieve acceptable image quality and reduce radiation dose compared with single energy CT, which helps its clinical diagnosis and treatment.

GUS101
Pseudonormal Corticomedullary Differentiation of the Kidney Assessed by T1-weighted MRI in Cirrhotic Patients with Chronic Kidney Disease (Station #2)
Fumi Yamada MD (Presenter): Nothing to Disclose, Yasuo Amano MD: Nothing to Disclose, Fumitaka Hidaka MD: Nothing to Disclose, Yoshimitsu Fukushima: Nothing to Disclose, Shinichiro Kumita MD: Nothing to Disclose

PURPOSE
Corticomedullary differentiation (CMD) of the kidney on T1-weighted magnetic resonance imaging (MRI) increases in cirrhotic patients with normal renal function, compared with normal controls. If the pathological condition also occurs in cirrhotic patients with chronic kidney disease (CKD), the severity of renal insufficiency can be underestimated by T1-weighted MRI. The aim of this study was to determine whether CMD in cirrhotic patients with CKD increased to a 'pseudonormal' appearance on the T1-weighted images.

METHOD AND MATERIALS
Abdominal T1-weighted MRI was performed in 32 cirrhotic patients with CKD and 32 age-matched CKD patients without liver cirrhosis. Estimated glomerular filtration rate (eGFR) did not differ between them (P= 0.43). Visual CMD was assessed using a 3-point scale (i.e. good, moderate, poor). Quantitative CMD was calculated by (signal intensity of the cortex / signal intensity of the medulla) for patients with visually good and moderate CMD. Differences in the proportions of the visual CMD scores were assessed between the patients with and without liver cirrhosis. We evaluated the differences in eGFR between the good, moderate, and poor scores of the patients with or without liver cirrhosis. We also assessed correlations between the quantitative CMD and eGFR in the patients with and without cirrhosis.

RESULTS
For visual CMD, the proportions of patients in each of the three scores were different between patients with and without liver cirrhosis: more good and fewer poor CMD in the cirrhotic patients (P= 0.048). In cirrhotic patients, eGFR differed between poor CMD and good or moderate CMD (P< 0.01), but not between good and moderate CMD. There were significant differences in eGFR between the three visual scores in CKD patients without cirrhosis (P< 0.05). No significant correlation was observed between quantitative CMD and eGFR in the cirrhotic patients (P= 0.22), in contrast to the CKD patients without cirrhosis (P< 0.05, r= 0.62).

CONCLUSION
Cirrhotic patients with CKD had pseudonormal CMD of the kidney on the T1-weighted MRI. We should interpret CMD carefully in the patients with both liver cirrhosis and CKD.

CLINICAL RELEVANCE/APPLICATION
T1-weighted MRI is useful for identifying chronic kidney diseases in daily practice, but not necessarily in cirrhotic patients because of pseudonormal corticomedullary differentiation of the kidney.

GUS102
PET/MR of Cervical Cancer: Correlation with Baseline and Post Treatment Clinical Staging (Station #3)
Julia R. Fielding MD (Presenter): Nothing to Disclose, Amir H. Khandani MD: Nothing to Disclose, Tiffany Matoska Sills MD, PhD: Nothing to Disclose, Ellen Louise Jones MD, PhD: Nothing to Disclose, Paola Gehrig: Nothing to Disclose, Pinakpani Roy MD: Nothing to Disclose, Weili Lin PhD: Nothing to Disclose

PURPOSE
To determine whether PET/MR correlates with response to treatment in women with advanced cervical cancer.

METHOD AND MATERIALS
In this prospective pilot study, simultaneous acquisition of PET/MR images of the pelvis pre- and post-initial treatment were obtained on 5 women with cervical cancer, clinical stage >1B. This study was IRB and HIPAA compliant. Contrast agents included gadobenate dimeglumine and FDG. The MR protocol consisted of high resolution T2WI, 3D pre- and post- contrast T1-weighted and diffusion series. Simultaneously, a single station PET acquisition was obtained. MR images and PET images of the primary tumor were assessed by 2 different physicians. Decreased tumor size and enhancement of the treated tumor on MR images and decreased SUV on PET images were considered to indicate response to therapy. These results were compared with clinical
response to radiation therapy or surgery.

RESULTS

4 patients underwent external beam radiation therapy and 1 underwent surgery. Pre-treatment exams demonstrated maximum tumor size of 1.7, 1.7, 4.7, 4.8 and 8.7cm. SUV were 12.8, 4.1, 4.9, 8.1 and 25.2, respectively. On MR imaging 2 patients had parametrial extension and 2 patients had lymph nodes larger than 1cm. Increased size and SUV correlated well with a high grade tumor biopsy and clinical stage. On post-therapy images no residual tumor was identified in the surgical patient on MR or PET images. Tumor size decreased as did SUV in all patients after undergoing external beam therapy. (See attached table)

CONCLUSION

In this pilot study both PET and MR imaging response correlated with clinical staging. Assessment of 20 patients following primary and secondary stages of radiation therapy or surgery is ongoing.

CLINICAL RELEVANCE/APPLICATION

Combined functional and anatomic imaging may become surrogates for or confirm clinical staging of advanced cervical cancer.

GUS103 Modified Look-locker Inversion Recovery (MOLLI) for T1 Mapping: Usefulness in Distinguishing Benign and Malignant Renal Lesions (Station #4)

Yuqin Ding MD (Presenter): Nothing to Disclose, Jianjun Zhou: Nothing to Disclose, Mengsu Zeng MD, PhD: Nothing to Disclose, Caixia Fu: Employee, Siemens AG, Hui Liu: Employee, Siemens AG

PURPOSE

To evaluate the usefulness of T1 mapping in distinguishing benign and malignant renal lesions

METHOD AND MATERIALS

29 malignant renal lesions in 29 patients and 14 benign renal lesions in 14 patients were examined using non-enhanced modified look-locker inversion recovery for T1 mapping. The maximum, minimum and averaged T1 values of the lesions were used for quantitative evaluation. Independent t test and receiver operating characteristics analysis were performed for statistical evaluation.

RESULTS

The maximum, minimum and averaged T1 values of benign and malignant renal lesions were (1144.71±446.9)ms,(1081.9±438.9) ms,(1096.2±418.9)ms and (1830.2±350.3)ms,(1527.4±361.5) ms,(1673.5±341.2)ms, respectively. The maximum, minimum and averaged T1 values of benign renal lesions were all significantly lower than those of malignant renal lesions(p

CONCLUSION

It is valuable to use non-enhanced modified look-locker inversion recovery for T1 mapping in distinguishing benign and malignant renal lesions.

CLINICAL RELEVANCE/APPLICATION

Non-enhanced modified look-locker inversion recovery for T1 mapping is useful in distinguishing benign and malignant renal lesions especially in patients with chronic renal disease.

GUS104 Arterial Spin Labelling in the Human Placenta: Mapping Perfusion (Station #5)

Gabriele Masselli MD (Presenter): Nothing to Disclose, Roberto Brunelli: Nothing to Disclose, Maria Giulia Bernieri MD: Nothing to Disclose, Saadi Sollaku: Nothing to Disclose, Riccardo Caprasecca: Nothing to Disclose, Elisabetta Polettini: Nothing to Disclose, Gian Franco Gualdi MD: Nothing to Disclose

PURPOSE

To prospectively evaluate the placental perfusion in both normal and Intra-Uterine Growth Restriction (IUGR) complicated pregnancies by means of magnetic resonance imaging (MRI), using Arterial Spin Labelling (ASL).

METHOD AND MATERIALS

This study was approved by the local ethics committee and all participants provided written informed consent. 40 women with singleton pregnancies at a gestational age between 26-39 weeks who underwent MRI for evaluating fetal abnormalities or to rule out placental adhesive disorders were enrolled in the present investigation. 33 patients displayed a fetal growth appropriate for gestational age; 7 pregnancies were complicated by late IUGR. All participants had an ultrasound scan performed on the very same day of MRI and fetal weight, amniotic fluid index and doppler interrogation of uterine and umbilical arteries were assessed. The position of ASL slice was carried out through the placenta long axis, from which placenta resulted as a discoid-shape on image. The inversion slice was positioned over spiral arteries in order to label mother blood spins. ASL parameters were: TR/TE= 2500/27; FOV=320; Matrix=100x100; TI= 1645; slice=8 mm. Measure was performed with 90 averages. Two experienced radiologists placed ROI over the perfusion maps including
only the placenta and mean value was recorded.

RESULTS

Mean perfusion value in normal pregnancies was 190.28 ml/100g/min. We observed a positive correlation between placental perfusion and gestation age (R²=0.167). Perfusion values were significantly lower in all the 7 pregnancies complicated by IUGR (134.43 vs. 190.28 p=0.03). In 4 IUGR patients with the lower perfusion index, we observed after a mean interval of 4 days from MRI, the onset of fetal brain sparing (cerebral vasodilatation). Notably, the PI indexes of both uterine and umbilical arteries of these patients were not significantly different from those of the remaining study population.

CONCLUSION

ASL MR imaging of placental perfusion provides a suitable non invasive tool to measure placental perfusion and can be used to differentiate fetuses small for gestational age from those with late forms of fetal IUGR, i.e. with a normal pulsatility index of the umbilical arteries.

CLINICAL RELEVANCE/APPLICATION

Arterial Spin Labeling MRI is a feasible non invasive new tool for evaluating and quantifying placental perfusion that may be potentially useful for the treatment of some forms of IUGR.
Second-Opinion Interpretations of Neuroimaging Examinations by Subspecialty Radiologists Significantly Impacts the Care of Cancer Patients (Station #1)

Vaios Hatzoglou MD (Presenter): Nothing to Disclose, Sofia Haque MD: Nothing to Disclose, Andrei I. Holodny MD: Employee, fMRI Consultants LLC

PURPOSE

To determine if second-opinion interpretations of outside neuroimaging studies by neuroradiologists at a tertiary care cancer center provided a significant benefit to cancer patients.

METHOD AND MATERIALS

This study was performed after local Institutional Review Board approval and in compliance with Health Insurance Portability and Accountability Act regulations. We retrospectively reviewed 300 second opinion interpretations performed by 3 subspecialty trained neuroradiologists from November 2012 through April 2013 and compared these reports to the outside reports submitted with the outside images. There were 15 excluded cases because the outside reader did not have the benefit of prior studies and/or histopathology available to the in-house neuroradiologists at the time of their second-opinion interpretations. The reports were categorized by using a previously described five-point scale: 1, no difference in interpretation; 2, clinically unimportant difference in detection; 3, clinically unimportant difference in interpretation; 4, clinically important difference in detection; and 5, clinically important difference in interpretation. Clinically important differences were defined as those that resulted in a change of diagnosis that affected prognosis (patient counseling), treatment approach, and/or patient referral.

RESULTS

The rate of clinically important discrepancies between the outside reports and the second opinion consultations was 21% (61/285). The discrepancies in detection (31) were similar in number to the discrepancies in interpretation (30). When histopathology, imaging follow-up and/or clinical assessment was available to establish the final diagnosis, the second-opinion consultation was more accurate 93% (40/43) of the time.

CONCLUSION

Second-opinion interpretations of outside neuroimaging studies of cancer patients by subspecialty radiologists at a tertiary care cancer center have a significant impact on patient care.

The Effects of Self-Editing on Radiologist Productivity, Fatigue and Quality (Station #2)

Sanjeev Katyal MD (Presenter): Nothing to Disclose, Shaina Robinson: Nothing to Disclose, Brian Scott Kuszyk MD: Nothing to Disclose, Susanj S. Patel MD: Nothing to Disclose, Eric Richter MD: Nothing to Disclose, Mark Brown MD: Nothing to Disclose, Suzanne Shullman MD: Nothing to Disclose, James Wilbert Backstrom MD: Nothing to Disclose

PURPOSE

The purpose of this prospective study is to investigate the effects of self-editing on radiologist productivity, report quality, fatigue levels, and overall cost effectiveness of care.

METHOD AND MATERIALS

Approximately 10,000 CT chest and CT abdomen and pelvis interpreted by four body imagers will be assessed over a 6 month period. Outpatient, inpatient and emergency exams will be included in the scope of this study. For each working week, one of two predetermined reading methods will be used by each radiologist: utilizing a medical transcriptionist with findings only dictation style or self-editing with templates. Effects on fatigue levels with and without the use of a medical transcriptionist will be monitored. Each radiologist will complete daily fatigue surveys on a scale ranging from 1 (little) to 4 (significant fatigue). All final reports will be reviewed for reporting errors to determine overall quality outcomes with and without the use of a medical transcriptionist.

RESULTS

A 1,400 representative sampling of our self-editing study data population was preliminarily reviewed. On average, the overall time/case was decreased by approximately two minutes when utilizing a medical transcriptionist than with self-editing. Overall, the four radiologists in our study were approximately 47% more efficient when transferring editing to a lower cost FTE. More importantly, they achieved this increased efficiency with lower fatigue levels. The average fatigue score for the sent to editor workflow was 2.1 and the average score for the self-edited workflow was 3.4. Through the preliminary analysis, there have been no differences in clinically significant accuracy rates between the two reading methods. The entire data set of 10,000 CT scans will be reviewed for both typographical and quality errors.
CONCLUSION

By sending to an editor instead of self-editing CT reports, our radiologists have decreased the overall
time/report by an average of 47% with associated lower fatigue levels. These gains in clinical efficiency can be
traded for reading more cases, performing imaging appropriateness and physician outreach, and spending more
time viewing each case.

CLINICAL RELEVANCE/APPLICATION

The use of voice recognition (VR) has decreased costs by eliminating medical transcriptionists but for most
practicing radiologists, VR may have the unforeseen consequence of decreasing overall productivity and report
quality.

Real Time Radiology Consultative Service for a Resource Poor African Nation (Station #3)

David Andrew Rosman MD (Presenter): Nothing to Disclose, Louise Kalisa: Nothing to Disclose, Peter Valere-Carlo Smeets MD: Nothing to Disclose

PURPOSE

Radiology in Rwanda is markedly underserved with 6 radiologists serving 12 million. The health system of
Rwanda is decentralized comprised of 430+ health centers, 39 district hospitals (inpatient and outpatient) and 4
national referral hospitals. The University Central Hospital in Kigali (CHUK) is the single point of final referral in
the country. As a result the pathology seen is that of the entire population of 12,000,000. An American
Radiologist living in Rwanda served in CHUK and frequently encountered cases that require subspecialty
expertise for ideal interpretation. We sought to create a real time subspecialty consultation service given the
low resource availability.

METHOD AND MATERIALS

CHUK is equipped with a 64-slice Siemen’s scanner. Using an IPhone, the local radiologist would photograph
key images, include history and then triage. An internet connection with speeds less than 100kb/sec was used.
Those which did not need prompt response were emailed to colleagues at the home institution which had a time
difference of 6-7 hours. Those that needed prompt attention were emailed to a Belgium (usually the same time
zone). A phone call was placed but not answered from Rwanda to Belgium (zero cost). Seeing the call, the
Belgian Radiologist would look at the case and triage to the appropriate subspecialty radiologist and email a
reply.

RESULTS

Over 20 cases were sent to Belgium predominately over a 3-month period. Diagnoses included: pleiomorphous
adenoma, agenesis corpus callosum with fat; CLIPPERS (chronic lymphocytic inflammation with pontine
perivascular enhancement responsive to steroids); 13 day old with Rhabdomyosarcoma; parapharyngeal
Lymphangiohemangioma; Megalencephalic leukoencephalopathy with subcortical cysts, metachromatic
leukodystrophy; HIV associated emphysema. Klippel-Trénaunay-Weber; and many others. Urgency was
indicated in the text of the email and when so indicated results have been returned as quickly as 17 minutes.
Cases on average were answered in under 24 hours.

CONCLUSION

Using only the camera and internet capabilities of an IPhone in urban Rwanda, near real time subspecialty
consultation is achievable in low resource settings at nearly zero cost allowing for remarkably improved
diagnosis

CLINICAL RELEVANCE/APPLICATION

With a worldwide shortage of radiologists, marked in impoverished nations, the need for teleradiology is obvious
- we present a way to achieve that with an IPhone and slow internet.

Informed Consent and CT Scans: What the Radiologist Needs to Know (Station #4)

Ian Amber MD (Presenter): Nothing to Disclose, Hima Prabhakar MD: Nothing to Disclose

TEACHING POINTS

1) Understand radiation risks from CT as well as the current paradigm for patient education regarding radiation
risk. 2) Understand the recent ethical and radiologic guidelines for the risk of detection and disclosure of
incidental findings. 3) Synthesize information on radiation risk from CT and the detection and disclosure of
incidental findings to guide the process of radiologist obtained informed consent for CT.

TABLE OF CONTENTS/OUTLINE

I. Explain why evolving ethical and patient care standards may prompt radiologists to consent patients for CT
scans. II. Utilize the radiology literature to discuss radiation risk, emphasizing differences between between
data obtained from radiologic studies versus extrapolated from post-atomic bomb follow-up. We will then
summarize the current paradigm for patient education of radiation risk, including pregnant women. III. Discuss
evolving ethical and radiological guidelines for the risk of detection and disclosure of incidental findings. We will
specifically reference current radiological literature as well as guidelines put forth by the Presidential
Commission for the Study of Bioethical Issues. IV. We will conclude by amalgamating information on radiation
safety and incidental findings to guide radiologist obtained informed consent for CT scans.
Web-Based Interactive Generation of Structured Reports for Lumbar Spine MRI Improves Conformity with Consensus Reporting Guidelines (Station #1)

Patrick H. Do MD (Presenter): Nothing to Disclose, Mingming Ma MD: Nothing to Disclose, Matthew Alexander MD: Nothing to Disclose, Benjamin Boun-Ming Chou MD: Nothing to Disclose, Young S. Kang MD: Nothing to Disclose, Rajul Parimal Pandit MD: Nothing to Disclose, Mahesh Ramu Patel MD: Stockholder, Novartis AG

CONCLUSION
Automated report generation improves accuracy and conformity with accepted guidelines, as well as improving radiologist efficiency.

Background
Classification of lumbar disc pathology identified on MRI and the nomenclature for radiology reporting have historically been variable and difficult to interpret. Professional societies, including ASNR, developed a consensus scheme for nomenclature and classification. With contemporary technology, a role for electronically generated standardized reporting has emerged. We developed and evaluated a customized, web-based program for automated generation of reports using consensus nomenclature.

Evaluation
A web-based structured report generator tailored to lumbar MRI without requiring input of protected health information was created using software implemented on a Linux-based Apache webserver. The involves mySQL databases, AJAX scripting, and additional open source tools. After selection of relevant responses for each field at every spinal level, the program outputs text in a format appropriate for the imaging report that can be simply pasted into the electronic dictation system. A retrospective review was conducted to compare reports generated with and without use of the program. Conformity was evaluated, and resident and attending physician satisfaction with the program was evaluated with a survey. 50 reports each were evaluated with and without program implementation. Conformity with consensus nomenclature was found in 50% of reports without implementation and 96% with implementation. 10 residents and 4 attendings were surveyed. 12 of 14 (86%) users indicated the program increased efficiency and decreased ambiguity of reports compared to the previously utilized macro-based scheme. 2 of 14 (14%) had no preference between the two schemes. 9 of the surveyed residents (90%) indicated improved inter-attending concordance following program implementation.

Discussion
Appropriate use of consensus classification and nomenclature aids clinicians in managing disease and assessing response to treatment. The above-described program improves conformity in reporting and increases radiologist efficiency. This process found widespread acceptance by surveyed radiologists.

To Call or Not to Call? Referring Providers’ Preferences on Communication of Non-Emergent Actionable Findings (Station #2)

Seetharam C. Chadalavada MD, MS (Presenter): Nothing to Disclose, Tessa S. Cook MD, PhD: Nothing to Disclose, Caroline Sloan: Nothing to Disclose, Darco Lalevic: Nothing to Disclose, Curtis P. Langlotz MD, PhD: Shareholder, Montage Healthcare Solutions, Inc Advisory Board, Reed Elsevier Advisory Board, Activate Networks, Inc Spouse, Consultant, Johnson & Johnson, Mitchell Dennis Schnall MD, PhD: Nothing to Disclose, Hanna Maryam Zafar MD: Nothing to Disclose

CONCLUSION
Our experience in developing a standardized lexicon for abdominal follow-up recommendations has been greatly shaped by the feedback of referring providers. Most referring providers prefer detailed follow-up recommendations when appropriate, but patients would also greatly benefit from an automated system to ensure follow-up occurs appropriately.

Background
Although free-text reports allow radiologists to customize reports, they introduce variability in the presence and content of follow-up recommendations, which may create confusion. Our objective was to understand referring provider preference for the communication of follow-up recommendations of non-emergent actionable findings on abdominal imaging using a standardized reporting lexicon.

Evaluation
We conducted a survey of all potential providers referring patients to abdominal imaging using an online survey software (Qualtrics). Among 433 referring providers 79 (18%) responded to the survey. 40 (51%) were female, 50 (63%) worked in a primarily outpatient/clinic based practice, and 61 (77%) providers had more than 5 years of clinical practice experience. Forty eight (65%) providers preferred recommendation for follow-up within the report, 2 (3%) selected never and 3 (4%) rarely. 63 (86%) providers desired both a modality and time interval for follow-up within the recommendations. Forty-two 42 (63%) providers indicated that the decision to not follow-up a recommendation is due to patient prognosis, while 26 (39%) stated it is based on patient preference. Twenty seven (37%) providers indicated they had no system in place for monitoring completion of follow-up and 9 (12%) indicated dedicated office personnel assigned to this task. Preferred means of communicating actionable findings were phone call (39, 53%), email (33, 45%), and electronic medical record message (27, 36%).

Discussion
Most providers desire recommendations for follow-up that include a specific modality and time interval. The decision to not pursue recommended follow-up is on clinical basis, often made based on patient prognosis. Most referring providers do not have an effective mechanism to ensure completion of follow-up recommendations.

Computed Tomography Turnaround Times in the Emergency Department: Radiologist Productivity and "Patient Ready Project" Will Make You Turn Around (Station #3)


CONCLUSION
Radiology turnaround times can be markedly improved by assuming ownership and addressing inefficiencies in the various segments defining PAEC and ECRA.

Background
Radiology Department (RD) turnaround times (TAT) are continuously scrutinized by the entire medical team. At our institution, radiologist interpretation times were historically cited as the primary source of delayed treatment and discharge of Emergency Department (ED) patients. A change in radiologists and governance structure in 2008 prompted a systematic improvement in imaging TAT in the ED.

Evaluation
1st part of our study evaluated ‘Patient Arrival to Exam Complete’ (PEAC) time at baseline and after process implementation that improved system efficiencies. Patient Ready Project was initiated at 7 Hospital campuses in step-wise fashion 9/2010-3/2012. In first quarter (Q1) of 2008, baseline TAT from PAEC averaged 229 minutes for 26,335 ED CT scans. During Q1 of 2012, PAEC time dropped to 105 min. avg. One year after Patient Ready implementation, communication/logistics between the ED and RD significantly improved through series of checklists. Avg. PAEC was 110 min. in Q4 of 2013 despite 26% increase in CTs to 33,280. 2nd part of the study evaluated ‘Exam Completion to Report Available’ (ECRA) time at baseline and after intervention increasing radiologist productivity (reorganized PACS worklists, voice recognition templates, incentives, swing shifts matching radiologist and study volumes). ECRA in Q1 of 2008 averaged 74 min, steadily decreased from 2008 to 2013, and averaged 15 minutes in Q4 of 2013. However, improved Radiology TAT did not yield an equivalent decrease in time to discharge from the ED.

Discussion
Overall time from patient arrival to discharge from the ED proved to be partly, but not solely, dependent upon radiology department functionality. Individual components of system-wide and radiologist-dependent processes were dissected in order to understand deficiencies and extract maximal benefit. Through this two part endeavor, turnaround times of CT studies arriving at the PACS station decreased 52% over 5 years, and Radiologist time decreased by 80%. Interestingly, these improvements did not yield a direct correlation with time to discharge from the ED.

A Pocket-Size, Portable PACS and Open-Source Software Development Platform for Biomedical Researchers and Educational Institutions (Station #4)


CONCLUSION
A portable, cost-efficient radiology application development ecosystem was created for biomedical researchers. Furthermore, low cost hardware coupled with open-source software makes the device a viable solution as a radiology teaching aid and rapid software development platform.

Background
A pocket-size PC utilizing open-source software was created to fulfill the need for a low cost software developer tool and teaching aid for biomedical researchers and educational institutions. The system was designed for “plug-and-play” setup and rapid application creation and deployment. Additionally, the device functions as a teaching instrument demonstrating basic PACS function and software development. A unique user interface with standard or touch screen display integration was designed to facilitate ease of use for users with no programing background.
Evaluation

Hardware includes a credit card size, Linux OS based PC with internet connectivity. Open-source software was modified and compiled specifically for the device and is comprised of (1) a PACS suite; (2) DCMTK library; (3) programming libraries (JAVA, PERL, Python); (4) internet server/services (Apache, PHP, SQL); (5) indexing search engine with anonymized database that allows keyword queries. All data including OS and developer software reside on a removable SD card.

Discussion

SD card contents are stored as an 'image' file which allows for a rapid and efficient backup solution. This equates to no down-time in the event of hardware failure. Also, the image can be cloned on to a new card, creating a multitude of identical devices, and eliminating time needed to reinstall/recompile the OS and developer libraries. Incorporating DCMTK binaries used in conjunction with the most common programming languages and web services provides for a robust and versatile software development environment. Coupled with a locally running PACS and keyword queryable database, applications specific to a researcher's needs can be written. Additionally, radiology image based studies can be initiated by simply uploading DICOM images and associated radiology, pathology, or similar text data to the device. This data is then processed by the device and accessible via the device's web interface.

TEACHING POINTS

CAD should not be seen as a 'black box.' Understanding how CAD analyses images and determines relevant outputs for the radiologist is fundamental for optimal diagnostic use as well as improving quality in radiology. Through participation in this exhibit, the audience will learn and demonstrate understanding of the goals, roles, and applications and future directions of CAD.

A Knowledge-based Representation of Clinical Trial Reports for Evidence-based Decision Support (custom application computer demonstration)

Numerical information presented in figures, tables, and text within a clinical trial report is the evidence that guides clinical decision making and evidence-based medicine (EBM). However, hurdles exist when attempting to extract and apply this information. The published report has data scattered throughout the report and the context behind each piece of data is not automatically extracted. In addition, the clinical trial study describes specific experiments performed on a pre-defined patient population and comparisons between reports to determine subtle differences in trial design requires critical review by a domain expert. The goal of this research is to demonstrate a system with a context-driven representation to: 1) synthesize fragments of information found in clinical trial reports, 2) assess the strength and quality of a the study, 3) compare knowledge from similar trials. Previously, we have demonstrated a framework to organize numerical data within one clinical trial report. In this exhibit, we further develop this system to include the ability to retrieve and compare similar trials based on similar population characteristics, methods, interventions, or survival metrics.

Evaluation

We demonstrate the tool using clinical trial papers in the domain of non-small cell lung cancer (NSCLC). The usability and satisfaction of the system was evaluated using a 10-point Likert scale. The query outputs from the system were evaluated by domain experts for scientific significance.

Discussion

A structured representation was demonstrated with an interactive visualization. The visualization performed common queries, aided in interpretation and has implications for furthering scientific discovery.

CONCLUSION

In this exhibit, we have specified a representation for the purpose of synthesizing and integrating selected information from clinical trial reports in the domain of NSCLC. The tool transforms free-text reports to the target representation with functions allowing comparisons between trials. This research is relevant to radiology researchers involved in comparing and synthesizing clinical trial results and provides the basis for inductive reasoning using evidence from trial studies.
The Ultrasound Report of the Future (custom application computer demonstration)


Background

Ultrasound is practiced in a chaotic fashion with ultrasonographers attempting to record images in a logical pattern but frequently having to return to prior anatomy to record additional images. As a result, a radiologist to formulate a logical report from the random collection of images. We have developed a multimedia structured reporting system that tags each image with an anatomical location and radiological observation/diagnosis. The system allows a radiologist to designate key images for each anatomical site, and then drag-and-drop related images onto the key images to create supporting images of those findings. With this method, a multimedia structured report can be assembled from a random collection of images, a process that is well-suited for the practice of ultrasound.

Evaluation

We have developed a multimedia structured reporting system that functions in a client-server software arrangement. The client software runs in parallel with any third-party vendor’s image display/analysis system to capture images, metrics and voice descriptions of each finding as identified by a radiologist. The images and voice data are transmitted to a server where metadata is extracted from the descriptions to indicate the anatomical location and radiological observation/diagnosis of each finding. The server software provides a means for a radiologist to drag-and-drop supporting images onto key images in order to organize a random collection of ultrasound images. The server software assembles the image findings into a multimedia structured report organized by anatomical categories. In addition, the server provides a means to link image findings from serial examinations to create graphical disease timelines showing the evolution of disease at each anatomical site.

Discussion

Ultrasound images are often recorded in random patterns. Our multimedia structured reporting system provides a means to organize random images while simultaneously creating structured report data which is essential for electronic health record initiatives.

CONCLUSION

We have developed a multimedia structured reporting process that is well-suited to the practice of diagnostic ultrasound.

Improving Peer Review Compliance: A Novel Solution for Anonymous Review on PACS (custom application computer demonstration)

Chun-Shan Yam PhD (Presenter): Nothing to Disclose, Bettina Siewert MD: Nothing to Disclose, Jonathan Yam: Nothing to Disclose, Jonathan B. Kruskal MD, PhD: Author, UpToDate, Inc, Seth Joshua Berkowitz: Nothing to Disclose

Background

Mandated by the ABR, Peer Review is becoming part of the daily routine for many radiologists in the United States; however, Peer Review is not yet 100% compliant in all radiology settings. One of most common issues hampering the Peer Review process in today’s radiology workflow is the lack of anonymity for the reading radiologist who rendered the original report. Many radiologists have shared a common concern that Peer Review may damage interpersonal relationships with their colleagues. Based on a literature search on currently available Peer Review implementations in radiology institutions, none of these systems are anonymous - the name of the reading radiologist is exposed to the reviewers. The main reason for this drawback is because the process is attached to the existing RIS and PACS system for image viewing and it is very expensive to duplicate the entire PACS just for anonymous viewing. In this study, we propose a novel and simple solution for an anonymized Peer Review system.

Evaluation

We have developed a mechanism to bridge the PACS image database and the Peer Review system using a simple Java based web browser for displaying the DICOM images. To be HIPAA compliant, other associated materials such as reports and pathology results are also available for the reviewer with all PHI removed. An applet was developed using an open source software Java Development Kit for image viewing. The DICOM communication between the viewer and PACS is connected by another freeware MIR Central Test Node DICOM Software. Basic image manipulation tools such as scrolling, zooming and measuring are provided for the reviewers. This new software is available for RSNA readers upon request to the authors.

Discussion

We have developed novel software allowing for anonymized Peer Review in PACS/RIS Radiology settings.

CONCLUSION

Since both images and reports are completely anonymized, reviewers can focus on the Peer Review process more effectively instead of worrying about the potential risk of damaging the interpersonal and/or professional
relationships with their colleagues. We believe this novel software will encourage more radiologists to participate into this required Peer Review process.

**Background**

In order to improve diagnostic performance of musculoskeletal MRI we compare our diagnostic reports against actual surgical report findings. Historically, this involved a cumbersome paper-based process whereby both reports were printed, reviewed by a division chief, and any discrepancies annotated. The annotated reports were then sent to the radiologist for review. In order to simplify this process and begin to understand our overall performance, a web-based peer-review application was developed.

**Evaluation**

The report correlator system was created as a web-based, database application which allows an administrator to easily prepare cases to be scored by staff radiologists. With the administrator's guidance, the system automatically uploads and extracts the impression and findings from the MRI Radiology report for individual scoring. The corresponding surgical report is then copied into the application from the electronic medical record. Once the data is uploaded, it is available to radiologists for peer-review. Cases are scored in a blinded manner using the surgical report as the gold-standard. Radiologists cannot score their own cases or view the scored cases of their colleagues. The division chief and department chairperson can review scoring for all cases. Once a radiologist logs in, he or she is given a choice to perform a review of newly added cases or view the surgical correlation for cases in which they provided the initial interpretation.

**Discussion**

The system has been deployed for our musculoskeletal division as a pilot evaluation with a limited number of radiologists. Based on pilot feedback, reporting tools will be added to allow individual radiologists to anonymously compare their performance to their peers. As this system expands, we anticipate that it will also be used as a tool for radiology-surgical pathology correlation.

**CONCLUSION**

Using an electronic, peer review system to correlate and score musculoskeletal MRI reports with surgical findings provides a necessary tool to evaluate diagnostic performance and provide educational feedback to our faculty.

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**MIS-SUA**

**Molecular Imaging Sunday Poster Discussions**

Scientific Posters

**MIS115**

Quantifying Progression and Regression of Atherosclerosis in ApoE-/- Mice Using Gadospin F at 7T MRI: Comparison of Volumetric Method and T1 Relaxivity to en Face Measurements (Station #7)

Caroline Jung (Presenter): Nothing to Disclose, Sabine Christiansen: Nothing to Disclose, Michael Gerhard Kaul: Nothing to Disclose, Markus Heine: Nothing to Disclose, Harald Ittrich MD: Nothing to Disclose, Gerhard B. Adam MD: Nothing to Disclose

**PURPOSE**

The aim of this study was to quantify atherosclerotic plaque by volumetric assessment and by determining T1 Relaxivity at 7T MRI using Gadospin F (GDF) in comparison to en face measurements.

**METHOD AND MATERIALS**

Mice (n=5 for each group) were set on high fat diet (HFD) at 9 weeks of age. In-vivo MRI of the aortic vessel wall was performed at 9, 13, 17 and 21 weeks after commencement of the HFD. Therapy group was reswitched
to normal rodent diet 13 weeks after starting HFD and monitored by MRI for 12 weeks. ApoE-/- and control mice were imaged before and two hours after i.v. injection of GDF (dosage: 100 µmol/kg) at a small animal MRI at 7T (ClinScan, Bruker). MRI was performed using a 3D Inversion Recovery Gradient echo MR sequence (TR/TE 650/2 ms, TI 250ms; FA 20°; NSA 6, matrix 196 x 196, 64 slices, slice thickness 180µm; TA 9min, ef. voxel resolution (180 µm)3 in transverse orientation covering the thoracic aorta. In same slice orientation T1 Mapping was performed using Saturation Recovery sequences. Subsequently, mice were killed for en face preparation. MR image analyses were performed using ImageJ (V. 1.44p, NIH, USA). Total plaque volume (TPV), total plaque volume relative to the examined area of the aorta (rTPV) and T1 Relaxivity were estimated. Pearson correlation between MRI and en face measurements was analysed.

RESULTS

MRI and en face analyses showed an exponential increase of TPV, rTPV and T1 relaxivity over time, which showed a slower and linear increase for therapy group. A good correlation (r=0.74; p<0.001) for TPV between MRI and en face measurements was observed which was even stronger estimating the rTPV (r=0.89; p<0.001). A correlation of r=0.71 (p<0.001) was achieved between T1 relaxivity and TPV en face measurements, while only a correlation of r=0.57 (p<0.01) was found between rTPV in en face measurements and T1 relaxivity. In control mice no plaque volume was observed. A moderate but not significant correlation was found for body weight and cholesterol and triglyceride level (r>0.7 and r>0.8, respectively).

CONCLUSION

GDF-enhanced MRI showed a moderate to strong correlation between measured plaque volume and T1 Realxivity in vivo and typical en face measurements ex vivo.

CLINICAL RELEVANCE/APPLICATION

GDF-enhanced in vivo MRI is a powerful noninvasive imaging technique allowing reliable estimation of plaque burden, monitoring of disease progression and evaluation of therapy response in preclinical studies.

Ultrasound-targeted Microbubble Load with Copper for Myocardial Infarction: Assessment with Echocardiography and 3.0T Magnetic Resonance Imaging in Rhesus Monkey [ MI Scavenger Hunt! ] (Station #8)

Ultrasonic-targeted Microbubble Load with Copper for Myocardial Infarction: Assessment with Echocardiography and 3.0T Magnetic Resonance Imaging in Rhesus Monkey

Lizhi Zhang MD (Presenter): Nothing to Disclose, Pengfei Han: Nothing to Disclose, Chunchao Xia: Nothing to Disclose

PURPOSE

Copper (Cu) has the ability of stimulating microvessel formation by regulating VEGF expression after myocardial infarction (MI). The aim of this study is to prospectively determine the effects of ultrasound-targeted microbubble destruction (UTMD) loaded with Cu intervening MI in the rhesus monkey, and to quantitatively evaluate the cardiac function and myocardial angiogenesis after treatment with echocardiography and 3.0T MRI scanner.

METHOD AND MATERIALS

The institutional animal care and use committee approved this study. Fifteen MI models were established by ligation the left anterior descending artery of coronary artery. MI was successfully induced in 15 rhesus monkeys (2-year-old) by ligation the left coronary artery. They were randomly assigned into three groups (n=5 in each group): UTMD loaded Cu group, microbubble loaded Cu without destruction group, and control group. Echocardiography and MRI were used to trace the Cu and measure the perfusion, infracted region, and LV ejection fraction. HandE, TTC stains and immunohistochemistry were used to assess the infracted region and microvessel density (MVD). One way ANOVA test was used to determine significantly differences between animal groups. Bonferroni correction was used to adjust p values for multiple comparisons.

RESULTS

After therapy, the infarcted regions in the UTMD loaded Cu group significantly reduced at perfusion and delayed-enhancement imaging (p<0.05), and ejection fractions increased (p<0.05) when compared with control and Cu without destruction group. In contrast, the infarcted regions and ejection fractions deteriorated in control group. Histopathologic findings and MVD in the UTMD loaded Cu group were better than the results in others groups (p=0.01).

CONCLUSION

Ultrasound-targeted microbubble can effectively deliver Cu to the infarcted region, which significantly improved cardiac functions, reduced infarcted regions, and stimulated angiogenesis. MR imaging may be helpful to dynamically monitor and assess the therapeutic effects in vivo.

CLINICAL RELEVANCE/APPLICATION

Copper (Cu) has the ability of stimulating microvessel formation by regulating VEGF expression after myocardial infarction (MI). Ultrasound-targeted microbubble can effectively deliver Cu to the infarcted region, which significantly improved cardiac functions, reduced infarcted regions, and stimulated angiogenesis. Our study provides a novel way in the therapy of myocardial infarction.

Preliminary Results: Functional and Morphological Evaluation of Hand Microcirculation of the Hand in Patients with Symptoms of Upper Extremity Ischemia by Means of a 2D Optical Imaging System

MIS116

MIS117
(Station #9)

Jan Neumann MD (Presenter): Nothing to Disclose, Alexander Zimmermann: Nothing to Disclose, Christoph Schmaderer: Nothing to Disclose, Moritz Wildgruber MD, PhD: Nothing to Disclose, Ernst J. Rummeny MD: Nothing to Disclose, Reinhard Meier MD, PhD: Nothing to Disclose

PURPOSE

The aim of this study was to investigate an Indocyanine Green (ICG)-enhanced optical imaging (OI) system to differentiate between haemodynamically relevant stenosis looking at the microcirculation of the hand in patients with symptoms of upper extremity ischemia and volunteers.

METHOD AND MATERIALS

3 female Patients (mean age = 42.3) with clinical suspicion of upper extremity peripheral artery disease including claudication, rest pain, or tissue loss and 10 healthy volunteers were examined with a clinically new available ICG-enhanced optical imaging system (mivenion GmbH, Germany). The microcirculation of both hands was graded objectively by three independent radiologists on a 3-point-ordinate scale (0: normal blood flow, 1: mild, 2: severe alteration of microcirculation). Results were correlated with CT, MRI or angiography as standard of reference.

RESULTS

All patients showed in OI an alteration of microcirculation of the affected hand in comparison to the healthy contralateral hand and in comparison to the healthy volunteers. CT, MRI or angiography as standard of reference confirmed a stenosis of upper extremeties arteries, dialysis (AV) shunt malfunction or vascular anomalies. The differences were significant between the patient group compared to the control group (p<0.05).

CONCLUSION

Our preliminary data shows, that optical imaging allows to differentiate between haemodynamically relevant stenosis looking at the microcirculation of the hand in patients with symptoms of upper extremity ischemia. OI might be of substantial added value to clinical examination due to its non-invasiveness, low costs and easy availability.

CLINICAL RELEVANCE/APPLICATION

OI is a fast, inexpensive, non-invasive and non-ionizing imaging modality which has potential to be helpful for characterization of the cutaneous microvascularization in patients with symptoms of upper extremity ischemia.

MIS118

Performance of Whole-body PET/MR and PET/CT in Evaluating Bony Metastases in Breast Cancer Patients (Station #10)


PURPOSE

To compare the diagnostic performance of whole-body FDG-PET/MR with same day FDG-PET/CT in the detection of bony metastases in patients with breast cancer (BC).

METHOD AND MATERIALS

144 consecutive patients with BC underwent whole-body FDG-PET/CT (Gemini TF, Philips) and same day FDG-PET/MR (Biograph mMR, Siemens). PET/CT and PET/MR studies were independently evaluated by two readers. Attenuation correction of PET/MR was performed with Dixon sequences. Accepted morphologic and nuclear medicine criteria were used to assess for bony metastases. Patients were excluded in the case of innumerable metastases or of benign lesions. In the case of numerous but still countable lesions, they all were counted. However only of the 5 most FDG-avid lesions had the SUV measured.

RESULTS

PET/MR quality was deemed adequate in 142/144 patients. 5 were excluded due to innumerable metastases and 5 because of the benign nature. Bony metastases were found in 22/132 patients on PET/MR and in 20/132 patients on PET/CT. A total of 132 metastases were found in 22 patients. In 9/22 patients PET/MR and PET/CT detected the same number of lesions, in 13/22 PET/MR disclosed more metastases than PET/CT. PET/MR detected 132 metastases: 70/132 both on PET and MR, 55/132 on MR only, 7/132 on PET only. Average SUV 6.88, SD±5.09. PET/CT demonstrated 75 metastases: 44/75 both on PET and CT, 8/75 on CT only, 23/75 on PET only. Average SUV 5.84, SD±3.84.

CONCLUSION

FDG-PET/MR demonstrated more numerous metastases per patient and metastases in more patients than same day FDG-PET/CT.

CLINICAL RELEVANCE/APPLICATION
PET/MR might represent a very promising and accurate technique for detection of bony metastases in breast cancer patients.

The Plantar Plate Complex of the First Metatarsophalangeal Joint: High Resolution MR Imaging at 11.7T and 3.0T with Anatomic and Histologic Correlation (Station #1)

Diego Avila Lessa Garcia MD (Presenter): Nothing to Disclose, Higor Grando MD: Nothing to Disclose, Eric Y. Chang MD: Nothing to Disclose, Sheronda Statum: Nothing to Disclose, Graeme M. Bydder MBChB: Nothing to Disclose, Christine B. Chung MD: Nothing to Disclose

PURPOSE

There is discrepancy regarding the nomenclature and inconsistent anatomical descriptions in the literature with regard to the plantar plate of the first metatarsophalangeal joint (MTPJ). The purpose of the study is 1) to provide high and ultra-high resolution morphologic evaluation of the plantar region of the first MTPJ focusing on anatomic relationships and structural integrity and 2) to introduce the concept of the plantar plate complex.

METHOD AND MATERIALS

The first MTPJ of six fresh-frozen cadavers were used for this study. Imaging of the first MTPJ was performed on a 3.0T clinical MR system (General Electric Healthcare Medical Systems, Milwaukee, WI, United States) with a 2D intermediate-weighted sequence (TR 2000ms TE 35ms) and a 3D-FSPGR sequence (TR 50ms TE 5.2ms) as well as on an 11.7T MR system with a spin echo sequence (TR 5000ms TE 10ms). The plantar regions of each MTPJ were qualitatively analyzed on the MR images. Correlation with gross anatomic dissections and histology was performed.

RESULTS

Five ligaments, two sesamoids, a fibrous tissue pad, a capsule and six tendons compose the plantar plate region of the first MTPJ. The external and internal architecture of each of these structures is well demonstrated at both field strengths. Through anatomic and histologic correlation, it is evident that the first plantar plate is not a single structure, but rather a capsuloligamentous complex assisted by a dynamic musculotendinous apparatus.

CONCLUSION

MR imaging with gross and histologic correlation allows clarification of the previously confusing plantar plate complex of the first MTPJ.

CLINICAL RELEVANCE/APPLICATION

Dedicated coils and high resolution MRI allows for evaluation of the first MTPJ at a level never before seen. Knowledge of the normal detailed anatomy of each component is important for radiological interpretation.
RESULTS
We reviewed 60 cases in 49 patients. Tendinosis of PTT was visualized only in 59.5% of the ankles, whereas a significant degeneration of the SLC was demonstrated in 87% of the cases. The most affected area of the SLC was the distal part of the superomedial component in all cases and we visualized a fibrillar disruption in almost one out of three of the cases. We assessed destabilisation more frequently in cases with both SLC degeneration and PTT tendinosis; additionally, in those patients with clear adduction of the talar head while standing, was more frequent the rupture of the SLC.

CONCLUSION
Ultrasound is an accurate technique in the evaluation of the spring ligament, and its signs of degeneration are more frequently visualized than PTT tendinosis in patients with acquired flat foot in their initial phases. Dynamic US is a reliable method for measurement the peritalar desestabilization.

CLINICAL RELEVANCE/APPLICATION
The radiological literature of the acquired adult flat foot is based on the study of the posterior tibial tendon and PTT insufficiency is considered the main cause of this disorder, however imaging techniques may show no abnormalities in this structure. This study shows that degeneration signs are more frequently visualized in SLC than in PTT, demonstrating the capital importance of this ligament complex on its own, in maintaining the normal alignment and height of the medial longitudinal arch.

MKS343
Ligament Complex in the Carpometacarpal Joint of the Thumb: Assessment Using 3D Isotropic T1-weighted Fast-spin Echo Indirect MR Arthrography (Station #3)

Hye Jung Choo MD (Presenter): Nothing to Disclose, Sun Joo Lee MD: Nothing to Disclose, Young Mi Park MD, PhD: Nothing to Disclose, Dong Ho Ha MD, PhD: Nothing to Disclose, Seon-Jeong Kim MD: Nothing to Disclose, Ok Hwa Kim: Nothing to Disclose

PURPOSE
The exact evaluation about the ligaments supporting the carpometacarpal joint (CMCJ) of the thumb is not easy on MRI, because the ligaments in the 1st CMCJ are complicated and the 1st CMCJ rests in a pronated and flexed position relative to the plane of the CMCJ of the other fingers. In this study, the ligament complex in the 1st CMCJ was evaluated by using 3D isotropic T1-weighted fast spin-echo (3D T1 FSE) indirect MR arthrography.

METHOD AND MATERIALS
Three-dimensional T1 FSE indirect MR arthrography of the wrists was obtained from 26 patients (11 women, 15 men, and mean age, 39.9 years) without abnormality in the 1st CMCJ. On the reformatted axial, coronal and sagittal MR images according to the plane of the 1st CMCJ, the visibility, signal intensity, and thickness of the dorsoradial ligament (DRL), posterior oblique ligament (POL), superficial anterior oblique ligament (sAOL), deep anterior oblique ligament (dAOL) and ulnar collateral ligament (UCL) of the 1st CMCJ were evaluated by two musculoskeletal radiologists in consensus.

RESULTS
The DRL, POL, and dAOL were visualized in all the patients (100%), whereas sAOL was visualized in 12 (46%) and UCL in 24 (92%). The DRL showed low signal intensity in 77% of the patients, POL intermediate signal intensity in 77%, dAOL intermediate signal intensity in 100%, and UCL striated appearance in 83%. The POL was the thickest ligament (mean thickness, 2.3 mm; range, 1.7-3.4 mm) and the sAOL was the thinnest ligament (mean thickness, 0.5 mm; range, 0.4-0.8 mm).

CONCLUSION
The multiplanar reformatted 3D T1 FSE indirect MR arthrographic images according to the plane of the 1st CMCJ provided the high visibility and the detailed information about the ligament complex of the 1st CMCJ.

MKS344
Evaluation of Soft-tissue Sarcoma Response to Pre-operative Neoadjuvant Therapy: Added Value of Functional MR Imaging Techniques at 3.0T (Station #4)

Theodoros Soldatos MD, PHD : Nothing to Disclose, Majid Chalian MD (Presenter) : Nothing to Disclose, Michael Anthony Jacobs PhD : Nothing to Disclose, Laura Marie Fayad MD : Nothing to Disclose

PURPOSE
To determine the added value of functional magnetic resonance (MR) sequences (dynamic contrast-enhanced [DCE] and quantitative diffusion-weighted imaging [DWI] with apparent diffusion coefficient [ADC] mapping) to conventional MR for assessing the response of soft tissue sarcomas (STS) to pre-operative neoadjuvant therapy.

METHOD AND MATERIALS
At 3T, 23 patients (13 males, 10 females, mean age 48±26 years, range 2-89 years) with high grade STS who underwent MR imaging with conventional (T1-weighted, fluid-sensitive, fat-suppressed static post-contrast T1-weighted) and functional (DWI/ADC mapping, DCE-MR) sequences following neoadjuvant therapy, were included. Two readers evaluated all imaging independently (with resolved differences by consensus) for the presence of response by conventional imaging (response defined as ≤5% post-contrast enhancement within the tumor), DCE-MR (response defined as ≤5% of tumor enhancement on arterial phase images), and DWI (response defined as ≤5% of tumor with ADC <1.0 mm2/sec). The presence of response by imaging was compared to the post-operative histologic response, (response defined as >95% non-viable tissue in the tumor), using Fisher's exact test. ROC analysis was performed to determine ADC threshold values that show adequate histologic response.

RESULTS

Of 23 tumors, 4 (17.4%) had adequate histologic response (≤5% viable tumor) in the form of necrosis and scar tissue (necrosis range 0%-95%, scar range 0%-100%), whereas the remaining 19 (82.6%) had a range of 10%-100% viable tumor. The sensitivity and specificity of imaging for determining adequate treatment response was 0% and 94.7% for conventional MR, 100% and 77.7% for DWI/ADC mapping, and 100% and 85.7% for DCE-MR, respectively. A threshold ADC for adequate treatment response was obtained with a minimum ADC>2.0 mm2/s (100% sensitivity, 61.1% specificity) or an average ADC>2.2 mm2/s (50% sensitivity, 77.8% specificity).

CONCLUSION

The addition of functional MR sequences to the conventional MR protocol increases the sensitivity of MR imaging for determining the presence of adequate treatment response in STS, particularly when the tumor undergoes histologic response by forming scar tissue rather than necrosis.

CLINICAL RELEVANCE/APPLICATION

Since STS may respond to neoadjuvant therapy with scar formation rather than necrosis, functional imaging may be used to improve the prediction of response by MR.

Characterization of Healthy and Symptomatic Patellar and Achilles Tendons by Shear Wave Elastography (SWE) (Station #5)

Timm Dirrichs (Presenter): Nothing to Disclose, Christiane Katharina Kuhl MD : Nothing to Disclose, Simone Schrading MD : Nothing to Disclose

PURPOSE

Non-invasive evaluation of tendon elasticity may enhance diagnosis of tendon injury, and if so, could be used to monitor treatment effects. Shear wave elastography (SWE) has shown to be a powerful tool to estimate tissue stiffness. Aim of this study was to evaluate the feasibility and imaging findings of SWE in healthy and symptomatic patellar and achilles tendons.

METHOD AND MATERIALS

55 achilles tendons (35 symptomatic and 20 asymptomatic tendons) and 50 patellar tendons (30 symptomatic and 20 asymptomatic tendons) were systematically examined with SWE in the longitudinal and axial plane using a high-resolution linear 15 MHz probe (Aixplorer, Supersonic Imagine, Aix-en-Provence, France). In all tendons at least 3 SWE color maps were acquired in the distal, middle and proximal part of the tendon. A semi-quantitative analysis was done by analyzing the SWE color maps (homogenously blue = soft, turquoise=intermediate stiffness, yellow-red= high rigidity) (max. 180kPA). In addition, a quantitative, ROI-based analysis of tendon elasticity was done. SWE values of symptomatic and healthy tendons were compared by using the student's t-test.

RESULTS

At semiquantitative analysis of the SWI color map, symptomatic tendons were rated as "soft" in 87.6% (57/65), as "intermediate" in 9.2% (6/65), and as "rigid" in 0.3% (2/65). In contrast, healthy tendons were rated as "soft" in 10% (4/40), as "intermediate" in 37.5% (15/40), and as "rigid" in 52.5% (21/40). At quantitative analysis, the symptomatic tendons exhibited significantly lower mean SWE values (43 kPa, range 19-65 kPa) than healthy tendons (185 kPa, range 56-265 kPa) (p=0.0004). No differences were observed between SWE values of symptomatic achilles (40.2 kPa) vs. symptomatic patellar tendons (45.4 kPa).

CONCLUSION

SWE appears to be a simple and reproducible way to identify tendon pathology. Symptomatic tendons can be identified due to their reduced SWE rigidity. SWE may therefore prove to be a sensitive tool to monitor treatment effects.

CLINICAL RELEVANCE/APPLICATION

Shear wave elastography (SWE) is a simple and reproducible tool to identify tendon pathology in patellar and achilles tendons due to reduced tendon rigidity.

You've Got Nerve!: A Review of Entrapment Neuropathies of the Ankle and Foot (Station #6)

Jessica Langer MD (Presenter): Nothing to Disclose, Daria Motamedi MD : Nothing to Disclose, Kira Chow MD : Nothing to Disclose, Shahla Modarresi MD : Nothing to Disclose

TEACHING POINTS

The goal of this exhibit is to: (1) Review anatomy of nerves in the lower extremity, (2) Provide an overview of
the common causes and imaging manifestations of entrapment neuropathies of the ankle and foot, and (3) discuss the imaging and clinical presentation of some of the most commonly encountered entrapment neuropathies in order to improve awareness and detection of these conditions.

TABLE OF CONTENTS/OUTLINE

Our exhibit will review the anatomy of nerves in the lower extremity, discuss the causes and clinical manifestations of common lower extremity entrapment neuropathies, and provide magnetic resonance imaging (MRI) examples of each, including: (1) Superficial Peroneal Nerve Compression, (2) Deep Peroneal Nerve Compression, (3) Sural Nerve Compression, (4) Tarsal Tunnel Syndrome, (5) Morton Neuroma, and (6) Baxter’s Neuropathy.

MKE234

Greater Trochanteric Pain Syndrome: Anatomy, Pathology and Ultrasound Guided Interventions (Station #7)
Eugene Maida MBChB (Presenter): Nothing to Disclose, Mary Margaret Chiavaras MD, PhD: Nothing to Disclose, Jon A. Jacobson MD: Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc, Lisa Billone: Nothing to Disclose, Jay Smith MD: Patent agreement, Tenex Health Inc Institutional license agreement, Tenex Health Inc Stockholder, Tenex Health Inc

TEACHING POINTS

1. To review the anatomy of the greater trochanter and surrounding structures, and to emphasize the use of bone landmarks for accurate identification of specific tendons and bursae. 2. To outline ultrasound techniques, including dynamic ultrasound examples of greater trochanteric pathology, such as tendinosis, tendon tears, bursitis and various snapping conditions with MRI correlation, as well as discussion of diagnostic pearls and pitfalls. 3. To provide a treatment algorithm which incorporates ultrasound as a diagnostic tool as well as ultrasound-guided treatment for both tendon and bursal abnormalities.

TABLE OF CONTENTS/OUTLINE


MKE201

Artifacts in Musculoskeletal Ultrasonography (Station #8)
Lana Hirai Gimber MD (Presenter): Nothing to Disclose, David Melville MD: Nothing to Disclose, Luke Scalcione MD: Nothing to Disclose, Russell S. Witte PhD: Nothing to Disclose, Hina Arif Tiwari MD: Nothing to Disclose, Miha S. Taljanovic MD: Nothing to Disclose

TEACHING POINTS

1. Recognize the high-resolution ultrasonography (US) appearance of normal and injured musculoskeletal (MSK) structures including bone surface, muscle, tendon and ligament. 2. Recognize the US findings of common artifacts in MSK US with B-mode gray-scale and Doppler imaging that can be mistaken for pathology and several artifacts that frequently accompany pathologic conditions. 3. Learn techniques that can help avoid or minimize artifacts in MSK US.

TABLE OF CONTENTS/OUTLINE

1. MSK US Equipment and Technology 2. US findings of normal bone, muscle, tendon and ligament 3. US findings of injured bone, muscle, tendon and ligament 4. US artifacts with B-mode gray-scale imaging: side-lobe, beam-width, anisotropy, artifacts related to velocity errors (speed displacement and refraction), posterior acoustic shadowing, posterior acoustic enhancement/increased through transmission, posterior reverberation, and mirror image 5. US artifacts with Doppler imaging: transducer pressure, tissue strain, improper focus, motion, blooming, mirror image, background noise, aliasing, and twinkling 6. Techniques that can help avoid or minimize artifacts in MSK US.

MKE211

Impingement Syndromes of the Lower Extremity: The Great Masqueraders (Station #9)
Gitanjali Bajaj MBBS (Presenter): Nothing to Disclose, Roopa Ram MD: Nothing to Disclose, Carey Lee Guidry MD: Nothing to Disclose, Maharshi Harischandra Patel DO: Nothing to Disclose, Kedar Jambhekar MD: Nothing to Disclose, Tarun Pandey MD, FRCR: Nothing to Disclose

TEACHING POINTS

1. Discuss the clinical presentation of lower extremity impingement syndromes. 2. Describe the imaging findings of lower extremity impingement syndromes. 3. Emphasize the diagnostic value of MR (Magnetic Resonance) Imaging in the early diagnosis of these commonly misdiagnosed conditions.

TABLE OF CONTENTS/OUTLINE

1. Graphic illustrations showing impingement syndromes about the hip, knee, ankle and foot. 2. MR imaging correlation using case based scenarios. 3. Pearls and pitfalls to prevent diagnostic delay and inappropriate management of lower extremity impingement syndromes.

MKE310

Bone Tumors, Their Reconstructive Options, and the Role of the MSK Radiologist in Their Assessment (Station #10)
Joshua Zeidenberg BA, MD (Presenter): Nothing to Disclose, Juan Abelardo Augusto Pretell MD: Nothing to Disclose, Ty Kany Subhawong MD: Nothing to Disclose, Jean Jose MS, DO: Nothing to Disclose, Thomas Temple MD: Nothing to Disclose, Sheila Conway MD: Nothing to Disclose
TEACHING POINTS
1. Limb sparing reconstruction plays a major role in the treatment of orthopedic oncology patients. 2. Strategic choice of endoprosthesis, autograft, allograft, or allograft-prosthetic composites balance procedural complexity/morbidity with maximizing functional outcome. 3. Familiarity with these procedures facilitates early recognition of complications.

TABLE OF CONTENTS/OUTLINE
A. Limb sparing reconstructive options Determinants of limb-sparing feasibility -patient age -disease burden/overall prognosis -extent of neurovascular involvement -Advantages and disadvantages of
-Manifestations as lytic bone lesion, soft tissue mass or calcification E. Conclusion -Variety of treatment options available -Choice of reconstruction influenced by multiple factors -Familiarity with techniques facilitates accurate and early identification of potential problems.

MKE327
Myxoid Containing Tumors of Soft Tissues: MR Appearance with Radiologic-Pathologic Correlation
(Station #11)
Nicolas Alberti MD (Presenter): Nothing to Disclose, Agnes Neville: Nothing to Disclose, Jean-Michel Coidre: Nothing to Disclose, Xavier Buy MD: Proctor, Gall Medical Ltd, Jean Palussiere MD: Travel support, Bracco Group, Amandine Crombe: Nothing to Disclose, Bin Buih: Nothing to Disclose, Michele Kind MD: Nothing to Disclose

TEACHING POINTS
Myxoid soft tissue tumors are a heterogeneous group of mesenchymal neoplasms with characteristic imaging features. Thus, MR results give the basis of decision-making by a multidisciplinary committee. The aim of this education exhibit was to identify specific MRI features and to correlate with pathology in a large series of histologically proven myxoid soft tissue tumours (STT) based upon our experience in a large tertiary referral centre.

TABLE OF CONTENTS/OUTLINE
I) MYXOMA II) MYXOID LIPOSARCOMA III) LOW-GRADE FIBROMYXOID SARcoma IV) MYXOFIBROSARCOMA V) EXTRASKELETAL MYXOID CHONDROSARCOMA

MKE233
Evaluation and Management of Ischiofemoral Impingement: A Radiologic and Therapeutic Approach to a Complex Diagnosis (Station #12)
Moises Hernando MD (Presenter): Nothing to Disclose, Luis Cereal MD: Nothing to Disclose, Luis Perez Carro: Nothing to Disclose, Lourdes Guillen Vargas MD: Nothing to Disclose, Rosa Dominguez-Oronoz MD: Nothing to Disclose, Ana Canga MD: Nothing to Disclose, Faustino Abascal: Nothing to Disclose, Raquel Prada MD: Nothing to Disclose, Maria Gonzalez Vazquez: Nothing to Disclose, Maria Costas Alvarez: Nothing to Disclose

TEACHING POINTS
To describe in detail the anatomy of the ischiofemoral space. To assess the pathophysiological mechanisms and develop an understandable classification, particularly focusing on its etiology, predisposing factors and musculoskeletal associated abnormalities. To assess the role of radiologist in the diagnosis, treatment and postoperative evaluation in the ischiofemoral impingement, both primary and secondary

TABLE OF CONTENTS/OUTLINE

MKE010-b
Is a Soft Tissue Mass Involving the Tendon Sheath Always a Tenosynovial Giant Cell Tumor?
(hardcopy backboard)
Seun Ah Lee MD: Nothing to Disclose, Baek Hyun Kim MD: Nothing to Disclose, Seon Jeong Oh (Presenter): Nothing to Disclose, Kyung-Sik Ahn MD: Nothing to Disclose, Suk-Joo Hong MD: Nothing to Disclose, Chang Ho Kang MD: Nothing to Disclose

TEACHING POINTS
1. To introduce tenosynovial giant cell tumor according to the 2013 WHO classification. 2. To review the radiologic and pathologic features of tenosynovial giant cell tumor in the extremities: localized and diffuse type. 3. To understand various other diseases that can occur in the extremities involving the adjacent tendon sheath.

TABLE OF CONTENTS/OUTLINE
Our exhibit will be divided into 4 sections and presented with relevant cases: 1. Revised nomenclature of tenosynovial giant cell tumor according to the 2013 WHO classification 2. Tenosynovial giant cell tumor in the extremities: radiologic and pathologic appearance. (1) Localized type: primary, recurred cases (2) Diffuse type
3. Other disease entities involving the adjacent tendon sheath of the extremities which mimic tenosynovial giant cell tumor: radiologic features with a brief disease review (1) Fibroma of tendon sheath (2) Fibromatosis of plantar fascia (3) Peripheral nerve sheath tumor such as schwannoma (4) Vascular leiomyoma (5) Synovial sarcoma (6) Alveolar rhabdomyosarcoma (7) Others 4. Differential diagnostic considerations between tenosynovial giant cell tumor and other disease entities.

MSE-SUA
Multisystem/Special Interest Sunday Poster Discussions

Education Exhibits

OT
AMA PRA Category 1 Credits ™: .50
Sun, Nov 30 12:30 PM - 1:00 PM Location: MS Community, Learning Center

Sub-Events

MSE157 Strategies for Reduction of Radiation Dose in Body CT with Iterative Reconstruction Technique (Station #1)

Wirana Angthong MD (Presenter): Nothing to Disclose, Panitpong Maroonrige: Nothing to Disclose, Vithya Varavithya: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: To review the general concepts of radiation exposure To describe body CT dose report and parameters pertinent to radiation dose To explain the appropriate selection of scan parameters to minimize radiation exposure while maintaining image quality. To discuss a practical approach to optimizing specific CT protocols with iterative reconstruction technique in current clinical practice

TABLE OF CONTENTS/OUTLINE

General concepts of radiation exposures Absorbed dose Effective dose Nomenclature of CT parameters and issues pertinent to radiation dose tube current (mA): fixed tube current or automatic exposure control tube peak kilovoltage (kVp) Beam pitch, beam collimation Reconstruction algorithms: filter back projection versus iterative reconstruction CT dose report CT dose index volume Dose length product Optimization of CT parameter for dose reduction Feasibility of iterative reconstruction technique in modified low dose body CT Low tube voltage and contrast agent dose reduction in CT chest/abdomen/pelvis and CT angiography Screening noncontrast CT lung nodule protocol Renal stone protocol Acute abdomen protocol for acute appendicitis

NMS-SUA
Nuclear Medicine Sunday Poster Discussions

Scientific Posters

NM
AMA PRA Category 1 Credits ™: .50
Sun, Nov 30 12:30 PM - 1:00 PM Location: S503AB

Participants

Moderator Ukihide Tateishi MD, PhD: Nothing to Disclose

Sub-Events

NMS150 Evaluation of Glioma Recurrence Using Dual Tracer 18F-FET and 18F-FDG PET/CT Imaging (Station #1)

Krystyna Maria Adamska MD, PhD (Presenter): Nothing to Disclose, Paulina Cegla: Nothing to Disclose, Witold Cholewinski: Nothing to Disclose, Joanna Kazmierska: Nothing to Disclose, Ewa Wierzchoslawska: Nothing to Disclose, Michal Smolen: Nothing to Disclose, Dorota Jezierska: Nothing to Disclose, Agnieszka Lewandowska: Nothing to Disclose

PURPOSE

18F-FET (tyrosine) is an interesting PET tracer, which have shown promising results in the imaging of brain tumors. 18F-FDG (Deoxyglucose) is a widely used PET tracer however due to physiologic uptake within brain tissue its use in brain tumors is limited. The aim of the study was to evaluate the usefulness of FET-PET and FDG-PET imaging in the detection of glioma recurrence and in the radiotherapy planning.

METHOD AND MATERIALS

13 patients with mean age of 56±13 and histologically confirmed gliomas were enrolled in the study. The FET scans were performed 20-40 minutes after intravenous injection of 160MBq of 18F-FET. The FDG imaging was performed 60min after injection of 370MBq of 18F-FDG. Scans were acquired on Gemini TF PET/CT scanner using 3D brain imaging protocol over 10min acquisition time. The PET Images were evaluated on a dedicated workstation. On reconstructed images, the tumor borders are drawn using semiautomatic dedicated software based on 70% threshold values. Tumor borders and volume were calculated on each nuclear image and
compared with the volume calculated on the diagnostic MRI. For each tumor region the tumor-to-background ratio was calculated for both FET and FDG images.

**RESULTS**

FET-PET/CT method showed 30 lesions in 11 pts with mean SUVmax value of 2.33 (range 1.6-3.5). Based on 70% threshold cutoff value the mean volume of brain foci was calculated on at 40.49±119.27cc. In FET imaging tumor-to-background ratios showed values below 1.0 (0.5-0.8). There was a mild positive correlation between tyrosine in glucose metabolism in glioma recurrence (r=0.544). In total FET imaging showed more abnormal lesions that MRI, however the difference was not significant (p>0.05).

**CONCLUSION**

18-FET PET/CT seems to be more sensitive than FDG-PET in the detection of the recurrence of glioma brain tumors and may be helpful in radiation therapy planning.

**CLINICAL RELEVANCE/APPLICATION**

FET-PET/CT and MRI can be used together to improve the diagnostic accuracy of recurrence glioma and planning radiation therapy. Correlation between FDG and FET uptake in brain tumors requires further studies of its potential use as diagnostic and prognostic measure.

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**NMS151**

Feasibility of Quantitative Response Evaluation with PERCIST in Follicular Lymphoma: With Special Focus on the Cases with Low FDG Uptake  (Station #2)

Mitsuaki Tatsumi MD, PhD (Presenter):  Nothing to Disclose, Kayako Isohashi :  Nothing to Disclose, Tadashi Watabe :  Nothing to Disclose , Eku Shimosegawa :  Nothing to Disclose, Noriyuki Tomiyama MD, PhD :  Nothing to Disclose, Jun Hatazawa MD, PhD :  Nothing to Disclose

**PURPOSE**

Follicular lymphoma (FL) often represents rather low FDG uptake in PET exams, which potentially affects results of treatment response. In the present study, quantitative response evaluation with PET response criteria in solid tumors (PERCIST) was applied in FL patients. The results were compared to ones from revised response criteria (RRC), which is usually used in clinical situations.

**METHOD AND MATERIALS**

This study included 45 pre- and posttreatment FDG PET/CT exam sets in 42 FL patients during Jul 2007 and Nov 2012. SUVmax was obtained in the hottest lesion in each exam. Changes of SUVmax after treatment were evaluated according to PERCIST and compared to the visual results of RRC. PET/CT exam sets were classified into high and low FDG uptake groups based on the pretreatment SUVmax (>5: high). Results in each group were also evaluated and compared to RRC. In the visually-negative posttreatment exams (complete remission <CR> cases), reduction of SUVmax was calculated at the same area as pretreatment SUVmax to recognize the ranges of change.

**RESULTS**

SUVmax in the hottest lesion ranged from 2.7 to 17.8 before treatment (mean: 6.8±3.5, median: 5.7). 25 and 20 exam sets were classified into high and low FDG uptake groups, respectively. Of all 45 exam sets, 38 (84%) exhibited concordant results with RCC (CR: 23, PR: 13, and PD: 2). 7 discordant results were all due to the combination of SD in PERCIST and PR in RRC. Subgroup analysis revealed 22 (88%) of 25 high- and 16 (80%) of 20 low uptake groups showed concordant results with RRC (no statistical difference). Reduction of SUVmax in PR cases was 61±11% for high- (n=8) and 57±12% for low (n=5) uptake groups, respectively. No statistical difference was observed between the groups. Reduction of SUVmax in CR cases ranged from 32 to 74% with a mean of 58±13% for low uptake group (n=10). Most of them (70%) showed >50% reduction.

**CONCLUSION**

This study demonstrated quantitative response evaluation with PERCIST provided similar results to RRC in most instances in follicular lymphoma. Effective treatment caused enough reduction of SUVmax to meet PERCIST even in cases with low FDG uptake before treatment.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative response evaluation with PERCIST was considered to be feasible in follicular lymphoma, even in cases with low FDG uptake before treatment.

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**NMS152**

Qualitative versus Quantitative PET CT Characterisation of Adrenal Masses (Station #3)

Padmini Gopalan MBBS (Presenter):  Nothing to Disclose, Eleanor Lorenz MBChB :  Nothing to Disclose

**PURPOSE**

To analyse the relative accuracy of qualitative and quantitative PET data in differentiating benign from malignant adrenal masses. To assess if routine use of quantitative maximal SUV or SUR data is necessary. To evaluate whether combined CT densitometry data and quantitative SUV PET maximise the specificity.

**METHOD AND MATERIALS**

Retrospective analysis of 38 patients with adrenal masses referred for PET CT. The study group included both
known primary extra adrenal malignancy and suspicious primary adrenal lesions. A cohort of 34/38 patients had both qualitative and quantitative analysis. Validation for the detected adrenal lesion was by histology, follow up CT and MR scans. Reference standards used: SUV adrenal to liver ratio: > 2 is considered malignant, 1.5-2 is equivocal and less than 1.5 is benign. SUV max more than 2.68 is highly suspicious for malignancy. CT attenuation value cut off for benign adrenal lesions is < 10HU.

RESULTS
16/38 (42%) were biopsy proven malignant lesions. The sensitivities for quantitative SUV versus visual analysis were 86% and 87%; Specificities were 78% and 83%. Positive predictive values were 81% and 82%; negative predictive values were 88% and 88% respectively for quantitative and qualitative analysis. Haemorrhage can cause high SUV values resulting in false positive result. Incorporating CT densitometry and SUV max value seems to improve the specificity.

CONCLUSION
Qualitative and quantitative analysis showed reasonably comparable results and were deemed complementary. Prospective SUV measurements may or may not sway towards quantitative analysis.

CLINICAL RELEVANCE/APPLICATION
The common conundrum is to differentiate benign adrenal adenomas from metastatic disease. Debate prevails whether quantitative or qualitative PET CT analysis is superior in characterising adrenal masses. Mester et al study favoured quantitative SUV PET data with a specificity of 92%. Boland et al study concluded routine quantitative analysis is not necessary as SUV test specificity to detect malignancy was 78%.

NMS153
Heterogeneity of 18F-FDG PET Images of Oesophageal Cancer as a Predictive and Prognostic Biomarker (Station #4)


PURPOSE
To investigate whether texture features describing heterogeneity of 18F-FDG PET uptake in oesophageal cancer are associated with NAC response or survival.

METHOD AND MATERIALS
124 patients with oesophageal adenocarcinoma (111 adenocarcinoma, 23 with squamous cell carcinoma), mean age 63.2y, 96M were include. 114 received at least three cycles of NAC. 10 second and high order texture features, standardised uptake values (SUVmax, mean and peak), total lesion glycolysis (TLG) and metabolic tumour volume (MTV) were tested. Patients were divided into responders (PR/CR) and non-responders (SD/PD) by CT RECIST and into good response (grade 1,2) and poor response (grades 3-5) by Mandard histological tumour regression grades. The ability of the parameters to predict responders was tested (Mann-Whitney U test) and correlations with MTV were determined (Spearman rank correlation). Cox regression was performed for survival analysis. A minimum volume threshold (14cm3) was calculated and implemented to exclude bias from small tumours.

RESULTS
There was a significant difference in zone percentage between CT RECIST responders and non-responders (p=0.012) independent of tumour size after the exclusion of small tumours. High order texture features including, coarseness (p=0.053), contrast (p=0.012) and complexity (p=0.021), were able to predict NAC response measured by Mandard grades. However, these features exhibited strong associations with MTV, (ρ=0.892,-0.895, -0.951, respectively, all p<0.001). No texture feature was significantly associated with overall survival.

CONCLUSION
Small volume tumours are subject to bias in texture feature calculation. However, allowing for this, texture features characterising heterogeneity of 18F-FDG uptake in oesophageal cancer may offer an alternative method of predicting NAC response but we have found no association with any texture feature and survival.

CLINICAL RELEVANCE/APPLICATION
There is no reliable imaging predictor for neoadjuvant chemotherapy (NAC) response or prognostic marker for survival in oesophageal carcinoma. Predictive and prognostic imaging biomarkers would be of value in this aggressive disease.

NME141
Bone Metastases Analysis Using a Computer-Assisted Diagnosis (CAD) System for Bone Scan: Could Quantitative Software Contribute to Helping with Diagnosis, and Is It Useful in the Prediction of the Prognosis? (Station #6)

Itsuko Okuda MD (Presenter): Nothing to Disclose, Yukinori Okada MD: Nothing to Disclose, Yasuyuki Kojima: Nothing to Disclose, Yasuo Nakajima MD: Nothing to Disclose

PURPOSE
Bone densitometry...
TEACHING POINTS

1. To review a bone scan.
2. To present the principle, techniques and methodology of quantitative bone scan using a CAD System.
3. To discuss usefulness of the bone scan indexes for evaluation of bone metastases from breast cancer, quantitatively.
4. To emphasize the clinical impact of quantitative bone metastases analysis, and the prediction of the prognosis for patients with bone metastases from breast cancer using a CAD System.

TABLE OF CONTENTS/OUTLINE

1. Review of bone scan
2. Principle, techniques and characteristic of bone metastases analysis using a CAD system
3. Quantitative bone metastases analysis by three kinds of the indexes Artificial neural network (ANN) value Bone scan index (BSI) Number of hot spots
4. Brief demonstration of bone metastases from breast cancer and their indexes
5. Relationship between the indexes and the prediction of the prognosis of the clinical cases
6. Effective utilization of CAD system and efficiency in interpretation for radiologists
7. Summary: We describe quantitative bone scan using a CAD System and provide examples of bone metastases from breast cancer. Knowledge of variations in imaging features of the bone scans and the indexes can help radiologists to make better diagnoses by contributing accurate diagnosis of bone metastases from breast cancer.

NRS-SUA

Neuroradiology Sunday Poster Discussions

Scientific Posters

AMA PRA Category 1 Credits™: .50
Sun, Nov 30 12:30 PM - 1:00 PM Location: NR Community, Learning Center

Participants

Moderator: Pratik Mukherjee MD, PhD: Research Grant, General Electric Company Medical Advisory Board, General Electric Company

Sub-Events

NRE240

Making Sense of Sellar Region Pathology: Image-based Diagnostic Algorithm (Station #9)

Ammar Ahmed Chaudhry MD (Presenter): Nothing to Disclose

TEACHING POINTS

? Review anatomy of the sella and parasellar regions? Case-based review of sellar and parasellar pathology highlighting key imaging findings that would narrow the differential diagnosis? Diagnostic algorithm can assist in navigation and interpretation of sellar pathology

TABLE OF CONTENTS/OUTLINE

TOC/Outline: Lesions in the sellar and pararasellar region are frequently encountered in clinical neuroradiology. Complex anatomy of this region contains numerous key structures which can be affected by various pathology. Although ‘SATCHMO’, a commonly used mnemonic, may help remember differentials, due to overlap in imaging findings it has limited diagnostic utility. This educational exhibit presents a case-based review utilizing age, gender, anatomic location, imaging characteristics, etc. to formulate an algorithm that will aid in more precise diagnosis of regional pathology. In addition, treatment, prognosis and follow up guidelines will be briefly discussed. Conclusion: A systematic approach is required to narrow the differential diagnosis of sellar and parasellar lesions. At completion of this educational exhibit, the viewer will be able to provide more accurate assessment of regional pathology, guide any potential biopsy and appropriate follow-up.

NRE118

Resting State Functional Magnetic Resonance: A Pictorial Review (Station #10)

Eduardo C. Gonzalez-Toledo MD (Presenter): Nothing to Disclose

TEACHING POINTS

The learner will know how to obtain the functional sequence The learner will know how to collect and process the data The learner will know basic principles on brain connectivity The learner will know how to compare his patient’s data with a normal pool The patient will know how to read the results

TABLE OF CONTENTS/OUTLINE

How to obtain MR data: patient's instructions and acquisition protocol How to process data obtained using freeware How to compare patient's results with a normal controls pool Normal connectivity Abnormal connectivity in patients with lesions from trauma, infection, neoplasms resting state fMRI in neurosurgical planning

NRE297

CT Imaging Appearance of Common Dental Diseases, Post-operative Hardwares, and Complications (Station #8)

Bob B. Chai MD, PhD (Presenter): Nothing to Disclose

TEACHING POINTS
1. To illustrate CT appearance of varying degrees of dental disease. 2. To become familiar with post-operative CT appearance of common dental hardware. 3. To evaluate for post-operative complications of common dental procedures.

**TABLE OF CONTENTS/OUTLINE**

1. Dental Disease
   a. Dental Caries
   b. Periapicitis
   c. Periodontitis
   d. Pericoronitis
2. Dental Disease Treatment Options
   a. Dental Fillings (Inlay/Onlays)
   b. Dental Crown
   c. Root Canal
   d. Tooth Extraction
   e. Osseointegrated Implants (w/ or w/o sinus lift)
   f. Fixed partial denture (Permanent bridge)
3. Post-operative Dental Complications
   a. Odontogenic Facial Cellulits/Abscess
   b. Oroantral fistula following maxillary dental extraction
   c. Recurrent periapicitis following root canal

**NRE238**

Law and Order - Neuroimaging: Understanding and Minimizing Risk for the Neuroradiologist (Station #11)

Lee Finkelstone MD (Presenter): Nothing to Disclose

**TEACHING POINTS**

Approximately 1 in 5 neuroradiologists have reported being sued at least once during their career in a recent survey by the American Society of Neuroradiology. While there is growing concern over liability, few physicians understand the fundamentals of malpractice and causes of common errors leading to malpractice suits. By the end of the exhibit, the viewer will have 1) a better understanding of malpractice concepts and 2) learn ways to reduce errors in neuroimaging in order to reduce risk.

**TABLE OF CONTENTS/OUTLINE**

1) Brief roadmap to medical malpractice
2) Reasons neuroradiologists are sued
3) Ways to reduce errors in neuroimaging using clinical vignettes with subsequent summary slides (i.e. checklists)
4) Post-test quiz

**NRE207**

Outlaws in the Saddle: Tumors and Cancer Related Diseases of the Pituitary (Station #12)

Komal Bankim Shah MD (Presenter): Nothing to Disclose

**TEACHING POINTS**

With reference to pituitary cases seen at a tertiary referral center, the purpose of this exhibit is to review: 1. Unusual pituitary adenomas
2. Imaging appearance of pituitary carcinoma
3. Pituitary disease due to primary cancers at other sites

**TABLE OF CONTENTS/OUTLINE**

Imaging of unusual pituitary adenomas
Giant invasive adenoma, extent may be underestimated by post contrast images without fat saturation
Ectopic pituitary adenoma
Similar histologic appearance of olfactory neuroblastoma and pituitary adenoma as neuroendocrine tumors (importance of radiologist's report)
Post treatment imaging (effects of surgery, cabergoline, radiation)
Pituitary carcinoma
Effect on pituitary of cancers at other sites
Pituitary metastasis, association with diabetes insipidus (unlike pituitary adenomas)
Ipilimumab induced hypophysitis

**NRE146**

Multimodality Review of Amyloid-Related Diseases of the Central Nervous System (Station #7)

Adam Landon Sipe MD (Presenter): Nothing to Disclose, Sarah E. Connolly MD: Nothing to Disclose

**TEACHING POINTS**

Amyloid is a class of aggregated proteins that occur in both common and uncommon diseases of the central nervous system (CNS). This exhibit will aim to: 1. Familiarize the radiologist with the pathophysiology and clinical presentation of amyloid-related diseases in the CNS including Alzheimer's type dementia, cerebral amyloid angiopathy, and cerebral amyloidoma.
2. Discuss the imaging appearance of these three CNS amyloid-related diseases in a case-review format with self-assessment questions. The goal is to assist the radiologist with distinguishing among these three amyloid related diseases and other diseases with similar clinical presentations.

**TABLE OF CONTENTS/OUTLINE**

Clinical cases of Alzheimer's type dementia, cerebral amyloid angiopathy, and cerebral amyloidoma are reviewed emphasizing: Clinical presentation Role of amyloid in the pathophysiology of the disease Imaging appearance utilizing the following modalities
a. Computed tomography (CT)
b. Magnetic resonance imaging (MRI)
c. Pittsburgh compound B (11C-PiB) and 18F-Florbetapir positron emission tomography (PET)

**NRE207**

Outlaws in the Saddle: Tumors and Cancer Related Diseases of the Pituitary (Station #12)

Charles H. Kim MD: Nothing to Disclose

**TEACHING POINTS**

With reference to pituitary cases seen at a tertiary referral center, the purpose of this exhibit is to review: 1. Unusual pituitary adenomas
2. Imaging appearance of pituitary carcinoma
3. Pituitary disease due to primary cancers at other sites

**TABLE OF CONTENTS/OUTLINE**
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Resting State Functional Magnetic Resonance: A Pictorial Review (Station #10)
Dario Saferstein MD : Nothing to Disclose

TEACHING POINTS
The learner will know how to obtain the functional sequence The learner will know how to collect and process the data The learner will know basic principles on brain connectivity The learner will know how to compare his patient's data with a normal pool The patient will know how to read the results

TABLE OF CONTENTS/OUTLINE
How to obtain MR data: patient's instructions and acquisition protocol How to process data obtained using freeware How to compare patient's results with a normal controls pool Normal connectivity Abnormal connectivity in patients with lesions from trauma, infection, neoplasms resting state fMRI in neurosurgical planning

Law and Order - Neuroimaging: Understanding and Minimizing Risk for the Neuroradiologist (Station #11)
Akash D. Shah MD : Nothing to Disclose

TEACHING POINTS
Approximately 1 in 5 neuroradiologists have reported being sued at least once during their career in a recent survey by the American Society of Neuroradiology. While there is growing concern over liability, few physicians understand the fundamentals of malpractice and causes of common errors leading to malpractice suits. By the end of the exhibit, the viewer will have 1) a better understanding of malpractice concepts and 2) learn ways to reduce errors in neuroimaging in order to reduce risk.

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Outlaws in the Saddle: Tumors and Cancer Related Diseases of the Pituitary (Station #12)
Steven Waguespack MD : Nothing to Disclose

TEACHING POINTS
With reference to pituitary cases seen at a tertiary referral center, the purpose of this exhibit is to review: 1. Unusual pituitary adenomas 2. Imaging appearance of pituitary carcinoma 3. Pituitary disease due to primary cancers at other sites

TABLE OF CONTENTS/OUTLINE
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Multimodality Review of Amyloid-Related Diseases of the Central Nervous System (Station #7)
Tammie Smith Benzinger MD, PhD : Research Grant, Eli Lilly and Company Researcher, Eli Lilly and Company Researcher, F. Hoffmann-La Roche Ltd, Jonathan Edward McConathy MD, PhD : Speakers Bureau, Eli Lilly and Company Research Consultant, Eli Lilly and Company Research Consultant, General Electric Company Research Consultant, Blue Earth Diagnostics Ltd Research Consultant, Siemens AG

TEACHING POINTS
Amyloid is a class of aggregated proteins that occur in both common and uncommon diseases of the central nervous system (CNS). This exhibit will aim to: 1. Familiarize the radiologist with the pathophysiology and clinical presentation of amyloid-related diseases in the CNS including Alzheimer's type dementia, cerebral amyloid angiopathy, and cerebral amyloidoma. 2. Discuss the imaging appearance of these three CNS amyloid-related diseases in a case-review format with self-assessment questions. The goal is to assist the radiologist with distinguishing among these three amyloid related diseases and other diseases with similar clinical presentations.

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Outlaws in the Saddle: Tumors and Cancer Related Diseases of the Pituitary (Station #12)
T. Linda Chi MD : Nothing to Disclose
TEACHING POINTS

With reference to pituitary cases seen at a tertiary referral center, the purpose of this exhibit is to review: 1. Unusual pituitary adenomas 2. Imaging appearance of pituitary carcinoma 3. Pituitary disease due to primary cancers at other sites

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NRE118

Resting State Functional Magnetic Resonance: A Pictorial Review (Station #10)

Jorge Raul Docampo MD : Nothing to Disclose

TEACHING POINTS

The learner will know how to obtain the functional sequence The learner will know how to collect and process the data The learner will know basic principles on brain connectivity The learner will know how to compare his patient’s data with a normal pool The patient will know how to read the results

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NRE240

Making Sense of Sellar Region Pathology: Image-based Diagnostic Algorithm (Station #9)

Alexander Filatov MD : Nothing to Disclose, Robert George Peyster MD : Nothing to Disclose

TEACHING POINTS

Review anatomy of the sella and parasellar regions Case-based review of sellar and parasellar pathology highlighting key imaging findings that would narrow the differential diagnosis Diagnostic algorithm can assist in navigation and interpretation of sellar pathology

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TOC/Outline: Lesions in the sellar and pararasellar region are frequently encountered in clinical neuroradiology. Complex anatomy of this region contains numerous key structures which can be affected by various pathology. Although 'SATCHMO', a commonly used mnemonic, may help remember differentials, due to overlap in imaging findings it has limited diagnostic utility. This educational exhibit presents a case-based review utilizing age, gender, anatomic location, imaging characteristics, etc. to formulate an algorithm that will aid in more precise diagnosis of regional pathology. In addition, treatment, prognosis and follow up guidelines will be briefly discussed. Conclusion: A systematic approach is required to narrow the differential diagnosis of sellar and parasellar lesions. At completion of this educational exhibit, the viewer will be able to provide more accurate assessment of regional pathology, guide any potential biopsy and appropriate follow-up.

NRE207

Outlaws in the Saddle: Tumors and Cancer Related Diseases of the Pituitary (Station #12)

Ian McCutcheon MD : Nothing to Disclose

TEACHING POINTS

With reference to pituitary cases seen at a tertiary referral center, the purpose of this exhibit is to review: 1. Unusual pituitary adenomas 2. Imaging appearance of pituitary carcinoma 3. Pituitary disease due to primary cancers at other sites

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NRE146

Multimodality Review of Amyloid-Related Diseases of the Central Nervous System (Station #7)

Michelle M. Miller-Thomas MD : Nothing to Disclose

TEACHING POINTS

Amyloid is a class of aggregated proteins that occur in both common and uncommon diseases of the central nervous system (CNS). This exhibit will aim to: 1. Familiarize the radiologist with the pathophysiology and clinical presentation of amyloid-related diseases in the CNS including Alzheimer's type dementia, cerebral amyloid angiopathy, and cerebral amyloidoma. 2. Discuss the imaging appearance of these three CNS amyloid-related diseases in a case-review format with self-assessment questions. The goal is to assist the
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NRE240

Making Sense of Sellar Region Pathology: Image-based Diagnostic Algorithm (Station #9)

Lev Bangiyev DO : Nothing to Disclose

TEACHING POINTS

? Review anatomy of the sella and parasellar regions? Case-based review of sellar and parasellar pathology highlighting key imaging findings that would narrow the differential diagnosis? Diagnostic algorithm can assist in navigation and interpretation of sellar pathology

TABLE OF CONTENTS/OUTLINE

TOC/Outline: Lesions in the sellar and pararasellar region are frequently encountered in clinical neuroradiology. Complex anatomy of this region contains numerous key structures which can be affected by various pathology. Although 'SATCHMO', a commonly used mnemonic, may help remember differentials, due to overlap in imaging findings it has limited diagnostic utility. This educational exhibit presents a case-based review utilizing age, gender, anatomic location, imaging characteristics, etc. to formulate an algorithm that will aid in more precise diagnosis of regional pathology. In addition, treatment, prognosis and follow up guidelines will be briefly discussed. Conclusion: A systematic approach is required to narrow the differential diagnosis of sellar and parasellar lesions. At completion of this educational exhibit, the viewer will be able to provide more accurate assessment of regional pathology, guide any potential biopsy and appropriate follow-up.

NRS387

Head to Head: Evaluating the Utility of Repeat Head CT in the Anticoagulated Trauma Patient (Station #1)

Armando S. Herradura MD (Presenter): Nothing to Disclose, Esther Bilinsky MD, MS : Nothing to Disclose, Laurie Sophia Sanchez MD : Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of routine repeat head CT (RRHCT) in anticoagulated trauma patients with initial head CT negative for intracranial hemorrhage (ICH).

METHOD AND MATERIALS

Utilizing PACS and patient electronic medical records, a retrospective analysis of over 30,000 head CTs performed over a three year period (2011-2013) at a Level I trauma center was conducted. Inclusion criteria were: (1) Documented traumatic injury, (2) Initial head CT negative for ICH, (3) Repeat head CT performed six hours after the initial head CT, and (4) Oral anticoagulation or risk factors for delayed ICH (i.e. abnormal coagulation profile) which per institutional protocol necessitated RRHCT. The hospital course of cases positive for delayed ICH were examined in detail to assess clinical outcomes and identify risk factors related to delayed ICH.

RESULTS

A total of 376 cases met inclusion criteria, with four cases positive for delayed ICH (1.1%). Statistical analysis yields a mean = 0.0107, SD = 0.1027, and 95% CI = 0.0007 - 0.0214. The most common documented forms of anticoagulation and mechanism of injury were aspirin (161 cases) and fall (193 cases), respectively. Clinical management and patient outcomes for two of the four cases of delayed ICH were unaffected by RRHCT. Seizure prophylaxis with Dilantin was performed for the remainder of the hospital course in the third case. For the fourth case, anticoagulation was withheld for the hospital course and commenced after the initial outpatient follow-up.

CONCLUSION

RRHCT is low in diagnostic value for anticoagulated trauma patients with an initial head CT negative for ICH. RRHCT was negative for delayed ICH in the vast majority of cases, nor did it make significant contributions to patient outcome in all cases of delayed ICH. RRHCT resulted in minor, transient changes in the patients' medication regiments in two of the four cases and no change in management for the remaining two cases of delayed ICH. Further investigation is required to elucidate if certain forms of anticoagulation or mechanisms of injury predispose patients to delayed ICH.

CLINICAL RELEVANCE/APPLICATION

RRHCT is performed due to theoretical risk of delayed ICH in anticoagulated patients. Current guidelines are scarce due to lack of evidence-based data. We find RRHCT yields minimal benefit at increased cost and radiation exposure.

NRS388

Region of Hypoattenuation vs. Different Leptomeningeal Collateral Grading Scores: Predictive Value for Follow-up Infarct Volume in Conventional and Dynamic CTA (Station #2)

PURPOSE

The aim was (a) to compare the predictive value of the region of hypoattenuation vs. different collateral vessel grading scores and (b) to determine the optimal time-point for reconstruction of the dynamic CTA images in order to best predict follow-up lesion volume.

METHOD AND MATERIALS

We included all patients with an M1±ICA occlusion, who had follow-up imaging, from an existing cohort of 1791 consecutive patients who underwent multimodal CT, including whole brain CT perfusion (WB-CTP), for suspected stroke. Collateralization was assessed in conventional and dynamic CTA using three different collateral vessel grading scores and segmentation of the region of hypoattenuation. To determine the optimal time-point for collateral assessment, arterial, arteriovenous, and venous phases were reconstructed for dynamic CTA.

Follow-up lesion volume was assessed by MR1 or NECT. Different collateral gradings systems were compared using the model fit of multivariate regression analyses (that were corrected for type of treatment) and calculation of the Bayesian information criterion (BIC). Differences in BIC of 2 to 6 were regarded as “positive”, 6 to 10 “strong”, and greater than 10 “very strong”.

RESULTS

Our study comprised 119 patients. In the multivariate analysis, models containing region of hypoattenuation showed a significantly better model fit than models containing collateral grading scores for conventional and dynamic CTA (ΔBIC > 10 for both). All collateral grading systems showed the best model fit for the arteriovenous phase. For region of hypoattenuation, model fit was significantly higher for the arteriovenous phase compared to the venous phase (ΔBIC = 6.2), the arterial phase (ΔBIC > 10), and conventional CTA (ΔBIC > 10). Also for collateral grading scores, model fit was higher for the arteriovenous phase compared to the venous phase (ΔBIC > 10 for each), the arterial phase (ΔBIC between 4 and 9), and conventional CTA (ΔBIC between 3 and 13).

CONCLUSION

Quantification of the region of hypoattenuation has a higher predictive value for follow-up lesion volume than collateral vessel grading scores. Arteriovenous phase is the optimal time-point for assessment of collateralization.

CLINICAL RELEVANCE/APPLICATION

The assessment of collateral blood flow on CT angiographies requires methodological standardization in order to be used to predict tissue outcome.

Intracranial Atherosclerotic Plaque Enhancement Using High-resolution MR Imaging in Patients with Ischemic Stroke (Station #3)

Wanqun Yang MD (Presenter): Nothing to Disclose, Biao Huang MD: Nothing to Disclose, Chang Hong Liang MD: Nothing to Disclose

PURPOSE

To assess the enhancement feature of intracranial atherosclerotic plaque in the vessel supplying the territory of infarction by using high-resolution MR imaging. To analyze the correlation between the strength of enhancement, elapsed time and concentration of hypersensitive C-reactive protein (hs-CRP).

METHOD AND MATERIALS

Wall characteristic of 81 patients with ischemic stroke and intracranial vascular stenoses was analyzed. All subjects were imaged with HR-MRI for plaque on a 3.0 T MRI scanner. All subjects were classified as early stage (12 weeks, n=10). The wall characteristic, presence and strength of enhancement of atherosclerotic plaque were assessed and the concentration of hs-CRP was tested. The Kruskal-Wallis H test and the Spearman correlation were used.

RESULTS

Fifty-five (55/81) plaques were located at the M1 segments, and the other 26 (26/81) plaques at the basilar artery. The strength and presence of enhancement from strong to none were 29, 25 and 4 in the early stage; 4, 6 and 3 in the middle stage and 0, 6 and 3 in the late stage, respectively. The strength and presence of enhancement was significant different among them (r² =16.934, P =0.000). The enhancements of the plaques were parallel with levels of hs-CRP(r =0.526, P =0.000)

CONCLUSION

Enhanced HR-MRI scanning may clearly demonstrate the enhancement characteristic of intracranial atherosclerotic plaques as an indicator of inflammation. It would play an important role to detect risk factors for intracranial plaque rupture and subsequent acute ischemic stroke.

CLINICAL RELEVANCE/APPLICATION

Enhanced HR-MRI scanning would play an important role to detect risk factors for intracranial plaque rupture and subsequent acute ischemic stroke.
Voxel-wise Statistical Testing of FDG-PET/CT: Impact on differential Diagnosis of Dementia (Station #4)


PURPOSE
Early and definite diagnosis of Alzheimer’s disease (AD) is critical, as current treatment options under consideration are not free of safety concerns. Currently, a combination of clinical, neurological and neuro-psychological testing and imaging is used in diagnosis. Visual evaluation of FDG PET brain images is challenging. Hence, the Society of Nuclear Medicine (SNM) recommends augmentation by (semi-)automatic quantification approaches. This study evaluated the impact on diagnosis of AD in FDG-PET/CT when applying voxel-based statistical testing to 3D volumes, which have been stereotactically normalized using b-splines.

METHOD AND MATERIALS
N = 94 subjects (50% AD and 50% normal) were selected from the Alzheimer’s disease Neuroimaging Initiative (ADNI) database. Two readers with 1 and 6 years of clinical experience classified FDG PET images, first by visual assessment of original images, then by rating stereotactically normalized 3D volumes, on which statistically significant areas of hypo-metabolism (Z-Scores, p

RESULTS
Sensitivity and specificity for the most inexperienced reader increased using voxel-wise statistical testing as overlay: For normal subjects, sensitivity and specificity were 95% and 56% without and 98% and 61% with overlays. In AD subjects, sensitivity and specificity were 54% and 95%, which changed to 59% and 98% when using overlays. Accuracy increased from 75% to 78%. The more experienced reader showed a better specificity by 2% (59% vs. 61%) for normal subjects when using overlays.

CONCLUSION
Voxel-wise statistical testing may help especially inexperienced readers in the differential diagnosis of dementia. As opposed to previously published studies, this not only applies to the assessment of cortical surface projections, but also to the assessment of stereotactically normalized 3D volumes.

CLINICAL RELEVANCE/APPLICATION
Differential diagnosis in dementia and especially Alzheimer’s disease is challenging and may be augmented by software.

Comparisons of Contrast-enhancement on Inner Ears among Patients with Unilateral Otologic Symptoms in Magnetic Resonance Images Taken at 10 Minutes and 4 Hours after Gadolinium Injection (Station #5)

Tae-Yoon Kim MD (Presenter): Nothing to Disclose, Dong-Woo Park MD : Nothing to Disclose, Young-Jun Lee MD : Nothing to Disclose, Choong-Ki Park MD : Nothing to Disclose, Ji Young Lee MD : Nothing to Disclose

PURPOSE
To compare the signal intensity of the inner ear in patients with unilateral symptomatic ear disease, between 10 minutes and 4 hours delayed intravenous gadolinium enhanced three-dimensional fluid attenuated inversion recovery magnetic resonance images (3D-FLAIR MRI), between affected and unaffected sides, between patients with sudden sensorineural hearing loss (SNHL) and non-sudden SNHL patients, and between patients with viral disease and non-viral disease, based on clinical manifestation.

METHOD AND MATERIALS
Total 50 patients with lateralizing otologic symptom, such as hearing loss, tinnitus, ear fullness, nystagmus, vertigo, facial nerve palsy, who underwent 3D-FLAIR MRI with 10 minutes and 4 hours delayed intravenous gadolinium enhancement, from May 2012 to October 2013, were retrospectively analyzed by 2 neuroradiologists blinded to the clinical presenstation. The signal intensity (SI) ratios of cochlear, vestibule, vestibulocochlear nerve (VCN), Meckel’s cavum and cisternal segment of trigeminal nerve to medulla oblongata were calculated and compared.

RESULTS
SI ratios of affected cochlea, vestibule, and VCN were higher than unaffected side in both 10 minutes and 4 hours. SI ratios of VCN in non-sudden SNHL patients were higher than sudden SNHL patients in both 10 minutes and 4 hours. Among sudden SNHL patients, SI ratios of affected cochlea with 10 minutes delayed enhancement were significantly higher than unaffected side. SI ratios of VCN in viral disease group were higher than non-viral disease group, in both 10 minutes and 4 hours. No statistically linear correlation, but positive correlation between mean of 4 hours delayed SI ratios of Meckel’s cavum of trigeminal nerve and 4 hours delayed SI ratios of unaffected cochlea.

CONCLUSION
SI ratios of inner ear in 10 minutes and 4 hours delayed intravenous gadolinium enhancement shows statistically significant increase in many diseases, especially viral origin disease. Anatomic discrimination of IE and VCN is better in 4 hours than 10 minutes. Positive correlation of SI ratios between trigeminal nerve and cochlea may represent the relationship of cranial nerve permeability and blood-labyrinth Barrier disturbance, but requires further study.
**CLINICAL RELEVANCE/APPLICATION**

SI ratios of inner ear can reveal correlation of contrast enhancement and diverse inner ear pathology. More accurate and objective SI ratio measurement is needed and requires further study.

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**OBE-SUA**

**Obstetrics/Gynecology Sunday Poster Discussions**

*Education Exhibits*

AMA PRA Category 1 Credits ™: .50

Sun, Nov 30 12:30 PM - 1:00 PM  Location: OB Community, Learning Center

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**Sub-Events**

**OBE115**

The Revised FIGO Staging System for Cancer of the Ovary, Fallopian Tube, and Peritoneum: Important Implications for Radiologists (Station #1)

Tsukasa Saida MD (Presenter): Nothing to Disclose, Yumiko Oishi Tanaka MD: Nothing to Disclose, Koji Matsumoto MD: Nothing to Disclose, Toyomi Satoh MD: Nothing to Disclose, Hiroyuki Yoshikawa MD, PhD: Nothing to Disclose, Manabu Minami MD, PhD: Nothing to Disclose

**TEACHING POINTS**

The International Federation of Gynecology and Obstetrics (FIGO) recently underwent significant revision for cancer of the ovary. The revision is based upon the concept that high-grade serous tubal intraepithelial carcinoma (STIC) may be the origin of some high-grade serous carcinomas (HGSC) of the ovary and peritoneum. Therefore, the staging criteria of the ovary, fallopian tube and peritoneum have just unified. The teaching points of this exhibit are: 1. To clarify the concept of STIC and apparent multicentric origin of HGSC of müllerian-derived tissues. 2. To show the examples of diseases along with the new staging criteria with MRI and CT.

**TABLE OF CONTENTS/OUTLINE**

A. A brief interpretation of "STIC" theory. B. Imaging examples of HGSC of the ovary, fallopian tube, and peritoneum C. CT and MRI examples of each stage of the diseases with emphasizing the changes of the revised FIGO staging system including: 1. Due to the difficulty in decision of the primary site, stage II was simplified. 2. Exclusive lymph node metastasis is no longer stage IIIc as patients with retroperitoneal lymph node involvement without peritoneal involvement have better prognosis. 3. Stage IV was divided into stage IVa with malignant pleural effusion and stage IVb with distant metastasis.

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**OBE145**

Premedicating Pregnant Patients with A Contrast Allergy Before CT: Is There a Role — Alternatives, Risks, and Benefits (Station #2)

Jaspreet Kaur Bisla MD (Presenter): Nothing to Disclose, Jeanne Miriam Horowitz MD: Nothing to Disclose, Cecil Gordon Wood MD: Nothing to Disclose, Senta Maria Berggruen MD: Nothing to Disclose, Frederick Lawrence Hoffman MD: Nothing to Disclose, Vahid Yaghmai MD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To review the risks and benefits of premedication in pregnant patients 2. To review indications for contrast enhanced CT in pregnant patients 3. To discuss alternative imaging tests for a pregnant patient

**TABLE OF CONTENTS/OUTLINE**

I. Risks and benefits of premedication in pregnant patients A. Benadryl-Class B B. Prednisone-Class C C. Break-through reactions D. Informed written consent II. Are there indications for a contrast enhanced CT in pregnancy? A. Body imaging B. Neuro imaging C. Low radiation dose CT technique III. Imaging alternatives A. Ultrasound a. Appendix b. Pelvic B. MRI- noncontrast a. Acute abdominal pain- appendicitis, SBO, biliary, pancreatitis IV. Conclusion - While pregnant patients can be premedicated, alternative imaging such as ultrasound and/or MRI is preferable to premedicating pregnant patients for a CT due to the risk of a breakthrough reaction and lack of radiation.

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**PDS-SUA**

**Pediatric Sunday Poster Discussions**

*Scientific Posters*

AMA PRA Category 1 Credits ™: .50

Sun, Nov 30 12:30 PM - 1:00 PM  Location: S101B
PDS212

Osteochondral Lesions of the Femoral Cartilage follow a Distinctive Pattern: Comparison of MR findings with Split Line Maps of the Knee Joint (Station #1)

Anna L. Falkowski (Presenter): Nothing to Disclose, Carlo Camathias: Nothing to Disclose, Jon A. Jacobson MD: Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Arthrex, Inc Olaf Magerkurth MD: Nothing to Disclose

PURPOSE

To characterize MR findings of osteochondral lesions in the knee joint with regard to location, size, shape, orientation of the axes and compare these findings with a split line map of the distal femoral cartilage.

METHOD AND MATERIALS

IRB approval was obtained. Patients with acute OCDs were included. The following measurements and observations were obtained: location, depth, shape and size of the OCD. Lesions with a ratio of short axis / long axis <0.6 were considered as oval and over 0.6 as round lesions. Orientation of the long and short axes were compared to a split line map. Interreader Agreement was tested with a paired two tailed t-test.

RESULTS

56 patients were included in the study. 17 OCDs were located in the medial central portion of the medial femoral condyle joint surface (R13, Fig.1). The location of the other lesions were: 4 in R1, 1 in R4 and R7, 4 in R10, 6 in R11, 1 in R12, 5 in R14, 8 in R17, 4 in R19, and 1 in R20. Orientation of the long axis correlated with the split line map. In regions R10-R12, lesions were round, whereas they were oval in R4, R7 and R13-R20. Testing for interreader agreement showed no significant difference and a good correlation (p=0.067, r=0.7100).

CONCLUSION

In this study shape of osteochondral lesions in the knee joint do follow split line maps representing the layered structure of the cartilage. We assume that paying attention to orientation of autologous chondral grafts might increase stability a the recipient site and improve outcome.

CLINICAL RELEVANCE/APPLICATION

The majority of osteochondral defects (OCD) in the knee joint occur in the femoral cartilage. According to the International Cartilage Repair society (ICRS) OCDs should be characterized by location (Fig. 1B), size, depth and involvement of the underlying bone. According to histological and biomechanical studies the cartilage is not an amorphous mass covering the epiphysis, but consists of a layered matrix orientated to tensile forces during motion of the joint. This layering is supposed to increase stability of the cartilage. We observed that osteochondral lesions are oval in shape and that the long axis may correlate with split lines maps (Fig. 1A) of the femoral cartilage. This might imply that in autologous chondral grafting paying attention to orientation of chondral plugs at the donor and recipient site might improve the outcome.

PDS213

Reading Networks in Children with Dyslexia Compared to Children with Ocular Motility Disturbances Revealed by fMRI (Station #2)

Ibone Saralegui MD (Presenter): Nothing to Disclose, Begona Garcia-Zapirain MD: Nothing to Disclose, Begona Fernandez-Ruanova: Nothing to Disclose, Alejandro Basterra: Nothing to Disclose, Jose Maria Ontanon MD: Nothing to Disclose, Ricardo Martinez MD: Nothing to Disclose

PURPOSE

To analyze the neural network while reading in a group of dyslexic children and to compare it that in two other groups, one of children with normal development and the other of children with monocular vision secondary to ocular motility disorders, to assess whether dyslexic readers share neuronal patterns with children with ocular motility disorders; if, in contrast, there are differences in their language networks, ocular motility disorders should not be considered a cause of dyslexia

METHOD AND MATERIALS

We conducted a comprehensive fMRI study including three different cognitive tasks, two lexical decision tasks and a semantic categorization task, in order to explore the two main routes of reading, phonological and orthographic. We studied the brain activation pattern while reading in the most eloquent cortical areas from the two reading routes, and the strength of their association with reading scores in 66 Spanish children aged 9-12 years divided into three groups: typically developing readers (control) (TDR), dyslexic readers (DXR) and readers with monocular vision due to ocular motility disorders (MVR).

We used a non-parametric K Test for comparisons between the three groups, followed by a post hoc MW test for comparisons between pairs of groups.

RESULTS
For the three paradigms, the pattern of activation while reading in MVRs seems different from that in DXRs but be similar to that in TDRs. In relation to the two paradigms designed to explore the phonological route, DXR tended to hypoactivate the posterior region of the VWFA (Visual Word Form Area): (p = .001, M-W test), DXRs vs TDRs (p = .001, K-W test) and vs MVRs (p = .002, M-W test); as well as the left Wernicke’s area, and both the Broca’s areas. In the paradigm linked to the orthographic route, the semantic categorization task, DXR hypoactivated the left Wernicke’s area: MVRs vs DXRs (p = .016, M-W test); and both triangular regions of both Broca’s areas, and they seemed to compensate by activating the Wernicke’s area of the contralateral hemisphere: (p = .006, K-W test), DXR vs TDRs (p = .002, M-W test)

CONCLUSION

According to our results, Spanish DXR do not have the same brain network for reading as MVR. Ocular motility disorders would not be a causal factor for dyslexia

CLINICAL RELEVANCE/APPLICATION

fMRI might help to distinguish the underlying mechanisms of dyslexia and its relation with visual impairment, with beneficial consequences for its diagnosis and treatment

PDS214

Addition of High Resolution Balanced Fast Field Echo Sequence of Lumbosacral Spine Increases Reviewer Confidence and Agreement among Reviewers in Evaluation of Spinal Drop Metastases in Children with Brain Tumors (Station #3)

Korgun   Koral MD (Presenter): Nothing to Disclose , Nabila  Choudhury MD : Nothing to Disclose , Lynn Gargan PhD : Nothing to Disclose , Song  Zhang PhD : Nothing to Disclose , Timothy Nicholas Booth MD : Nothing to Disclose

PURPOSE

To test whether addition of a balanced fast field echo (BFFE) sequence increases confidence of diagnosis and inter-observer agreement in diagnosis of spinal drop metastases in children with brain tumors.

METHOD AND MATERIALS

Institutional review board approval was obtained for this retrospective HIPAA compliant study. Query of the Neuro-Oncology database from 3/2010 through 3/2013 yielded 42 patients (113 examinations) who underwent MRI for evaluation of spinal drop metastasis using a protocol with both gadolinium enhanced (sagittal and axial) T1W spin echo (SE) sequences and sagittal BFFE sequence of the lumbosacral spine. Two pediatric neuroradiologists with 12 and 16 years’ experience independently reviewed the de-identified studies that were presented randomly. Three sessions, at least 15 days apart, were conducted with each reviewer. At each session, only the T1W SE sequences, only the BFFE sequence and combined T1W SE and BFFE sets were reviewed. The reviewers recorded the presence or absence of the drop metastases and their confidence levels (3= highly confident, 2= moderately confident, 1= not confident). The degree of agreement between the reviewers was assessed for each dataset. Whether the addition of BFFE to T1W SE sequence influenced the diagnosis and confidence level was analyzed.

RESULTS

Kendall’s coefficient of concordance (0.85) was greater for the combined data set than it was for T1W SE and BFFE sequences, 0.73 and 0.80, respectively. Addition of BFFE resulted in a change in diagnosis of drop metastasis from negative to positive in 9.7% and 7.1% of examinations and from positive to negative in 7.1% and 1.7% of examinations for the reviewers, respectively. The diagnoses changed in 13.7% of observations when both reviewers’ evaluations were combined (31/226).

CONCLUSION

Addition of high resolution BFFE sequence to gadolinium enhanced T1W SE sequence increases the confidence and agreement among reviewers. A significant percentage of diagnoses changed with inclusion of BFFE sequence in the imaging protocol.

CLINICAL RELEVANCE/APPLICATION

Accurate detection of spinal drop metastases determines the delivery and dose of spinal radiation in children with brain tumors. Demonstration of clinical utility characterized by increased rates of agreement and confidence of an additional sequence is important in justifying the additional scanning time (on the order of 4-5 minutes).

PDS215

Alterations of the Regional Low-frequency Fluctuation and Peculiarities of the Brain Metabolism in Autistic Children: fMRI and In-vivo 1H MRS Study (Station #4)

Zina Z. Rozhkova PhD, DSc (Presenter): Nothing to Disclose , Oleksii  Omelchenko : Nothing to Disclose

PURPOSE

We propose amplitude of low-frequency fluctuations ALFF, and values of the fractional ALFF (fALFF), and also the ratios of the main cerebral metabolites for the characteristics of functional and metabolic abnormalities of autism.

METHOD AND MATERIALS
METHOD AND MATERIALS

26 children are examined by fMRI and 1HMRS using 1.5T Signa EXCITE HD (GE). All subjects are divided into two groups. The 1st group (NG) consists of 8 healthy children (3-16yo). The 2nd group (PG) includes 18 (3-14yo) autistic children. For all subjects T2*-W-GE-EPI(TR/TE=3000/71ms) were obtained. Single, and group ICA analysis using MELODIC were carried out. The frequency fluctuations of the BOLD signal in the range 0.0024-0.167 were measured. ALFF and fALFF were calculated using REST software, and analyzed in two different frequency bands (slow-5:0.01-0.027Hz, slow-4:0.027-0.073Hz). To detect the differences of ALFF and fALFF in two groups for all voxels in the gray matter (GM) the GLM was applied. 1H spectra are recorded with STEAM:TR/TE=1500/144ms in both hemispheres in the white and gray matter (WM, GM).

RESULTS

In PG decreasing ALFF of both frequency bands and fALFF of slow-5 band, including left inferior/middle/superior temporal gyrus, left inferior parietal gyrus, left supramarginal gyrus, left angular gyrus, left fusiform gyrus, left middle occipital gyrus are found. In PG in slow-4 band ALFF decreased in right inferior/middle/superior temporal gyrus, right supramarginal gyrus, right angular gyrus, right fusiform gyrus, and right lateral cerebellum. In contrast, ALFF of slow-5 band increased in bilateral brainstem, cerebellar vermis, media cerebellum, and left parahippocampal gyrus. Frequency-specific ALFF/fALFF abnormalities in PG are associated with deficit of social cognition. In PG decrease of NAA/Cr, increase of Cho/Cr, and mIns/Cr in anterior cingulate and left striatum in comparison with NG are obtain. In WM in the NG in the age 3-6y the Glu/Cr increase rapidly from (0.23+0.02), reach maximum in 6y (0.34+0.02), and thereafter decreased moderately to adults level (0.30+0.02) for the age 8y. In GM in the NG in the age 3-6y the Glu/Cr (0.28+0.02) increase rapidly before values (0.36+0.03), characteristic for adult level.

CONCLUSION

fMRI and MRS gives us a possibility for monitoring of the brain functional development in the norm and under pathology.

CLINICAL RELEVANCE/APPLICATION

We combined these methods to understanding of the mechanisms of autism formation.

MRI of Fetal Congenital Diaphragmatic Hernias: Liver and Lung Volume Index of Neonatal Survival (Station #5)

Beth A. Furey MD, BEng (Presenter): Nothing to Disclose, April Alexander Bailey MD : Nothing to Disclose, Kevin Worley MD : Nothing to Disclose, Patricia Santiago-Munoz MD : Nothing to Disclose, Jodi S Dashe MD : Nothing to Disclose, Diane Mary Twickler MD : Nothing to Disclose

PURPOSE

To evaluate the percentage of fetal lung and liver occupied in the thorax with MRI as predictors of survival in fetuses with congenital diaphragmatic hernias (CDH).

METHOD AND MATERIALS

A retrospective review of fetuses with the diagnosis of isolated CDH referred for fetal MR from July 2001 to December 2013 was performed. Observed lung volume and intrathoracic liver (“liver-up”) volume to expected lung volume ratios were calculated using region of interest (ROI) measurements, and compared to neonatal survival. Data stratified for gestational age (GA) at the time of MR examination (≤ 28 weeks vs. > 28 weeks) was also compared. Wilcoxon rank sum tests were used for individual significance of lung volume and liver-up ratios in determining neonatal survival. Logistic regression was used for predicting neonatal survival.

RESULTS

To date, 48 MR examinations of fetuses with isolated CDH who had neonatal outcomes available have been included. Newborns who survived the neonatal period had significantly larger observed to expected lung volume ratios [median 0.25 (Q1 = 0.17, Q3 = 0.42) vs. 0.13 (Q1 = 0.10, Q3 = 0.20) p=0.0004] and smaller liver-up to lung volume ratios [median 0.08 (Q1 = 0, Q3 = 0.16) vs. 0.27 (Q1 = 0.19, Q3 = 0.41), p=0.0002] than the non-survivors. Measurements of observed to expected lung volume ratios obtained at a GA of ≤ 28 weeks were less predictive [median 0.42 (Q1 = 0.17, Q3 = 0.43) vs. 0.16 (Q1 = 0.10, Q3 = 0.27), p=0.0474] than GA > 28 weeks [median 0.25 (Q1 = 0.17, Q3 = 0.33) vs. 0.13 (Q1 = 0.08, Q3 = 0.16), p=0.0031]; measurements of liver-up to expected lung volume ratio obtained at a GA of ≤ 28 weeks were also less predictive [median 0.11 (Q1 = 0, Q3 = 0.16) vs. 0.22 (Q1 = 0.16, Q3 = 0.35), p=0.0356] compared to GA > 28 weeks [median 0.05 (Q1 = 0, Q3 = 0.16) vs. 0.35 (Q1 = 0.20, Q3 = 0.45), p=0.0004]. Both remained statistically significant. A logistic regression analysis was generated for survival with area under the curve (AUC) based on both MR volumes and GA = 0.9304 [95% CI: 0.8654, 0.9954].

CONCLUSION

The fetal MR combination of liver-up and lung volume ratios in conjunction with gestational age at the time of study can assign an index which may be helpful in predicting survival of fetuses with CDH.

CLINICAL RELEVANCE/APPLICATION

Accurate prediction of survival in fetuses with CDH by MR measurements of lung and liver-up volumes is important for antenatal parental counseling and decisions for neonatal care.
Tumor-like Musculoskeletal Lesions in Children and Young Adults: MR Appearance of Multifocal Diseases (Station #6)

Brett S. Talbot MD (Presenter): Nothing to Disclose, Burke Morin DO: Nothing to Disclose, Steven Paul Meyers MD, PhD: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to:

1) Demonstrate an extensive collection of osseous tumors and tumor-like conditions in pediatric and young adult patients that present in a multifocal, diffuse, or poorly defined manner.

2) Discuss MR findings in both malignant and non-malignant conditions.

3) Illustrate key clinical and pathopysiologic principles that aid in diagnosis and prognostication.

TABLE OF CONTENTS/OUTLINE

Nonmalignant -Inherited anemias (sickle cell disease, thalassemia, sideroblastic anemia) -Bone infarction -Serous atrophy of malnutrition (anorexia nervosa) -Gaucher disease -Osteomyelitis -Hypervitaminosis AandD, Fluorosis, Lead toxicity -Glycogen Storage Disease type 1A and 1B -Langerhans Cell Histiocytosis/Eosinophilic Granuloma -Radiation Injury -Multiple enchondromatosis (Ollier disease, Maffucci syndrome) -Fibrous dysplasia (polyostotic, McCune Albright) -Multiple Osteochondromas -Reflex Sympathetic Dystrophy

Malignant

-Leukemia

-Metastatic disease -Lymphoma

What a Radiologist Should Knows about Pediatric Ocular Ultrasound (Station #7)

Ana Maria Vargas Diaz MD (Presenter): Nothing to Disclose, Diana Garcia Casado: Nothing to Disclose, Gloria Gomez Mardones: Nothing to Disclose, Arturo Rodriguez Minguez: Nothing to Disclose

TEACHING POINTS

Review the congenital and acquired ocular pathology that may involve the pediatric orbit.

Review ocular sonography performed in our center, select the most representative images and illustrate the characteristic radiological images.

TABLE OF CONTENTS/OUTLINE

Ultrasound is the technique of choice for evaluating orbital pathology in children in the initial study of a wide spectrum of diseases and an additional tool for the ophthalmoscopic assessment

Orbital pathology is divided into:

Congenital: Persistent hyperplastic primary vitreous, congenital cataracts, coloboma, drusen, coats disease and congenital microphthalmos.

Acquired: traumatism and tumors.

Ocular sonography is able to demonstrate the morphology of the lesions, solid or cystic nature or the presence of calcification, hemorrhage, retinal/choroid detachment and foreign bodies.

The study was performed placing the transducer directly on the eyelids after applying gel on them. Ocular assessment begins with the identification of the anatomical characteristics and must continue with the specific characteristics and structural abnormalities.

The indications of the ocular ultrasound are: Opacity of the ocular media, marked pupillary miosis, visible mass on clinical examination, retinal/choroid detachment, trauma, foreign body and clinical suspicion of congenital microphthalmia
Comparison of Standard and Water-exchange-modified Dual-input Pharmacokinetic Models for DCE-MRI in Advanced Hepatocellular Carcinoma (Station #1)


CONCLUSION

Parameter values differ substantially between standard and WX PKMs. The results suggest that DCE-MRI data are water-exchange sensitive.

Background

DCE-MRI data have often been analyzed using standard pharmacokinetic models (PKMs) that assume a fast water exchange limit (FXL). Recently, it has been demonstrated that deviations from the FXL model occur when contrast agent arrives at the target tissue. However, the analysis has not been reported in the liver tumor with dual blood supply. The aim of this study was to compare kinetic parameters between 5 different standard dual-input PKMs and their corresponding water exchange-modified (WX) versions obtained from DCE-MRI of advanced hepatocellular carcinoma (HCC).

Discussion

$BF$ ($P<0.003$), $BF_{PV}$ ($P<0.03$), $BV$ ($P<0.001$), and $PS$ ($P<0.022$) were statistically significantly different for the pairwise comparison with all models except the AATH model, $γ$ ($P<0.023$) with the TK and ETK models, $BF_A$ ($P<0.008$) with all models except the ETK model, $MTT$ ($P<0.05$) with the 2CX and DP models, $V_I$ ($P<0.012$) with all models, and $E$ ($P=0.021$) with only the DP model, respectively. No parameter was consistent over all PKM pairs.

Evaluation

T1-weighted DCE-MRI of 20 patients was performed on a Siemens Avanto 1.5T with 2 consecutive 7s acquisitions during breath-holds that repeated 10 times with a break of 21s between them over a 4 minute period. The arterial and portal input curves were modeled by a sum-of-exponentials function. Total hepatic blood flow ($BF$), arterial fraction ($γ$), arterial BF ($BF_A$), portal BF ($BF_{PV}$), blood volume ($BV$), mean transit time ($MTT$), permeability-surface area product (PS), fractional interstitial volume ($V_I$), and extraction fraction ($E$) were estimated by fitting data to analytic solutions of 5 different FXL PKMs: the Tofts-Kety (TK), extended TK (ETK), two compartment exchange (2CX), adiabatic approximation to the tissue homogeneity (AATH), and distributed parameter (DP) models, and their WX PKMs using a 2-site exchange model for the TK model and a 3-site 2-exchange model for the ETK, 2CX, AATH, and DP models. Paired comparison of parameters within HCC between FXL and WX PKMs was evaluated using Wilcoxon signed-rank test for each parameter and for each PKM pair.

Advanced Experience with a Semi-automatic, Customized Software Tool for Clinical MRI Quantification of Visceral and Subcutaneous Adipose Tissue (Station #2)

Harald F. Busse PhD (Presenter): Nothing to Disclose, Alexander Schaudinn MD: Nothing to Disclose, Nicolas Linder: Nothing to Disclose, Gregor Thormer: Employee, Siemens AG, Thomas Kurt Kahn MD: Nothing to Disclose, Nikita Garnov: Nothing to Disclose

CONCLUSION

The presented software enables visualization and quantification of various fat depots and is considered a valuable tool to assess disease conditions and monitor related interventions.

Background

With obesity-related diseases, such as type 2 diabetes, on the rise, quantification of visceral and subcutaneous adipose tissue (VAT, SAT) volumes is becoming increasingly important as a diagnostic means for risk assessment. MRI-based analysis is common for that purpose but is either time-consuming with manual or error prone with automatic data processing. We report on our advanced experience, highlighting benefits and limitations of a customized semiautomatic fat quantification tool that has been used over the last three years for VAT and SAT analysis in obese patients.

Evaluation

The Matlab tool works with Dixon MR images, at our site, with 2-point acquisitions in supine position (1.5 T Achieva XR, Philips, 50 slices, 10 mm thick, 0.5 mm gap, in 160 s plus breathing intervals). An active contour model is used to define inner and outer VAT and SAT boundaries. VAT volumes are quantified by histogram analysis of the MR signal intensities. Starting at an automatic threshold, the user has immediate visual feedback of the segmented VAT image as the threshold is adjusted until results are acceptable. Also, SAT and VAT outlines can easily be corrected manually. Work can be saved and retrieved at any time for later processing. SAT and VAT total volumes and per slice are reported in common spreadsheet format.

Discussion

This tool has been used on over 500 datasets, originally covering 20 slices in the lumbar region and, for more than a year, 40 slices across the whole abdomen. About 1 in 6 slices require minor and another 1/6 major corrections. Mean segmentation time for total VAT is 24 min. Difficulties in automatic segmentation arise, e. g., from liver or intestinal fat that is mistaken for VAT, fatty abdominal muscles with tissues mixed, a limited FOV or artifacts occurring for BMIs > 40, and in regions like the minor pelvis or diaphragm dome where specific
fat signals are missing. On the other hand, 4 in 6 slices can be left as is, and corrections for patients with intact abdominal muscle layers are minimal.

**PHS127**

**Preliminary Investigation of Diaphragmatic Motion-based Magnetic Resonance Elastography for Assessing Liver Fibrosis (Station #3)**

Allison Johnsen MD (Presenter): Nothing to Disclose, Jared Weis PhD: Nothing to Disclose, Abigail Searfoss: Nothing to Disclose, Geoffrey Eugene Wile MD: Nothing to Disclose, Thomas Yankeelov PhD: Research Consultant, Eli Lilly and Company, Michael Miga PhD: Nothing to Disclose, Richard Glenn Abramson MD: Consultant, ICON plc Board Member, Partners in the Imaging Enterprise LLC

**PURPOSE**

Conventional magnetic resonance elastography (MRE) of the liver requires an external device for generating mechanical shear waves. We developed a novel MRE methodology that takes advantage of natural diaphragmatic respiratory motion to assess liver mechanical properties. The approach uses a model-based reconstruction algorithm to estimate mechanical elasticity using MR image volumes acquired under different states of deformation. The purpose of this initial investigation was to demonstrate this methodology for assessing liver fibrosis in cirrhotic and non-cirrhotic subjects.

**METHOD AND MATERIALS**

Technique was developed using normal volunteer subjects on a 3 T research scanner (Phillips Healthcare, Best, The Netherlands) and subsequently deployed on a patient with cirrhosis undergoing clinical MR imaging on a Phillips 1.5 T MR scanner. Each MR examination included breath-hold modified DIXON (mDixon) sequences acquired in sagittal plane at both end-inspiration and end-expiration (1.3 × 1.3 × 3.0 mm voxel resolution). Post-processing elastography images were then generated through the use of a modality independent elastography (MIE) reconstruction optimized for liver parenchymal deformation induced by diaphragmatic respiratory motion.

**RESULTS**

Post-processing with a MIE reconstruction yielded a map of the spatial distribution of stiffness within the liver, kidney, and surrounding adipose tissue. The cirrhotic patient exhibited significant focal heterogeneity of liver stiffness with areas approximately two-fold greater than background liver stiffness values. Mean stiffness of the cirrhotic liver, normalized to fat, was 1.64 times greater than mean liver stiffness in a normal volunteer.

**CONCLUSION**

A MRE approach based on diaphragmatic motion yielded plausible results in this initial attempt to assess cirrhotic and non-cirrhotic livers. These preliminary results indicate the potential for this approach to provide non-invasive assessment of liver stiffness without the use of external hardware. Further study is warranted.

**CLINICAL RELEVANCE/APPLICATION**

Diaphragmatic motion-based magnetic resonance elastography has the potential to provide valuable information on liver stiffness without the use of external hardware.

**PHS128**

**Effect of Iterative Model-based Reconstruction on the Sensitivity of Computed Tomography towards Iodine and Gold Nanoparticle Contrast Agents (Station #4)**

Ally Leigh Bernstein: Nothing to Disclose, Amar Dhanantwari: Employee, Koninklijke Philips NV, Thomas B. Ivanc MS: Employee, Koninklijke Philips NV, Efrat Shefer PhD: Employee, Koninklijke Philips NV, David Peter Cormode DPhil, MS (Presenter): Research Grant, Koninklijke Philips NV Consultant, Koninklijke Philips NV

**CONCLUSION**

IMR-based reconstruction techniques will allow contrast agents to be detected with greater sensitivity, potentially allowing lower contrast agent doses to be used.

**Background**

CT images have historically been reconstructed using filtered back-projection algorithms (FBP). Reconstructions via hybrid-iterative (ITER) and iterative model-based (IMR) algorithms have recently become available. These newer algorithms offer lower image noise than FBP. We therefore sought to determine whether newer algorithms would allow improved sensitivity of detection or reduced contrast agent doses via a phantom scanning study.

**PHS129**

**Influence of Acquisition Parameters on in Vivo X-ray Phase-contrast and Dark-field Radiographic Imaging of Mice (Station #5)**


**PURPOSE**

Recently first in vivo x-ray differential phase-contrast and dark-field radiographic images of a mouse were reported. It was noticed that the dark field yields much stronger signal for the lung tissue than the conventional absorption. The purpose of this study was to analyze how the lung dark-field signal depends on the scanning...
parameters like x-ray spectrum, detector pixel size and how much animal breathing affects the results.

**METHOD AND MATERIALS**

A compact small-animal preclinical scanner, which acquires conventional x-ray absorption simultaneously with phase-contrast and dark-field images, was used to acquire projection images of an in vivo 10-week-old C57BL/6N mouse. The measurements were performed for three different spectra (35 kVp, 45 kVp and 50 kVp) and processed using different detector binning modes. During image acquisition the mouse was breathing freely. Subsequently, the mouse was sacrificed and the measurements were repeated introducing different air volumes to the lung.

**RESULTS**

The processed dark-field images revealed that the best contrast-to-noise ratio was achieved for the 35 kVp spectrum, though other spectra also yielded significant signal. The lung could be clearly visualized for all three source settings. 200 x 200 μm pixel size was considered, applying a 4 x 4 detector binning. Hereby obtained images demonstrate that dark field gives a strong signal also for clinically compatible pixel sizes. Finally, comparison of the data acquired in vivo and ex vivo showed that breathing introduces only insignificant feature blurring due to motion.

**CONCLUSION**

This study analyzes different acquisition parameters for lung dark-field radiographic imaging. The results show that the high contrast for lung tissue can be achieved also for higher source voltages and clinically compatible pixel sizes. Furthermore, it is demonstrated that the animal breathing affects the image quality only negligibly. The results of this study provide a rule of thumb for future choice of acquisition parameters for preclinical dark-field studies.

**CLINICAL RELEVANCE/APPLICATION**

The results of this study give an overview of how different acquisition parameters influence the imaging results for x-ray phase-contrast and dark-field radiographs. These results are of importance for future preclinical studies.

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**PHS130**

**Standardization of Ultrasound Scanners for Dynamic Contrast-enhanced Ultrasonography (DCE-US) (Station #6)**

Stephanie Pitre-Champagnat (Presenter): Nothing to Disclose, Benoît Coiffier: Nothing to Disclose, Laurene Jourdain: Nothing to Disclose, Laure Delphine Boyer: Nothing to Disclose, Ingrid Leguerney: Nothing to Disclose, Nathalie Brigitte Lassau, MD, PhD: Speaker, Toshiba Corporation, Speaker, Bracco Group Speaker, Novartis AG Speaker, Pfizer Inc Speaker, F. Hoffmann-La Roche Ltd

**CONCLUSION**

This new methodology of standardization was validated and its simplicity could facilitate the development of multicenter studies in DCE-US.

**Background**

The growing interest in DCE-US clinical studies to use quantitative imaging parameters to assess therapeutic effects raises the problem of standardization of the ultrasound scanner to conserve the same dynamics and parameter thresholds in each clinical center. The aim of this study is to validate an original and fast method to establish the standardization in contrast mode of two different ultrasound scanners using settings initially defined for a French multicenter study.

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**PHE111**

**Novel Spectral Detector CT—Techniques and Clinical Applications (Station #7)**

Maryam Etesami MD: Nothing to Disclose, Prabhakar Rajiah MD, FRCR (Presenter): Institutional Research Grant, Koninklijke Philips NV

**TEACHING POINTS**

1) To explain basic principles of dual energy CT and different available methods with emphasis on the novel dual layer spectral detector CT technology (SDCT)
2) To discuss the advantages and disadvantages of SDCT compared to conventional CT and other dual energy methods
3) To review multiple specific clinical applications of SDCT for different organ systems

**TABLE OF CONTENTS/OUTLINE**

1) Basic principles of dual energy CT 2) Different methods of dual energy CT imaging 3) Single source, dual layer detector spectral CT technique 4) Advantages of SDCT • No need for pre-planning • Full availability of dose management tools; patient radiation dose • Elimination of time lag of sequential acquisitions, ideal for imaging moving tissue • Full field of view • Less artifact 5) Clinical advantages and applications • Increased sensitivity to contrast • Improved image quality • Less contrast media administration • Oncologic lesion characterization • Improved PE evaluation • Virtual non-contrast image • Material characterization • Kidney stone composition • Gout tophi characterization • Differentiation of calcium from iodine • Enhanced CTA and cardiac studies • Improved automated bone removal • Calcium quantification on CT angiogram • Metallic artifact reduction • Molecular contrast agent imaging 6) Limitations

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**PHE010-b**

**Real-time Demonstration of Simulated Low-dose Clinical CT Images (custom application computer**
**Background**

Practical simulation of low-dose examinations is of immense value for optimization of CT. However, current methods are limited to specific vendor platforms, and generally rely on sinogram data that are difficult to access. We have developed a vendor-neutral computational scheme for producing simulated low-dose from standard dose CT images.

**Evaluation**

Interface: In this computer demonstration, we will present simulated low-dose clinical CT images. Examples will include brain, abdomen, and pelvic CT examinations. In a real-live presentation, any particular dose level or examination will be simulated and presented to the participant. The degree of dose reduction can be prescribed in 5% increments. The simulated CT images will be produced in real time and displayed on a side window of the standard dose CT images for comparison. Both the standard and the simulated CT images can be interpreted in scrolling mode. Methodology: Our methodology is based on adding noise to simulated sinogram data generated by Radon transform of the original CT dataset. The magnitude of noise addition is based on the difference between the tube current-exposure time product (mAs) of the original examination and the targeted reduced mAs. The approach was validated using images of the ACR CT phantom which indicated that the noise addition had the proper magnitude and texture (characterized in terms of the NPS) as those of real dose-reduced images with no negative impact on image resolution.

**Discussion**

The simulation of low-dose CT images is a highly powerful approach to address the need for optimization in CT. However, current methods are limited to specific vendors and require access to sinogram data. Our technique eliminates these limitations with a simple methodology and a practical user interface. The approach is currently based on FBP reconstruction and needs to be extended to iterative reconstructions in the future.

**CONCLUSION**

We developed computer software for producing simulated low-dose CT images, which can be used for determining optimal dose setting of various CT examinations clinically without time-consuming experiments and risks in terms of increased patient dose.

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**Reliability of fMRI Experiments in the Setting of Neurovascular Uncoupling (hardcopy backboard)**

**Background**

Activated neurons in the brain send a vasodilatory stimulus to surrounding blood vessels to increase supply of oxygen and glucose to meet metabolic demands. Functional magnetic resonance imaging (fMRI) uses blood oxygen level dependent (BOLD) contrast to detect changes in blood flow based on differences in the magnetic properties of oxygenated versus deoxygenated hemoglobin, and then infer neuronal activity from the observed changes in blood flow.

Cerebrovascular reactivity (CVR) is the ability of arterioles to increase blood flow in response to a global vasodilatory stimulus. CVR can be reduced or exhausted in steno-occlusive cerebrovascular disease resulting in blunted increases in blood flow, or even decreased blood flow due to steal physiology.

We hypothesize that in areas with exhausted vascular reserve and steal physiology there will be diminished blood flow response following neuronal activation, and that these areas would appear as false negatives on traditional BOLD fMRI.

**Evaluation**

Patients with unilateral steno-occlusive disease received a vasodilatory stimulus during BOLD MRI to generate CVR maps. These were compared to traditional BOLD fMRI maps of neuronal activation in the motor cortex in response to a motor task. Neuronal activation from the motor task was found to be linearly correlated with CVR (n=11 patients, R=0.82). Patients with positive (normal) CVR showed positive activation on BOLD fMRI, while patients with negative CVR had decreased or absent neuronal activation on BOLD fMRI.

**Discussion**

Activated neurons send a vasodilatory stimulus to surrounding blood vessels, and the corresponding increase in oxyhemoglobin levels is the basis of the BOLD signal. In areas with cerebrovascular disease where CVR is impaired there is uncoupling of neuronal activation and blood flow that results in false negative errors on BOLD fMRI.

**CONCLUSION**
BOLD MRI CVR mapping can provide spatial information about the vascular reactivity of the brain that is essential to interpreting traditional BOLD fMRI studies in the setting of cerebrovascular steno-occlusive disease.

**QSE-SUA**

**Quality Storyboards Sunday Poster Discussions**

**Quality Storyboards**

SQ

AMA PRA Category 1 Credits™: .50

Sun, Nov 30 12:30 PM - 1:00 PM Location: QS Community, Learning Center

**Sub-Events**

**QSE100**

**Improving Quality through Integrated Program Management in a Paediatric Tertiary Care Radiology Department (Station #1)**

Zoran Bojic (Presenter): Nothing to Disclose, Ellen Charkot: Nothing to Disclose, Manohar Meghraj Shroff MD: Nothing to Disclose

**PURPOSE**

The main purpose of this initiative was to address communication problems and system dysfunction associated with significant program complexity. In a work environment characterized by a rapid pace of change, numerous improvement projects were simultaneously launched to address challenges and further improve quality of patient care. However, these projects were unsynchronized and they were often planned and executed within functional silos. This lack of project coordination resulted in delays of strategically important projects that were expected to eliminate known deficiencies and deliver improved quality of services. It was necessary to establish effective program governance structure to ensure the alignment of major program initiatives with hospital strategic directions, provide leadership oversight, improve decision making process, and enable timely response to changing conditions.

**METHODS**

The Quality Assessment and Improvement Committee adapted, introduced and used Program Management methodology that involved systems approach to planning, executing and controlling multiple projects. With this methodology, the committee achieved consensus on key priorities and outcomes, allocated resources, identified project interdependencies, coordinated communication across projects, integrated plans, and developed shared governance structure to manage changes. The Program Management was implemented by eliminating organizational communication barriers, enhancing transparency, creating a sense of urgency, and leveraging information technology. Clinicians and administrative staff were empowered to make decisions and implement changes. Lean Six Sigma principles, tools and techniques were applied to process redesign in order to eliminate waste, reduce cycle time, and minimize wasteful activities while creating value from the viewpoint of patients and other stakeholders.

**RESULTS**

One of the projects involved collaboration with front line staff to improve the overall excellence score measured through the independent Ambulatory Clinic Paediatric Patient Experience Survey. The project plan was focused on improving communication with patients and families who are in the waiting room, providing staff education, increasing awareness about service excellence, and ensuring that the waiting areas are set up in a way that is comfortable for the child as well as for parents and guardians. Following implementation of the project, the excellence score for Diagnostic Imaging ambulatory services was improved by 25%. Several quality improvement initiatives were implemented in MRI suite to enhance safety, improve access and address demand for services that increased 46% in the period of 5 years. As a result of effective interprofessional collaboration, MRI room utilization rate increased from 60% to 87%, MRI exam protocols were standardized, new distraction techniques were introduced to reduce the need for General Anaesthetic (GA), average MRI wait time was reduced by 38%, and average room turnover time between GA patients was consistently less than 18 min. Robust processes for screening of surgical implants and screening of patients were developed to reduce risks associated with the strong static magnetic field, varying gradient field, and radio frequency field in MR environment.

**CONCLUSION**

Using adaptable and integrated Program Management methodology is an effective approach to align multiple projects with strategic directions, resolve resource constraints, engage staff, enhance decision making, and develop strategies to address challenges and maximize opportunities. Program Management also provides the framework for implementing organizational strategies, initiatives and large scale change. Effective, clear and precise communication has been recognized as an essential factor for optimal team performance and process effectiveness. When leading change, it is important that all stakeholders keep patient's needs at the forefront and are prepared to make the necessary adjustments. Continually refined quality indicators have to be used to measure, evaluate, and improve effectiveness of all critical processes. Finally, the synergy that comes from putting employees together to review practices, solve problems, and take action is power that any healthcare institution can harness.

**OSE110**

**Institution-wide Training and Education Program for CT Technologists (Station #2)**
Multifaceted Approach to CT Dose Reduction for “Rule-out Aortic Dissection” (Station #3)

Judah Goldschmiedt MD (Presenter): Nothing to Disclose, Sharon Steinberger BA: Nothing to Disclose, Jeffrey Michael Levsky MD, PhD: Nothing to Disclose, Linda Bryde Haramati MD, MS: Investor, OrthoSpace Ltd Investor, Kryon Systems Ltd Spouse, Board Member, Bio Protect Ltd Spouse, Board Member, OrthoSpace Ltd Spouse, Board Member, Kryon Systems Ltd

PURPOSE

Acute Aortic Syndromes (AAS) is a broad diagnostic category that includes aortic dissection, intramural hematoma, penetrating atherosclerotic ulcer and frank aortic rupture. Because AAS carries a very high morbidity and mortality, rapid diagnosis and treatment are essential. At the same time, the notoriously poor performance of clinical signs and symptoms has increased the reliance upon rapid and accessible imaging to identify patients with AAS. Audit of our departmental performance of CT for suspected AAS revealed a far-reaching problem. CT protocols employed multiphase acquisitions of the chest and abdomen with an average effective dose of 43 + 20 mSv, representing some of the highest CT dose among diagnostic imaging examinations. Departmental data also described an extremely low overall positivity rate for AAS of 2.7%. With this in mind, we wish to describe a multifaceted approach to CT dose reduction for patients suspected of having an AAS at an inner-city academic medical center.

METHODS

After analysis of our study results, we were able to identify and address several discrete areas for potential quality improvement. 1) Instead of our initial standard 120-140 kVp setting, we changed our routine CT protocol to a 100 kVp standard, with mAs tailored to imaging patients with larger body habitus. 2) We began to consistently archive full dose reports within PACS for all studies. 3) Instead of routine non-contrast imaging of both the chest and abdomen to demonstrate intramural hematoma, we limited the craniocaudal scope of the non-contrast portion of the exam by starting at the aortic arch and ending at the diaphragm. The scope of the contrast-enhanced portion of the exam remained unchanged and spanned the chest and abdomen to the aortic bifurcation. 4) We unified this protocol across our multiple imaging sites and named it “CT Aortic Dissection” in
an effort to standardize communication between the clinical services, technologists and radiologists, and to facilitate quality assessments. 5) We collaborated with our Emergency Department (ED) colleagues on retrospective research aimed at identifying consistent and reliable clinical factors that can be used to assess the likelihood of AAS. 6) We successfully collaborated on prospective research aimed at evaluating the performance of our clinical decision tool by embedding the electronic CT requisition. Prospective data recorded included parameters that were identified as reliable clinical indications of AAS, such as the presence and a description of the quality and onset of patient’s reported chest pain.

RESULTS

We prospectively identified 192 patients who underwent CT for suspected AAS using our new “CT Aortic Dissection” protocol over a 6 month period. Compared with our historical study population, this cohort demonstrated a significantly lower radiation exposure, with mean effective dose of 13 + 6 mSv (p < 0.0001). There was also a non-significantly higher positivity rate for AAS of 4.6% compared with 2.7% (p-value 0.14). At the same time, standard dose reports were viewable in PACS in 100% of the cases, compared with 61% reported in our historical group (p-value <0.05).

CONCLUSION

Successful radiation reduction programs require a multifaceted approach which includes technical modifications, fostering of inter-department collaboration and attention to the quality improvement processes to effectively reach this goal. Optimizing technique, reviewing the scope of multiphase scanning. In addition, the consistent archiving of radiation dose reports in PACS facilitates quality assurance. Consistent naming and archiving of the “CT Aortic Dissection” protocol has facilitated physician ordering of the appropriate examination along with allowing for consistent execution of the proper imaging protocol and also facilitated ongoing quality assurance measures. The elimination of “unnecessary” scans is the most effective radiation reduction strategy, as unscanned patients are not irradiated at all. The clinical data points that were collected prospectively were the result of critical discussions between the radiology and ED staff directed at imaging appropriateness. Together, we identified and highlighted those presenting signs and symptoms that may suggest AAS. Since the initiation of our intervention, we have noted a trend toward a higher positivity rate for patient undergoing CT for “rule-out dissection". If this trend continues over time, it suggests that their report cards via email, closure of emergency CT, thus further lowering the radiation exposure to our population. Our institution's successful experience serves as model of a multifaceted approach to curtail radiation exposure to large patient populations.

QSE111

Learning from our Missed Opportunities: Initial Experience using Sonographer Report Cards to Improve the Diagnostic Accuracy of Pediatric Appendix Ultrasound and Decrease Pediatric CT Utilization (Station #4)

Karyn Alayne Ledbetter MD (Presenter): Nothing to Disclose, Andrew Kent Moriarity MD: Nothing to Disclose, Safwan Halabi MD: Nothing to Disclose

PURPOSE

In our community health system, there has been increased utilization of pediatric appendix ultrasound by the emergency department over the past decade, with approximately 250 studies performed in the last year. Nevertheless, both the sensitivity and specificity of the examination have remained low. Baseline data collected over a six month interval found visualization of the pediatric appendix in less than 25% of studies, equivocal results in over 33% of cases, and less than 5% of examinations confidently reported as negative. As a result, 30% of pediatric patients underwent subsequent CT scan and 12% were transferred to a local children's hospital for further evaluation. In this quality improvement initiative, we describe a novel method of providing quarterly structured feedback report cards to our sonographers with the goal of improving the diagnostic accuracy of the pediatric appendix ultrasound.

METHODS

Baseline data encompassing a six-month time frame was collected to establish the pre-intervention diagnostic accuracy of the right lower quadrant pediatric ultrasound and patient outcomes. Variables recorded include patient age, patient gender, sonographer name, appendix visualization, radiologist, and radiologist impression and recommendations. Any subsequent CT performed and applicable results as well as final patient disposition (discharge, admitted for observation, admitted for surgery or transferred) was also recorded. We then developed a report card to be distributed to all sonographers performing right lower quadrant ultrasound in the emergency department. Specifically, the report card includes imaging results (e.g. rate of visualization, radiologist final impression) and patient outcomes (e.g. CT performed, patient transferred, surgery performed). In addition to the clinical information, the report card also includes technique reminders with step-by-step detail of our imaging protocol and examples of the sonographic appearance of the normal and the acutely inflamed pediatric appendix. Prior to report card distribution, each report is reviewed by a team consisting of a radiology resident, an attending pediatric radiologist, the section head of ultrasound and the ultrasound department supervisor. An initial report card was generated. The sonographer received and evaluated the baseline performance from the six-month baseline data timeframe compared to department averages. Given the volume of cases per sonographer, an individualized quarterly report card is generated reflecting each sonographer’s performance in pediatric appendix ultrasound. Sonographers receive their report cards via email to ensure privacy and allow for easy reference and comparison with future reports. Individual and department results are analyzed every three months to evaluate for overall increased diagnostic accuracy of right lower quadrant pediatric ultrasound and measure CT utilization. Additionally, cumulative sonographer reports are reviewed semiannually by the study investigators and the ultrasound leadership team to identify opportunities to provide targeted sonographer training and education.

RESULTS

During the baseline collection period, an average of 21.4 examinations were performed per month with the appendix confidently visualized in 15% of cases, 5.6% of cases interpreted as positive and 0.8% of cases interpreted as negative. CT was recommended for 32% of cases, performed for 30% of cases and positive in 4.9% of cases. The patient was admitted, transferred to a pediatric tertiary care center and underwent surgery in 5.3%, 12.2% and 8.1% of cases, respectively. Approximately 35% of patients were evaluated on follow-up and pathology for all surgical cases was reviewed.
A Comprehensive Approach to Convert a Radiology Department from ICD-9 based Coding to ICD-10

CONCLUSION

Ultrasound is a proven method for diagnosing appendicitis and is becoming a standard screening modality for evaluating lower right quadrant pain. Nevertheless, the baseline data at our community hospital demonstrates suboptimal diagnostic accuracy and above average CT utilization. Our novel report card methodology aims to improve the diagnostic accuracy of pediatric appendix sonography with the goal of increasing referring clinician confidence in the modality thereby decreasing pediatric radiation exposure. Through continued monitoring, departmental collaboration and sonographer follow-up, we are working to continually improve outcomes for our pediatric patients. We believe this novel report card method of continuous quality improvement may be useful at other institutions and applicable beyond the initial focus on pediatric appendix ultrasound.

QSE001-b Microembolism during Endovascular Treatment of Unruptured Cerebral Aneurysms: Successful Reduction by Modification of the Coiling Technique and Maintenance of Intraprocedural Blood Pressure (hardcopy backboard)

Joo Yeon Lee (Presenter): Nothing to Disclose, Jae Yoon Kim: Nothing to Disclose, Jung Cheol Park: Nothing to Disclose, Yu Sub Sung: Nothing to Disclose, Choong Gon Choi MD: Nothing to Disclose, Deok Hye Lee MD: Nothing to Disclose

PURPOSE

Diffusion-weighted MR images (DWI) obtained after endovascular treatment of cerebral aneurysms frequently show multiple high-signal intensity (HSI) dots. Although most of the cases were subclinical, we came across some symptomatic cases from time to time. To reduce this phenomenon we draw our attention to the antithrombotic regimen. However, the lesions persistently observed even after routine use of dual antiplatelets (aspirin and clopidogrel) regardless of stent use. While searching for possible causes of the micro-embolisms, we found that a significant amount of air bubbles might have been introduced by various devices including the various detachable embolization coils which were currently available. Furthermore, we were informed that cardiac surgeons had experienced similar problems during open heart surgery and that they could eliminate this potentially morbid phenomenon by modifying patients’ blood pressure during surgery. Considering these facts, we hypothesized that we could decrease the occurrence of microembolic lesions by reducing air-bubble introduction through modification of our embolization procedure and by facilitation of wash-out of inadvertently introduced air bubbles through maintenance of the patient’s blood pressure above a certain level during general anesthesia.

METHODS

During the study period we had a total of 72 patients who underwent endovascular treatment of unruptured cerebral aneurysms. In the former three months (period 1), we had already applied various anti-embolic measures (conventional measures). In the latter three months (period 2), we began to apply more vigorous anti-embolic measures (additional measures). No other procedural condition differed between the two time periods except for the additional measures during period 2. There were 37 patients in period 1 and 34 in period 2. The patients were on a dual antiplatelets regimen for at least five days, before the procedure. P2Y12 inhibition assay was performed on admission. When the test results showed a PRU value of 240 or higher, we loaded 200 mg of cilostazol regardless of the stent use. To minimize dissolved gases in the flushing saline, the saline bags which were kept warm (37-40°C) were cooled down to room temperature before the procedure. 1000 units of heparin were mixed in a 1000-mL bag before use. Air bubble filters were not used. As we could observe multiple sources of air embolism (Fig 1) during the various steps of our embolization procedures, we attempted in order to reduce those embolic sources in addition to the conventional, anti-embolic techniques of neurovascular procedures. We considered that every introduced material and every procedural step could be the source or cause of air bubble embolism or thromboembolism. Upon removal of a microguidewire after placing a microcatheter or on removal of a coil pusher after delivery of a detachment coil, the microcatheter lumen was aspirated back until fresh blood gushed out and was flushed with saline using a 2-mL syringe before reconnecting to the pressurized flushing system in order to avoid any air bubble or thrombus introduction during the microguidewire/coil delivery system manipulation. In addition, after placing the guiding catheter, the anesthesiologist managed the patient’s blood pressure when the mean pressure was lower than 80 mmHg. Too high pressure was avoided by limiting the systolic pressure to not higher than 130 mmHg until the final completion angiography. We obtained TOF-MRA and DWI on post-procedural day 1. Most of the images were obtained approximately 24 hours following the procedure. DWI images were reviewed by a neuroradiologist. This reader classified HSI dots which could not be explained as artifacts, normal cortical signal or white matter bundles as infarction. Although there were no size criteria of the HSI dot. The number of all those HSI dots including the overt infarct lesions was counted by the reader. The values are presented as the median and interquartile range (IQR). The Fisher’s exact test and the Mann Whitney U-test were used for analysis (SPSS ver. 11; Chicago, IL, USA). A two-sided P value < 0.05 was considered significant. For analysis of the microembolic lesions on post-procedural DWI, we compared the DWI-positive (the presence of any DWI HSI dot) rates between the two time periods. We also compared the incidence of symptomatic microembolic lesions.

RESULTS

The incidence of the DWI HSI lesions differed significantly at 89.2% (33/37) during Period 1 and 26.5% (9/34) during Period 2 (P < 0.0001). The incidence of symptomatic lesions differed between the two periods (29.7% during Period 1 vs. 2.9% during Period 2, P < 0.003).

CONCLUSION

By modifying our microcatheter handling technique with intentional active manipulation of a patient’s blood pressure during coiling of unruptured cerebral aneurysms, we could successfully reduce the incidence of microembolic lesions on post-procedural DWI.

OSE011-b A Comprehensive Approach to Convert a Radiology Department from ICD-9 based Coding to ICD-10
PURPOSE

In 2009, the US Department of Health and Human Services announced that the currently used International Classification of Diseases, Ninth Revision code set (ICD-9) will be replaced with the tenth revision (ICD-10) code set. The change is currently set to take effect on October 1, 2015. The new code set greatly increases the specificity of coding and expands the total number of diagnosis codes from approximately 13,000 to more than 60,000. The transition to ICD-10 will affect every medical practice in the US, although the degree of the effect will partially depend on the specialty and patient mix. Radiology practices, like other specialties, have unique challenges that must be overcome in order to code their studies accurately. The purpose of this project is to describe one academic radiology department’s strategy to convert the department from using an ICD-9-based coding schema to an ICD-10-based schema.

METHODS

Initially, a risk assessment was performed. All final radiology reports signed by one of ten faculty radiologists over a three-month period were coded using a commercial ICD-10 automated coding system (CodeRyte CodeAssist; 3M Health Information Systems, Salt Lake City, UT). The resultant codes were then assessed to identify specific procedures in which generic codes were frequently used. After performing the risk assessment, two major patterns emerged in deficient reports: reports were either missing detailed historical or diagnostic information. Each deficiency was addressed in a different manner. In order to improve clinical history in final radiology reports, all technologists were asked to collect a detailed clinical history from the patient or their family and to document the history in the electronic medical record. This work expanded on a previously implemented improvement project. To assess the technologists’ effectiveness in obtaining the clinical history, audits were performed for each modality division and compared to baseline performance. Each history was scored by one project team member and was considered complete if it was able to answer the following questions: What happened? Where is the problem? When did the problem start? The percentage of complete histories was plotted on a run chart with a goal of 90% of studies having complete histories. The department has a history of using standardized, structured reports for nearly every study performed throughout the department. Because many of the final radiology reports still lacked the detailed clinical history obtained by the technologist, the standard, structured reports were altered to populate this information automatically. In order, to improve the diagnostic information in the final dictated reports, procedures with the most commonly deficient reports were identified and the corresponding structured reports were edited so that the required information could be consistently obtained.

RESULTS

A total of 11,792 final reports were initially assessed using the commercial ICD-10 coding engine. Of these, 44% were judged to be deficient, yielding an unspecified code. The vast majority of these deficient reports were for extremity radiographs (63% of total). Initially, radiography technologists worked to document a complete clinical history. At baseline, the radiography technologists obtained a complete history for 65.5% of radiographs performed in the department. One month after implementing the project, the percentage of complete histories improved to 94%. In February 2014, the history project was expanded to include all modalities. At baseline, technologists obtained a complete history for 48.5% of CTs, 44.0% of ultrasounds, 81.6% of MRIs, 17.0% of interventional radiology cases, and 30% of nuclear medicine studies. Because the vast majority of reports deficient in diagnostic information were extremity radiographs, these structured reports were the most heavily edited. An ICD-10 code book was used to ensure that the required information was obtained for accurate ICD-10 coding. For every extremity radiograph, the radiologist is now asked to report on a series of findings relating to fractures such as the location and type of fracture, the presence of physeal involvement or displacement, and the presence of healing. These reports are currently in the approval process and, once implemented, will be used to report on all extremity radiographs.

CONCLUSION

We believe that a coordinated and comprehensive process is required to convert a radiology department from ICD-9-based coding to ICD-10-based coding. Through this project, we have performed a risk assessment and identified and implemented strategies to mitigate these risks. As we approach the October, 2015 deadline to convert to ICD-10 coding, we plan to begin dual coding and use this data to further refine our reports.
Due to patient free breathing, tumor and other critical organs deform during cancer radiation treatment. The voxel to voxel mapping among the 3DCT images at different time instances will be of great help in dose calculation and treatment verification. To address these challenges, an iterative morphing approach has been developed to define the iso-surface feature points and to map the 3D volumes.

METHOD AND MATERIALS

To map the tumor (similarly for other critical structures) from the source 3DCT to the target 3DCT, first, the tumor iso-surfaces of both the source and target phases are automatically detected based on neighboring CT intensity patterns. Then, the minimized bounding boxes of the tumor on both the source and target phases are derived based on tumor iso-surface. The feature points (landmarks) on the source iso-surface are selected based on gridding on the minimized bounding box and distances to the iso-surface. Next, for both the source and target phases, the nearest tumor iso-surface intensity and relative positions are projected to the six 2D planes of the bounding boxes. The corresponding landmarks are then mapped from the source to the target phase based on image template matching algorithm. Last, using a modified Shepard morphing approach, the entire tumor volume is mapped from the source phase to the target phase.

RESULTS

A prototype has been developed and preliminary experiments have been performed with the previously acquired 4DCT. The figure below illustrated one set of the experiments where phase 0 was selected as the source phase and phases 7, 8 and 9 as the target phases, respectively. On the source phase, 31 landmarks were obtained on the tumor and the landmarks mapping results are illustrated in Fig. 1. The mapping results were evaluated with the similarity of the image intensity histogram and the displacement of the tumor volume. For the experiment demonstrated, the average landmark intensity differences of the predicted and actual 3D volume were 1.09, 1.36, and 1.08 for the phase 7, 8, and 9, respectively, with the average stdev of 0.82.

CONCLUSION

We proposed a tumor iterative morphing method for 3D tumor iso-surface and volume mapping from one 3DCT to another with deformation. The dose effects from tumor deformation will be further investigated.

CLINICAL RELEVANCE/APPLICATION

NA

Application of Partial Volume Effect Correction and 4D PET/CT in the Accurate Quantification of Lung Cancer Lesions (Station #3)

Ali Salavati MD, MPH (Presenter): Nothing to Disclose, Sina Houshmand MD: Nothing to Disclose, Boon-Keng Kevin Teo PhD: Nothing to Disclose, Benjapa Khiewvan: Nothing to Disclose, Habib Zaidi MSc, PhD: Nothing to Disclose, Drew Avedis Torigian MD, MA: Nothing to Disclose, Abass Alavi MD: Nothing to Disclose

PURPOSE

To compare the impact of simultaneous use of respiratory gating with partial volume effect correction on the accurate quantification of FDG-PET/CT parameters in patients with lung cancer.

METHOD AND MATERIALS

The study included 106 lesions of 55 lung cancer patients who underwent respiratory-gated FDG-PET/CT for radiation therapy treatment planning. Volumetric PET/CT parameters were determined by using both 4D PET/CT and non-gated PET/CT images. We used a semi-automatic program employing an adaptive contrast-oriented thresholding algorithm for segmentation as well as a lesion based partial volume effect correction algorithm. We compared respiratory-gated parameters with non-gated parameters by using pairwise comparison and interclass correlation coefficient assessment. In a multivariable regression analysis we also examined factors, which can affect quantification accuracy, including the size of lesion and the location of tumor.

RESULTS

We observed a minor difference in FDG uptake and volumetric parameters of lesions by comparing the highest respiratory-gated values versus non-gated PET/CT values. After correction for partial volume effect, the mean standardized uptake value (SUVmean) and total lesion glycolysis (TLG) increased substantially (p-value < 0.001). However, we did not observe a significant difference between partial volume corrected parameters of respiratory gated and non-gated PET/CT scans. Regression analysis showed that tumor volume is the single most significant predictor of quantification inaccuracy that was mainly caused by partial volume effect.

CONCLUSION

Based on this study, volumetric and partial volume corrected parameters of non-gated PET/CT images are comparable to respiratory-gated PET/CT parameters. Partial volume correction increased both the respiratory-gated and non-gated values significantly and appears to be the dominant source of quantification inaccuracy particularly in small lesions.
Accurate quantification of lung malignancies is an important part of treatment planning and response monitoring in clinics. In this study, we compared factors causing inaccurate quantification in clinical practice.

Sub-Events

**VIS211**

**Arsenic Trioxide Contained Transcatheter Arterial Chemoembolization for Treatment of Unresectable Hepatocellular Carcinoma: A Prospective Multicenter Randomized Controlled Trial (Station #1)**

Tengchuang Ma (Presenter): Nothing to Disclose, Hai Bo Shao MD: Nothing to Disclose, Long Gao: Nothing to Disclose, Hongying Su: Nothing to Disclose, Xu Ke MD: Nothing to Disclose

**PURPOSE**

To evaluate the efficacy and safety of arsenic trioxide (As2O3) contained transcatheter arterial chemoembolization (TACE) for treatment of unresectable hepatocellular carcinoma (HCC).

**METHOD AND MATERIALS**

A multicenter randomized controlled trial was conducted on 223 patients with unresectable HCC at twelve tertiary referral center hospitals between January 2007 and December 2010. Patients were randomly assigned to three groups with different intra-procedure drug administration protocols (group 1: TACE-As2O3 20mg, n=69; group 2: TACE-epirubicin 40mg, n=71; group 3: TACE-two drugs combined, n=83). All TACE procedures were carried out by superselective embolization using drug-lipiodol emulsion. Repeated TACEs (mean 2.8 times) were performed at one-month intervals and followed up at three-month intervals. Therapeutic effect was evaluated by mRICIST criterion. The primary end point was overall survival (OS). The secondary end point was time to progression (TTP). Adverse effect (AE) observation obeyed CTCAE 4.0.1 version. Survival analysis was performed with Kaplan-Meier method by Log-rank test. Factors associated with OS and TTP were also analyzed.

**RESULTS**

There were no treatment-related deaths. By follow-up of 6 to 43 months, there was no significant difference in OS among three groups (16.0, 15.6, 17.2 months in group 1, 2 and 3, p=0.5614). However, TTP in group1 (12.9 months) and group 3 (13.8 months) was significantly longer than that in group 2 (7.7 months, P<0.01). Multivariate analysis showed that BCLC stage was an independent prognostic factor for OS and TTP. Intra-procedure drug administration protocol was a prognostic factor for TTP. On stratification analysis, As2O3 contained TACE (group 1 and 3) showed longer OS (P<0.001) and TTP (P<0.001) in patients in BCLC B stage. The proportion of - AEs in group 2 and 3 was significantly higher than that in group 1 (liver function abnormalities, P<0.05; degree toxicity incidence ,P <0.05).

**CONCLUSION**

As2O3 contained TACE improved TTP of the patients with unresectable HCC, especially the patients in BCLC B stage (both OS and TTP were prolonged). The toxicity of TACE was not increased for single or combined use of As2O3.

**CLINICAL RELEVANCE/APPLICATION**

As2O3 contained TACE may prolong TTP and OS of unresectable HCC especially in BCLC B stage without enhancement of toxicity.

**VIS212**

**Endovascular Repair of an Isolated Common Iliac Aneurysm in 21 Patients (Station #2)**

Soichiro Hase (Presenter): Nothing to Disclose, Yuya Koike: Nothing to Disclose, Motoshige Yamasaki: Nothing to Disclose, Hiroshi Iwamura: Nothing to Disclose, Junichi Nishimura MD: Nothing to Disclose, Naoki Washiyama: Nothing to Disclose, Mutsumu Fukata: Nothing to Disclose, Hiroshi Nishimaki MD: Nothing to Disclose

**PURPOSE**

To evaluate the efficacy and safety of endovascular repair of an isolated common iliac aneurysm (EVAR) in 21 patients during a 5-year period.
To evaluate the clinical results in endovascular aneurysmal repair (EVAR) of isolated common iliac artery aneurysms (CIAAs) retrospectively.

**METHOD AND MATERIALS**

Between June 2009 and March 2014, 21 patients (17 males) underwent EVAR for isolated CIAAs. The age ranged from 52 to 90 years (mean, 69 years). Unilateral involvement of CIAA was seen in 15 patients, with bilateral involvement in the remaining 5 patients. Internal iliac artery involvement was seen in 5 patients. The maximum diameter of aneurysm ranged from 23 to 55 mm (mean, 35 mm). The bifurcated endograft in 11, the iliac limb of the aortic graft in 7, and the combination of aortic cuff and parallel-aligned iliac extender in 3 patients were used. The follow-up CT was performed at discharge, 3, 6, and 12 months and annually thereafter.

**RESULTS**

The mean follow-up period was 529 days (range, 30-1768). Technical success was achieved in all 21 patients (100%). No mortality and morbidity were observed during follow-up. Follow-up CT revealed no evidence of type I/III endoleaks and aneurysmal enlargement (>5mm). In 9 CIAAs (33%), shrinkage of aneurysmal sac was observed.

**CONCLUSION**

Endovascular repair for isolated common iliac aneurysm is feasible with a favorable mid-term result.

**CLINICAL RELEVANCE/APPLICATION**

Because side branches from a common iliac artery are infrequent, it is easier for complete exclusion of common iliac artery aneurysms than of abdominal aortic aneurysm.

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**VIS213**

**Local Control Effect of Microballoon-occluded Transarterial Chemoembolization with Miriplatin for Hepatocellular Carcinoma: A Retrospective Comparison of Conventional TACE with Epirubicin (Station #3)**

Masakazu Hirakawa MD (Presenter): Nothing to Disclose, Yoshiki Asayama MD: Nothing to Disclose, Akihiro Nishie MD: Nothing to Disclose, Yasuhiro Ushijima MD: Nothing to Disclose, Kimitaka Miyajima MD, PhD: Nothing to Disclose, Hiroshi Honda MD: Nothing to Disclose

**PURPOSE**

The aim of this retrospective study is to compare the local control effects of microballoon-occluded transarterial chemoembolization (B-TACE) with miriplatin (MPT) and those of conventional TACE with epirubicin (EPIR) for hepatocellular carcinoma (HCC)

**METHOD AND MATERIALS**

Sixty-five HCC cases were treated with TACE using EPIR or MPT. Forty patients (25 men, 15 women; mean age, 73.4 years) were treated using B-TACE with MPT (the MPT-B-TACE group), and 25 patients (15 men, 10 women; mean age, 72.2 years) were treated using TACE with EPIR (the EPIR-TACE group). The local control rates (modified Response Evaluation Criteria in Solid Tumors [mRECIST]), time to local recurrence (Kaplan-Meier and log-rank tests), and adverse events (AEs) were evaluated. Statistical analyses were conducted to evaluate the relationship between the patient's characteristics and local recurrence after MPT-B-TACE using Pearson's Chi-squared test. Multivariate logistic regression analysis was also performed.

**RESULTS**

There were no significant differences in patient's characteristics between the groups. The overall AE incidence did not significantly differ between the groups. According to the mRECIST, the objective response rate including complete and partial responses, in the MPT-B-TACE group (92%) was significantly higher than that in the EPIR-TACE group (76%). Overall, local recurrences in the MPT-B-TACE group were significantly lower than in the EPIR-TACE group (p < 0.05). Excluding multiple HCC cases, the local recurrence rate in the MPT T-B-TACE group was significantly lower than in the EPIR-TACE group (p < 0.05). Local recurrence after MPT-B-TACE was recognized in the 35% patients in the follow-up periods. Tumor size larger than 2cm and tumor number more than three HCCs were significant key factors in the local recurrence after MPT-B-TACE.

**CONCLUSION**

MPT-B-TACE was associated with a higher objective response rate and lower local recurrence rate than EPIR-TACE, and both showed similar adverse effects. Tumor size larger than 2cm and tumor number more than three HCCs were risk factors of the local recurrence after MPT-B-TACE.

**CLINICAL RELEVANCE/APPLICATION**

B-TACE with miriplatin may have great potential advantages in comparison with conventional TACE with epirubicin, and might constitute a novel therapeutic option for unresectable HCC.

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**VIS209**

**Complication and Diagnostic Yield Rates of Ultrasound Guided Renal Biopsies: A Retrospective Review of 832 Biopsies Performed at a Tertiary Referral Institution (Station #4)**

Ramaswamy Rajesh MBBS, MRCS (Presenter): Nothing to Disclose, Shueh Hao Lim MBChB: Nothing to Disclose, Robert Hunter: Nothing to Disclose, Fiona Gifford: Nothing to Disclose, Judith Margaret Anderson MD: Nothing to Disclose, Caroline Whitworth: Nothing to Disclose, Christopher Bellamy: Nothing to Disclose
PURPOSE

To determine the complication and diagnostic yield rates of ultrasound guided native and transplant kidney biopsies over a 5-year period.

METHOD AND MATERIALS

Retrospective analysis of 832 biopsies performed in 735 patients who underwent ultrasound guided diagnostic renal biopsies between January 2008 and October 2012 in our institution were identified and analysed from the hospital renal and pathology data bases. Chi-square and Mann Whitney test were used and significance set at <0.05.

RESULTS

A total of 832 biopsies were performed in 735 patients. 314 (38%) biopsies were performed as emergency procedures and 518 (62%) as elective. The median age of the study group was 54 years (range 10 to 90 years) and M: F ratio 57:43. The overall complication rate was 6.7% (1.3% major and 5.4% minor). The major complication rate in the emergency biopsy group was significantly higher compared to the elective group (2.5% vs 0.8%; p=0.04). Renal function was significantly worse in the major complication group (creatinine 457 umol/l vs 201umol/l, p=0.01). All 11 patients who sustained major haemorrhage received a blood transfusion and 8 underwent emergency arterial embolisation. The risk of major haemorrhage was higher in the transplant compared to native group (2.2% vs 1.0%; p= 0.25). No coagulation profile difference was noted between the major and minor complication groups. No difference was noted in the minor complication rate between the native and transplant groups. In the 30-day periprocedural period there were 2 deaths unrelated to the procedure. Overall diagnostic yield rate was 95.1%, with an average of 12.3 glomeruli in the formalin sample. In the non-diagnostic sample group (4.9%), the average number of glomeruli in the formalin sample was lower at 1.3 glomeruli. No difference was observed between the native and transplant group yield rates.

CONCLUSION

The complication rate of our cohort group compares favourably with those quoted in the published literature. The major complication rate was significantly higher in the group who underwent biopsy as an emergency procedure, in patients with significantly impaired renal function and in the transplant patient group. There were no biopsy related kidney losses or deaths.

CLINICAL RELEVANCE/APPLICATION

Ultrasound guided diagnostic renal biopsy is a safe procedure with a high diagnostic yield.

**VIS210**

Low Dose and Low Contrast Medium Volume CT Angiography of the Abdominal Aorta and Lower Extremity Vessels (Station #5)

Yue Dong (Presenter): Nothing to Disclose, Yijun Liu: Nothing to Disclose, Ruxin Wang: Nothing to Disclose, Lifei Sun ARRT, MBBS: Nothing to Disclose, Renwang Pu MBBCh, FRCPCH: Nothing to Disclose, Liang Hu: Nothing to Disclose

PURPOSE

To investigate low dose and low contrast medium volume CT angiography and to compare the image quality and diagnostic accuracy at different doses with digital subtraction angiography (DSA) in the evaluation of the abdominal aorta and lower extremity vessels.

METHOD AND MATERIALS

31 patients with a clinical diagnosis of obstructive arterial disease of the extremities underwent MDCT (GE Discovery 750HD) angiography of the aorta and peripheral vessels. Group A:21 patients, 120kVp, noise index of 7,150ml of contrast medium 350 at 5ml/s. Group B:10 patients, 80kVp, noise index of 15, 80ml of contrast medium 350 at 3ml/s followed by 40ml saline flush. Two protocols used auto mA mode and AISR 30% reconstruction. The measurement of radiation dose was based on the CTDI and DLP. Image quality was analyzed by two vascular radiologists in consensus using a three-point scale(poor, better and good). The arterial system was divided into 19 anatomical segments (from abdominal aorta to ankle arteries). Each segment was evaluated for patency by using a five point scale: 1=normal, 2=moderate disease (<50% stenosis), 3=single severe stenosis (>50% stenosis), 4=diffuse severe stenosis (>50% stenosis) and 5=complete occlusion. DSA represented the reference.

RESULTS

Mean CTDI and DLP of group B (6.8±1.7mGy, 926.26±172.21mGy•cm) were reduced by 66.7% and 62.8%, compared with group A (20.4±3.6mGy, 2489.42±362.48mGy•cm). The average overall diagnostic image quality for the 2 groups was graded as good or better. No difference in image quality was seen between group A and B(p>0.05). Group A revealed a sensitivity, specificity, accuracy, PPV and NPV of 96%, 96%, 96%, 89% and 99% in the evaluation of the presence and degree of stenosis compared to 93%, 92%, 94%, 84% and 97% for Group B.

CONCLUSION

Low dose scan with low contrast medium volume was a feasible option for the abdominal aorta and lower extremity vessels angiography. This technique provides less contrast medium and lower radiation exposure to the patient while maintaining optimal diagnostic accuracy.
For the abdominal aorta and lower extremity vessels angiography, this technique provides less contrast medium and lower radiation exposure to the patient while maintaining optimal diagnostic accuracy.

**VIS214**

**A Retrospective Evaluation of CT Radiation Dose in CT Guided Cryoablation of Renal Tumors: With and without Radiation Dose Reduction Technique**  
(Station #6)

Tze Min Wah MBChB, FRCR : Consultant, Galil Medical Ltd , Michael Min Gallagher (Presenter): Nothing to Disclose, Christopher Min Hounslow : Nothing to Disclose, Gareth Richard Iball MSC, BSC : Nothing to Disclose

**PURPOSE**

The aim of this study was to evaluate the CT radiation dose in CT guided cryoablation (CRYO) of renal tumors in a single large teaching institution and to assess the percentage reduction of radiation dose with and without a dose reduction technique in our intra-procedural CT CRYO treatment protocol.

**METHOD AND MATERIALS**

From 2008 to 2014, a total of 97 patients underwent CT guided CRYO of renal tumors and were included in this retrospective evaluation of their CT radiation dose during treatment. Amongst them were 56 patients (61 procedures; mean age, 65; 37 males and 29 females) without CT dose reduction technique and 41 patients (43 procedures; mean age, 73; 27 males and 14 females) with CT dose reduction technique. The group without CT dose reduction technique were scanned with the same parameters throughout whilst those with the dose reduction technique had sequential reduction of mAs during scanning until the interventional radiologist deemed the increased image noise had compromised the diagnostic quality of the images.

**RESULTS**

The average DLP with and without CT dose reduction technique was 6044 (+/- SD 2676) mGy-cm and 3354 (+/- SD 1308) mGy-cm. Thus the average DLP was 43.7% lower in the dose reduced group when compared to the non-dose reduced group (p<0.0001) (Figure 1). The total CTDIvol was used to estimate the patient skin dose; in the non-reduced group the maximum 'skin dose' was 1.1Gy, vs. 0.38Gy in the dose reduced group. However, there was no significant difference between the number of cryoprobes used, number of CT examination runs or total exam time between the two groups.

**CONCLUSION**

The use of a sequential mAs dose reduction strategy in our CT CRYO treatment protocol has produced significant dose reduction for patients undergoing treatment of their renal tumors. In our clinical practice, we would now advocate the use of this dose reduction strategy at all times as long as the image quality remains sufficient for the clinical purpose of the examination.

**CLINICAL RELEVANCE/APPLICATION**

It is important to use the dose reduction strategy during CT CRYO treatment of renal tumors as the radiation burden can be reduced significantly by the simple sequential mAs dose reduction approach.

**VIE206**

**The Role of Adrenal Venous Sampling in Primary Hyperaldosteronism**  
(Station #7)

Carmen Zevallos Maldonado (Presenter): Nothing to Disclose, Jose Garcia-Medina MD : Nothing to Disclose, Carmen Aleman : Nothing to Disclose, Maria Carmen Alcantara MD : Nothing to Disclose, Placida Aleman : Nothing to Disclose, VICENTE GARCIA : Nothing to Disclose

**TEACHING POINTS**

To describe how is performed the adrenal venous sampling in our service, and its role in the etiological diagnosis of Primary Hyperaldosteronism.

**TABLE OF CONTENTS/OUTLINE**

-Primary Hyperaldosteronism: Clinical tests, screening, biochemical tests, etiological diagnosis and treatment.  
-Aldosterone-producing adenoma and bilateral adrenal hyperplasia: Images using computerized tomography and magnetic resonance.  
-Anatomy of the suprarrenal veins and the angiographic patterns of the adrenal veins.  
-Technique of adrenal venous sampling used in our service.  
-Interpretation of the results and complications involved in adrenal venous sampling.  
-Cases in our service.

**VIE007-b**

**Current State of Aortic Dissection Classification and Management**  
(hardcopy backboard)


**TEACHING POINTS**

1. To highlight key anatomic findings of aortic dissection on CT Angiography and detection of fenestrations, now assuming increasing relevance with the rising role of endovascular repair.  
2. To review the accepted classification systems of aortic dissection demonstrated on CT Angiography as well as newly proposed systems of evaluating thoracic aortic dissection.
TABLE OF CONTENTS/OUTLINE
1. Purpose: Emphasize important points of current models for assessment of aortic dissection. 2. Background:
a. Thoracic Aortic Dissection statistics. b. Accepted classification systems i. current limitations (loopholes) c. Review newly proposed criteria 3. Example cases displaying important points from new and old criteria and common misreads based on loopholes in current classifications systems which have potential medicolegal ramifications a. Primary entry tear sites as well as extent and directional propagation of dissection i. several appearances of true lumens  b. Status of the false lumen and extent and location of fenestrations c. Branch vessel involvement i. static ii. dynamic 4. Potential complications of new management approaches that may be related to endovascular management approaches. 5. Conclusion

Hologic: Essentials of 3D Mammography Self-Guided Training

Vendor Workshops
Sun, Nov 30 12:45 PM - 2:45 PM  Location: Booth 1465

LEARNING OBJECTIVES
Hologic is offering a series of ongoing sessions to allow radiologists to participate in an online Hologic 3D Mammography interactive virtual training. Each session takes approximately 2 hours to complete, therefore the last session will commence no later than 3:00 p.m. each day. Participants will be provided a workstation with headphones to enhance their learning experience. The sessions will include a lecture by a leading breast radiologist and an interactive case review module. The sessions are intended for radiologists interested in learning more about 3D mammography for screening and diagnosis. Please note the program will provide a certificate of completion that may be used towards the FDA mandated training for tomosynthesis. The course is not accredited for CME. Please visit <a href="http://www.hologic.com/RSNAtomo-courses" target='_blank'>www.hologic.com/RSNAtomo-courses</a> to register for this Vendor Workshop.

BRS-SUB
Breast Sunday Poster Discussions

Scientific Posters

BR
AMA PRA Category 1 Credits ™ : .50
Sun, Nov 30 1:00 PM - 1:30 PM  Location: BR Community, Learning Center

Sub-Events
BRS241

Lesion Stiffness Measured by Shear-wave Elastography: Preoperative Predictor of the Histologic Underestimation of US-guided Core Needle Breast Biopsy (Station #1)

Ah Young Park MD : Nothing to Disclose, Ji Hyun Youk MD : Nothing to Disclose, Eun Ju Son MD, PhD : Nothing to Disclose, Hye Mi Gweon MD : Nothing to Disclose, Jeong-Ah Kim MD, PhD : Nothing to Disclose, Dahye Lee (Presenter): Nothing to Disclose

PURPOSE
To determine whether lesion stiffness measured by shear-wave elastography (SWE) could be used to predict the histologic underestimation of ultrasound (US)-guided 14-gauge core needle biopsy (CNB) for breast masses.

METHOD AND MATERIALS
This retrospective study enrolled a total of 99 breast masses including 40 high-risk lesions and 59 DCIS which were diagnosed at US-guided CNB and excised surgically. SWE was performed for all breast masses to measure quantitative elasticity values. To identify the preoperative factors associated with the histologic underestimation, patient age, symptom, lesion size, B-mode US findings, and quantitative SWE parameters were compared between the upgrade group and the non-upgrade group and estimated the predictive power for underestimation of each variable using univariate and multivariate logistic regression.

RESULTS
The overall underestimation rate was 28.3% (28/99) and the underestimation rate of high-risk lesion (ADH, phyllodes tumor and other atypia) and DCIS was 25.0% (57.1%, 16.7%, and 20.0%) and 30.5%, respectively. Lesion size was larger (16.0 vs 10.0 mm, p=.016) and BI-RADS category was higher (p=.030) in the upgrade group than in non-upgraded group. The medians of all elasticity values of the upgrade group were significantly higher than those of the non-upgrade group: mean (Emean), 133.1 vs 57.4 kPa; maximum, 151.1 vs 66.6 kPa, minimum, 103.1 vs 43.6 kPa; the lesion-to-fat ratio, 7.8 vs 4.6. In subgroup analysis, high-risk lesions which were upgraded to malignancy showed higher Emean than the non-upgrade lesions (ADH, p=.077; phyllodes tumors, p=.028; other atypia, p=.030) and as did DCIS upgraded to invasive cancer (p<.0001). In multivariate analysis, Emean was an independent predictor for underestimation of malignancy (odds ratio, 1.022; p<.0001).

CONCLUSION
Breast lesion stiffness quantitatively measured by SWE could be helpful to predict the underestimation of malignancy in US-guided CNB.
**BRS242**

**Imaging and Histopathologic Features of BIRADS 3 Lesions Upgraded During Imaging Surveillance (Station #2)**

Aya Michaels MD (Presenter): Nothing to Disclose, Catherine Streeto Giess MD: Nothing to Disclose, Chris Sungwon Chung MD: Nothing to Disclose, Elisabeth P. Frost MD: Nothing to Disclose, Robyn L. Birdwell MD: Nothing to Disclose

**PURPOSE**

To evaluate clinical or imaging differences between screen-detected benign and malignant upgraded lesions initially assessed as BIRADS 3 at diagnostic evaluation

**METHOD AND MATERIALS**

IRB approved retrospective review of the mammography database from 1/1/04-12/31/08 identified 1188 (1.07%) of 110,776 screening examinations assessed as BIRADS 3 following diagnostic evaluation at our academic center (staffed by breast specialists) or our outpatient center (staffed by general radiologists). 1017 with at least 24 months follow up or biopsy. Sixty (5.9%) BIRADS 3 lesions were upgraded to BIRADS 4 or 5 during imaging surveillance (the study population). Prospective reports, patient demographics, and clinical outcomes were abstracted from the longitudinal medical record.

**RESULTS**

Mean patient age was 54.1 years (range 35-85). Lesions consisted of 7 masses, 12 focal asymmetries (FAD), and 41 calcifications. Fifteen (25%) of 60 lesions upgraded from initial BIRADS 3 assessment were malignant (1.47% of total; 15/1017 BIRADS 3 examinations). Breast imaging specialists interpreted 21 of 60 upgraded lesions, with 3 (14.3%) malignancies, compared to general radiologists who interpreted 39 of 60 upgrades, with 12 (30.8%) malignancies (p=0.160). Twelve (26.7%) of 45 benign upgraded lesions were masses or FADS, and 7 (46.7%) of 15 upgraded malignant lesions were masses or FADS (p=0.149). Six of 7 malignant upgraded masses/FADS had negative US at time of initial BIRADS 3 assignment. At initial assessment, prospective reports described features appropriate for BIRADS 3 classification in only 30/60 (50%). Mammographic development or change was reported in 18/60 (30%), increased prominence in 20/60 (33.3%) and stability in 1/60 (1.7%); change was not reported in 17/60 (28.3%), and 4/60 (6.7%) had no prior studies.

**CONCLUSION**

Most mammographic lesions upgraded from probably benign to suspicious had shown change or increased conspicuity at the time of initial BIRADS 3 assessment. Non breast imaging specialists had a higher malignancy rate among upgraded lesions compared to specialists. Masses and focal asymmetries represented a higher proportion of malignant than benign upgrades, and usually had no US correlate.

**CLINICAL RELEVANCE/APPLICATION**

Malignant masses and focal asymmetries mis-characterized as probably benign usually had no US correlate. Careful utilization of BIRADS terminology will improve appropriate characterization.

**BRS243**

**Positive Predictive Value of Biopsy of Palpable Masses on the Mastectomy Side in Reconstructed and Non-reconstructed Breasts (Station #3)**

Sandra Brennan MBBCh, MSc (Presenter): Nothing to Disclose, Donna Danielle D'Alessio MD: Nothing to Disclose, Jennifer Brisman Kaplan MD: Nothing to Disclose, Marcia Edelweiss MD: Nothing to Disclose, Alexandra Heerdt: Nothing to Disclose, Elizabeth A. Morris MD: Nothing to Disclose

**PURPOSE**

To determine the positive predictive value (PPV) of biopsy of palpable masses on the mastectomy (MX) side and to determine if there are patient or imaging features predictive of cancer.

**METHOD AND MATERIALS**

Following IRB approval, we performed a HIPPA-compliant retrospective review of 3,286 breast ultrasounds (US) performed from June 2008 to January 2013 to identify patients with MX presenting with palpable masses on the MX side. We included reconstructed and non-reconstructed breasts and both prophylactic and therapeutic MX. Medical records and imaging studies were reviewed. Statistical analysis was performed with Fisher’s exact test. 95% confidence intervals (CI) were calculated.

**RESULTS**

69 patients with MX had targeted US of palpable masses. Age 25-82, mean 52 years. 43/69 (62%) underwent biopsy. 26/69 (38%) had follow-up and no biopsy; range of follow-up was 4-71, mean 21 months. 53/69 patients had a mass on US. 16/69 had no mass and the palpable was related to the implant in 7, clip/suture in 4, rib 1 and 4 had no finding on US. 12/43 (28%, 95% CI; 17-43) who underwent biopsy had cancer (age 35-68, mean 49 years), 31/43 (72%) were benign. All 12 cancers were on the original cancer side not the prophylactic MX side. 5/12 (42%) had received prior radiation and 6/12 (50%) hormonal therapy. Recurrences...
ranged from 0.6 to 4.5 cm maximum diameter, mean 1.6cm. Neither patient age (p=1.0), hormonal (p=0.14) or radiation therapy (p=0.7) had a statistically significant association with finding cancer on biopsy. Lesion shape (irregular versus oval/round) was very statistically significant (p=0.003) as was non-parallel orientation on US (P=0.01). Circumscribed versus non-circumscribed margins was not quite statistically significant (p=0.08). Lesion size and presence of shadowing were not statistically significant (p=1.0). No cancers were found on follow-up.

CONCLUSION

The PPV of biopsy of palpable masses on the MX side in our study was 28% (95% CI; 17-43). Neither patient age, prior history of radiation or hormonal therapy had a statistically significant association with positive biopsy. All recurrences were on the original cancer side. An irregular shape and anti-parallel orientation on US were significantly associated with cancer.

CLINICAL RELEVANCE/APPLICATION

The PPV of biopsy of palpable masses on the MX side is high at 28% with irregular shape and anti-parallel orientation on US significantly associated with cancer.

BRS244

Outcomes of Probably Benign Lesions Detected on Screening Ultrasound in Women with Average and High Risk: Are We Recommending Unnecessary Follow Up Exams? (Station #4)

Kristin Elias MD : Nothing to Disclose, Islamiat O. Ego-Osuala MD (Presenter): Nothing to Disclose, Sara Daniel Shaylor MD : Nothing to Disclose, Marissa Lauren Albert MD, MSc : Nothing to Disclose, Hildegard B. Toth MD : Nothing to Disclose, Linda Moy MD : Nothing to Disclose

PURPOSE

The purpose of this study is to evaluate the prevalence and rate of malignancy of BI-RADS category 3 lesions detected on screening ultrasound in average and high risk patients.

METHOD AND MATERIALS

IRB approved retrospective review of consecutive technologist performed, hand-held screening ultrasound from 1/11 to 12/12 was performed. Patient characteristics, outcome, mammography results, and follow up of all BI-RADS 3 cases were recorded and evaluated.

RESULTS

116/1937 screening US (6%) performed over a consecutive two year period were interpreted as BI-RADS category 3 with a total of 201 probably benign lesions. 53% of women had no known risk factors for breast cancer. 50% of the women were premenopausal and 78% had mammographically dense breasts. Mammography was performed within 1 month in 84.5% of the cases. 108/116 (93%) US exams with 190 probably benign lesions had mean follow up of 15.7 months, range 5-36 months. On follow up, 141/190 (74.2%) lesions were downgraded to benign due to decrease in size, more definitive benign features, or stability over two years. 43/190 (22.6%) lesions remained stable and probably benign. Biopsy was performed of 6 (3.2%) lesions that demonstrated interval growth or suspicious change. One biopsy was performed due to patient preference. All 7 biopsies were benign with results including cysts, fibrocystic change, or fibroadenoma. Two subsequent malignancies were detected in the contralateral breast on follow up within one year. The index lesions assessed as probably benign remained stable. Of the 108 cases with follow up no BI-RADS 3 lesions were found to be malignant.

CONCLUSION

In this study where 53% of women were average risk no subsequent cancers were detected in lesions assessed as probably benign on screening ultrasound.

CLINICAL RELEVANCE/APPLICATION

It is possible that with careful assessment some lesions may be interpreted as benign rather than probably benign in order to decrease unnecessary follow up exams without missing a malignancy, especially in an average risk population.

BRE157

You will See it When you Know it: Clustered Ring Enhancement, a New Breast MRI BI-RADS Descriptor for Internal Enhancement Pattern of Non-mass Enhancement (Station #5)

Youichi Machida MD, PhD (Presenter): Nothing to Disclose, Mitsuhiro Tozaki MD, PhD : Nothing to Disclose, Akiko Shimauchi MD : Nothing to Disclose, Tamiko Yoshida : Nothing to Disclose, Yoshihide Kanemaki : Nothing to Disclose

TEACHING POINTS

1. Clustered ring enhancement (CRE) becomes more distinct on delayed phase of dynamic contrast MRI following either a heterogeneous or clumped internal enhancement pattern on early phase. 3. When a non-mass enhancement (NME) bears both CRE internal pattern and segmental enhancement, the lesion is highly predictive of malignancy. 4. While focal and regional distributions are descriptors of intermediate supicion, NMEs with such distributions are indicative of malignancy when CRE is observed, especially in combination with clumped internal pattern.
TABLE OF CONTENTS/OUTLINE

CRE has reported to be high predictive of malignancy. Although this descriptor will be more widely used after the revision of BI-RADS, employing it without knowledge of its definition or characteristics can lead to misinterpretation and undesirable outcomes. Radiologists engaged in breast imaging will be able to promote a better understanding of CRE through the following contents; 1. Reviewing the definition of CRE: how can we detect it? 2. Corresponding pathological findings and assumed pathophysiology. 3. Examples of CRE: assessment in combination with distributions.

BRE208

Rare Breast Lesions: Correlation with Radiologic Imaging, Pathology, and Clinical Management (Station #6)


TEACHING POINTS

The purpose of this exhibit is to illustrate the varying rare entities occurring in the breast and to give a pictorial multimodality essay of these entities. Additionally, pathologic correlation and clinical management will be discussed.

TABLE OF CONTENTS/OUTLINE

There are multiple uncommon lesions of the breast that are encountered after biopsy. Characteristics of these rare entities will be discussed in a multimodality approach along with pathologic correlation and clinical management. Cases that will be included are entities such as sarcoid, lymphoma, angiosarcoma, phyllodes tumor, pseudoangiomatous stromal hyperplasia, granular cell tumor, tubular adenoma, granulomatous inflammation, diabetc mastopathy, lipoma, and metastases.

BRE219

A New Era in Axillary Management in Early Breast Cancer: The Gold Star is Ultrasound (Station #7)

Karina Pesce: Nothing to Disclose, Flavia Beatriz Sarquis MD (Presenter): Nothing to Disclose, Bernardo Oscar Blejman MD: Nothing to Disclose, Carlos Mariano Lamattina MD: Nothing to Disclose, Fabiana Gisela Vega MD: Nothing to Disclose

TEACHING POINTS

To analyze the history evolution of the management of the axilla in early breast cancer. To discuss the diagnostic value of pre-surgery axillary ultrasound for nodal staging in patients with early breast cancer. To define a sonographically normal anatomy and normal appearing axillary lymph node. To describe the spectrum of sonographic findings in axillary pathologic lymphadenopathy. To discuss false positive and negative value of axillary US.

TABLE OF CONTENTS/OUTLINE

1-Introduction 2-History evolution of the management of the axilla in early breast cancer 3-Ultrasound anatomy of the axilla and normal sonographic appearance of a lymph node 4-Differentiation of malignant vs. benign axillary nodes with imaging and pathological correlation will be illustrated 5-Limits, false positive and negatives of the axillary ultrasound 6-Role of the detection of axillary nodes in the staging of early breast cancer will be discussed 7- Conclusion

BRE168

Three Heads Are Better than One: Unique and Complementary Strengths of Mammography, Ultrasound and MRI in Achieving Optimal Evaluation of Breast Lesions (Station #8)

Morlie Ling Wang MD, MPH (Presenter): Nothing to Disclose, Marleine Tremblay MD, MSc: Nothing to Disclose, Raffat Tahirah Ahmad MD: Nothing to Disclose, Hiroyuki Abe MD: Consultant, Seno Medical Instruments, Inc

TEACHING POINTS


TABLE OF CONTENTS/OUTLINE

1. The imaging lexicon and highlights from the 2013 5th Edition of the ACR BI-RADS Atlas are central to the proficient practice of breast imaging. 2. Each modality provides unique and complementary information and has potential pitfalls.

BRE187

How I Do It: The Diagnostic Breast Evaluation (Station #9)

Rebecca Rakow-Penner MD, PhD (Presenter): Nothing to Disclose, Jade De Guzman MD: Nothing to Disclose, Ifeanyi C. Onyeacholem MD: Nothing to Disclose, Haydee Ojeda-Fournier MD: Nothing to Disclose
TEACHING POINTS

After reviewing this exhibit the learner will 1. Review an algorithmic approach for callbacks from screening evaluation and for patients presenting with clinical symptoms; 2. Understand the rationale for specific imaging protocols for callbacks; 3. Present special considerations for unique situations including post-surgical, pregnant and nursing patient; 4. Discuss common pitfalls in the diagnostic workup; 5. Have an opportunity for self-assessment with imaging case review in multiple choice format.

TABLE OF CONTENTS/OUTLINE

The approach to the diagnostic exam in breast imaging continues to be a source of much confusion due to lack of standardization and differences in approach that may be present even in an individual practice. The methodology and rationale for performing certain mammographic views in various situations and when and where to perform breast US is not well understood, especially in light of recent controversies. This educational exhibit will contain: Introduction; Rational and motivation for standardizing protocols; Algorithmic approach for clinical symptoms; Algorithmic approach for callback from screening mammogram; Special considerations including protocols for the post surgical breast, nursing or pregnant patient, others; Outline common pitfalls in the diagnostic evaluation; Conclusion; Test yourself

### Feasibility of Free-Breathing, GRAPPA-Based, Real-Time Cardiac Cine Assessment of Left-ventricular Function in Cardiovascular Patients at 3T (Station #1)

Zhu Xiaomei: Nothing to Disclose, Felix Schwab PhD: Nothing to Disclose, Daniel Theisen MD: Nothing to Disclose, Konstantin Nikolaou MD: Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG, Fabian Bamberg MD, MPH (Presenter): Siemens AG Research Grant, Bayer AG Research Grant, Siemens AG

#### PURPOSE

To determine the feasibility of free-breathing, GRAPPA based, real-time (RT) cine 3T cardiac magnetic resonance imaging (MRI) for the assessment of left-ventricular function in a cohort of patients with various cardiac conditions as compared to conventional segmented cine imaging.

#### METHOD AND MATERIALS

In this prospective cohort study, subjects with cardiac conditions underwent both two RT cine sequences (high resolution [Tres: 48.8 ms, voxel: 1.9×3.1×10 mm3, R=5] and low resolution [Tres: 51.3 ms, voxel: 2.5×5.0×10 mm3, R=3]) and standard segmented cine imaging (Tres: 31.8 ms, voxel: 1.6×1.6×10 mm3, R=2) using a 3T system. Standard qualitative and quantitative parameters of left-ventricular function, including end-diastolic and end-systolic volume (EDV and ESV), stroke volume, ejection fraction, myocardial mass (MM), and wall thickness were quantified by two independent, blinded investigators. Univariate and multivariate comparisons were performed in order to identify differences and associations with patient-related factors.

#### RESULTS

Among 25 subjects, 24 were included in the analysis (mean age: 50.5, 67% male, 25% with cardiomyopathy). For both RT cine sequences, agreement with the segmented cine imaging with respect to detection of regional wall motion abnormality was very good (κ=0.71 and κ=0.73 for high and low resolution; respectively). RT cine derived quantitative parameters of volumes and MM were strongly correlated with segmented cine imaging (ICC: >0.72 and ICC: >0.80 for high and low resolution RT cine; respectively) but correlation for peak ejection and filling rates were moderate to poor for high (ICC: 0.33 and 0.23; respectively) and low resolution RT cines (ICC: 0.40 and 0.33; respectively). Similarly, RT cines significantly underestimated peak ejection and filling rates (>103.2±178 ml/s) while observed differences were relatively low for volumes, MM and wall thickness when compared with segmented cines. Among patient factors, heart rate was strongly predictive for deviation of measurements (p<0.05).

#### CONCLUSION

Both RT cine sequences at 3T are feasible for qualitative and quantitative assessment of left ventricular function but results in significant underestimation of peak ejection and filling rates.

#### CLINICAL RELEVANCE/APPLICATION

RT GRAPPA-based cine imaging at 3T can be used in clinical patients for assessment of left ventricular function but results in significant underestimation of peak ejection and filling rates.
Clinical Utility of Prospective ECG Triggered Absolute Fixed Delay in Atrial Fibrillation Patients in the Assessment of Cardiac Structures and Coronary Anatomy (Station #2)

Shamir  Rai  BSC (Presenter):  Nothing to Disclose  ,  Chesnal  Dey  Arepalli  MD :  Nothing to Disclose  ,  Patrick McLaughlin  FFR(RCSI) :  Nothing to Disclose  ,  Savvas Nicolaou  MD :  Nothing to Disclose

PURPOSE

Detailed anatomic imaging of the cardiac structures is challenging in atrial fibrillation (AF) patients. Computerized tomography (CT) prospective ECG triggered absolute delay based on fixed time interval from R wave are least subjected to mis-registration and motion artifacts. A new absolute prospective ECG triggered Atrial fibrillation (AFb) algorithm with a fixed delay of 250 ms after the R wave was developed at our institute. The purpose of our study was to assess diagnostic quality of cardiac (coronary and non-coronary) and extra cardiac structures utilizing AFb algorithm.

METHOD AND MATERIALS

15 consecutive atrial fibrillation patients who had AFb algorithm prior to their LAA ablation procedure were identified retrospectively. Images were acquired on a second generation dual source 128 slice scanner with 110 ml of Omnipaque 350. Cardiac structures evaluation included the four chambers, mitral and aortic valves; coronary arteries (CA) and extra cardiac structures included pulmonary veins, lung parenchyma and fissures and thoracic aorta. CA evaluation was based on 17-segment model as defined by American Heart Association. Each anatomic structure was graded for image quality by two blinded independent radiologists (1, non-diagnostic; 2, decreased image quality, unlikely to be diagnostic; 3, decreased image quality with potential to be diagnostic; 4, decreased image quality but diagnostic; 5, diagnostic study).

RESULTS

The mean heart rate (HR) for the studies analyzed was 70 ± 19; maximum HR was 94 ± 41. Both reader 1 and reader 2 had an excellent interobserver agreement with a median score of 5 ± 0 and 5 ± 1 for cardiac structures and median scores of 5 ± 0 for non-cardiac structures.

CONCLUSION

AFb algorithm based on prospective ECG triggered absolute delay method at 250 ms from R wave assess the essential anatomical cardiac structures relevant to AF ablative procedure. Further, diagnostic quality coronary arteries assessment is also feasible with the AFb algorithm.

CLINICAL RELEVANCE/APPLICATION

In atrial fibrillation patients, optimized prospective ECG triggered absolute delay protocol can simultaneously evaluate cardiac structures including coronary arteries. This algorithm has the potential to replace the prospective ECG gated diastolic phase study that is utilized to assess the coronary arteries.

Infarct Size by Cardiovascular Magnetic Resonance with Technical Delay Enhancement as Factor Prognostic in the Coronary Artery Disease (Station #3)

Cielmar  Galeana  PhD (Presenter):  Nothing to Disclose  ,  Jhonatan  Alejandro  Vargas  MMed :  Nothing to Disclose  ,  Oskar  Giovanni  Lopez Espinoza  MD :  Nothing to Disclose  ,  Jorge  Vazquez-Lamadrid  MD :  Nothing to Disclose  ,  Martha  Morelos Guzman :  Nothing to Disclose

PURPOSE: To determine whether infarct size measured by DE-CMR has predicted involvement in patients with ischemic heart disease.

METHOD AND MATERIALS

METHODS: Retrospective study of sixty eight patients who underwent cardiovascular magnetic resonance between September 2004 to September 2008 referrals to suspicion or knowledge of ischemic heart disease. CMR imaging was performed using GE 1.5 T system. Steady state free precession (SSFP) cine MR images were acquired in long axis and short axis orientation. delayed enhancement imaging was performed in the same slice locations using a segmented inversion recovery fast gradient echo sequence. Images were acquired 2-3 minutes to evaluation of the phenomenon non reflow and 10 minutes to assessment of myocardial viability after administration of 0.2 mmol/kg gadolinium contrast. Assessment is made of functional parameters including end diastolic volume (VDF), end systolic volume (ESV), left ventricle ejection fraction ( LVEF) and systolic volume (SV) indexed a body surface area (BSA) presence of fibrosis, their quantification, localization and transmurality.

RESULTS

The average age of the study population was 65.6 years, 12% were in functional class III-IV NYHA, the mortality rate was 16.1%. the 39.7% of the segments presented delay enhancement. The percentage of infarction was significantly higher (21.6% vs. 14.4%) between survivors and the dead (p=0.01). The mayor adverse cardiac events (MACE) were presented in 90% of the group of death compared with 26% de living patients (p=0.001) in relations to survival curve that this declined by a more accelerated during the first week after the ischemic events, and 10 weeks after is slower, with a survival rate de 84% a year since the 2 ½ years of 77% the correlations between infarct size and telesistólico and diastolic volume left ventricle and left ventricle ejection fraction (LVEF) were statistically significant with a P=<0.001

CONCLUSION

Conclussion: Infarct size measured by delayed enhanced cardiovascular magnetic resonance (DE-CMR) has predicted involvement in patients with ischemic heart disease.
**CLINICAL RELEVANCE/APPLICATION**

Infarct size is related with the incidence of new cardiovascular events. Our hypothesis is that the bigger the size of the infarct, the outcome of the patient worsens.

**CAS180**

**Analysis of FFRCT and Blood Flow using CFD Software (Station #4)**

Masashi Takahashi RT (Presenter): Nothing to Disclose, Naohiro Yamagami: Nothing to Disclose, Satoshi Inada: Nothing to Disclose, Yue Dong: Nothing to Disclose, Hironori Ueda: Nothing to Disclose, Yoshio Monzen MD: Nothing to Disclose

**PURPOSE**

Fractional flow reserve (FFR) is a standard method, which give us physiological information about coronary artery disease with invasive methods. On the other hand, a new technology fractional flow reserve computer tomography (FFRCT) by using coronary CT angiography (CTA) can provide FFR without invasive methods. The accuracy, reliability, and feasibility for clinical application of FFR are evaluated in this study.

**METHOD AND MATERIALS**

Eight phantom models made of ABS resins with different ratio of stenosis underwent CT scan. And the three-dimensional datasets of phantoms obtained by CT scan were generated, and were analyzed by the CFD Software. The threshold for VR model was calculated by FWHM of CT value generated from profile curve on 2D image. On the liquid flowing phantom models, we compared FFRCT value from CFD software and actual measured value calculated by Pressure-Wire, in order to evaluate the accuracy of FFRCT value. Moreover, we examined hemodynamic by using Velocity, Pressure and WSS (stands for Wall shear stress, and relative to vascular events) generated by CFD analysis.

**RESULTS**

In FFR and FFRCT, an approximately equal value was provided. WSS and pressure decreased with the same rate range on the tandem lesion model which possessed two same stenosis. However, on the tandem lesion model with proximal severe stenosis, the influence of distal stenosis for whole tube WSS was small. FFR calculated from pressure wire can only evaluate the change of Pressure, however CFD analysis can observe and visualize Pressure, WSS, and Velocity.

**CONCLUSION**

FFRCT by CFD analysis is useful and it could be a standard evaluation tool for optimal PCI. The information of Pressure, WSS and Velocity could assess the hemodynamics of coronary artery and were useful to build a strategy for optimal PCI on complex lesions. Moreover, the FFRCT could predict the prognosis of coronary artery disease and be a non-invasive follow up tool after PCI.

**CLINICAL RELEVANCE/APPLICATION**

FFRCT by CFD will be useful application for coronary cardiac diagnosis.

**CAS181**

**ECG-gated aortic CT using High-pitch and Iterative Reconstruction: Dose and Image Quality—Can Coronary Arteries be Simultaneously Assessed? (Station #5)**

Anne-Lise Hachulla MD (Presenter): Nothing to Disclose, Jean-Paul Marcel Vallee MD: Nothing to Disclose, Xavier Montet: Nothing to Disclose, Stephane Noble: Nothing to Disclose, Dominique Didier MD: Nothing to Disclose

**PURPOSE**

To study dose length-products (DLP), image quality and contrast-to-noise ratio (CNR) of thoracic and abdominal gated aortic CT obtained with a high-pitch CT imaging protocol using sinogram-affirmed iterative reconstruction (SAFIRE®) or filtered back projection (FBP) algorithms.

**METHOD AND MATERIALS**

Eighty-four patients underwent gated aortic CT without B-blockers on a Somatom Definition Flash CT scanner for aortic disease with Flash protocol using a pitch of 3.2 with both SAFIRE® and FBP reconstruction algorithms. CNR between vessels and myocardium were calculated on the aorta and the coronary arteries. Two blinded readers graded subjective image quality of the aorta and the coronary arteries on a 3-point scale. Coronary artery stenoses were recorded and compared with coronaryography in 24 patients. Kappa values were also calculated.

**RESULTS**

High-pitch acquisition protocol resulted in a DLP of 234 ±93 mGy.cm(4.2 mSv) for an acquisition of the entire aorta, with a mean heartbeat of 73 ±16 beats per minute. CNR (ascending aorta vs myocardium) was 7.3 ±2.8 and 10.6 ±4 for FBP and SAFIRE® algorithms respectively (p

**CONCLUSION**

ECG-gated aortic CT using high-pitch and iterative reconstruction allows for a simultaneous assessment of coronary arteries with lower dose and improved image quality.
ECG-gated aortic CT with high-pitch acquisition reconstructed with SAFIRE® allows better CNR than with FBP alone. Despite the lack of B-blockers, proximal and mid-segments of the coronary arteries could be evaluated in the same acquisition.

**CLINICAL RELEVANCE/APPLICATION**

ECG-gated aortic CT with high-pitch acquisition has the potential to reduce radiation exposure as well as to analyze the whole aorta and the coronary arteries in a single acquisition.

**CAE122**

**"Terrible Ts": Five Cyanotic Congenital Heart Lesions That Every Radiologist Should Know (Station #6)**


**TEACHING POINTS**

To describe the five cyanotic congenital heart lesions also known as the "Terrible Ts." Tetralogy of Fallot (TOF), Transposition of the Great Arteries (TGA), Tricuspid Atresia (TA), Total Anomalous Venous Return (TAPVR), Truncus Arteriosus. To illustrate the main imaging findings for each of the "Terrible Ts." (MDCT and MRI) For diagnosis Presurgical evaluation Postsurgical evaluation 3. To describe the protocol of acquisition and technique (MDCT and MRI) in pediatric population

**TABLE OF CONTENTS/OPTLINE**

Pathophysiology of cyanotic heart disease Description of each of the five diseases Tetralogy of Fallot (TOF), Transposition of the Great Arteries (TGA), Tricuspid Atresia (TA), Total Anomalous Venous Return (TAPVR), Truncus Arteriosus. Review of the main diagnostic criteria for each of the 5 pathologies by: MDCT and MRI 4. Review of the imaging findings in temporary/palliative surgery and complete intracardiac repair by: MDCT and MRI. To describe the protocol of acquisition and technique in pediatric population (MDCT and MRI)

**CAE129**

**Amyloidosis: Within the Heart and beyond (Station #7)**

Sadia Choudhery MD (Presenter): Nothing to Disclose, Rajaa Mohammed Almestady MD: Nothing to Disclose, Hythem Adnan Omar MD: Nothing to Disclose, Yasseen M. Butt: Nothing to Disclose, Suhny Abbara MD: Research Consultant, Radiology Consulting Group, Nagina Malguria MBBS: Nothing to Disclose

**TEACHING POINTS**

The objectives are to:
1) Review primary and secondary forms of cardiac amyloidosis and their pathophysiology.
2) Present spectrum of findings on multimodality imaging of amyloidosis and provide pathology correlation.
3) Discuss clinical management and role of imaging in amyloidosis.

**TABLE OF CONTENTS/OPTLINE**

1. Amyloidosis: Definition and types: Primary, secondary and localized. 2. Pathophysiology of amyloidosis and relevance to imaging manifestations. 3. Review of characteristic imaging and pathology features of amyloidosis in the heart and other organ systems; • Cardiac: Diffuse subendocardial enhancement, patchy myocardial enhancement, atrial enhancement, enhancement on both sides of the ventricular septum, early washin and washout of contrast on MRI. Inversion time(TI) of myocardium shorter than or equal to that of blood pool. • Extracardiac: Tracheobronchial: Diffuse thickening, nodules, Lungs: Interstitial disease, nodules. Brain: Cerebral amyloid angiopathy, lobar hemorrhages. Head and Neck: Calcified or noncalcified nodules, low intensity nodules on MRI, perineural enhancement. Renal: Large echogenic kidneys on ultrasound. Musculoskeletal system: Osseous erosions with low to intermediate TI/T2 soft tissue and intra-articular deposits with variable enhancement. 4. Role of imaging and significance of accurate diagnosis in treatment options.

**CAE105**

**MR Imaging of ST-segment Elevation Myocardial Infarction (STEMI) Patients (Station #8)**

Zaihleen Shariff Keller MD (Presenter): Nothing to Disclose, Cameron Hassani MD: Nothing to Disclose, Alison Wilcox MD: Speaker, Toshiba Corporation, Christopher Lee MD: Nothing to Disclose, Farhood Saremi MD: Nothing to Disclose

**TEACHING POINTS**

• To learn how to protocol patients with post STEMI revascularization • To learn how to correlate MR findings with cath-based prognostic parameters • To correctly interpret MR findings in initial and follow up examinations and exclude potential diagnostic pitfalls

**TABLE OF CONTENTS/OPTLINE**

• Definition and classifications of patients with acute coronary syndrome • Cardiac damage analysis and indications of MRI in STEMI • MR protocol and specific sequences • Diagnosis of myocardial at risk in reperfused myocardium and its prognostic significance: T2WI and DWI, and controversies • MR assessment of reperfusion injury, T2*-weighted mapping T1 mapping: micovascular obstruction, hemorrhage and their prognostic value: • MR changes in follow up cases • Imaging pitfalls, artifacts and remedies • Role of MR in comparison with CT, echo, and invasive catheterization
Pulmonary Nodule Volume in Ultra-low-dose CT with Sinogram-affirmed Iterative Reconstruction (Station #1)

Wei Song MD : Nothing to Disclose, Xin Sui MD (Presenter): Nothing to Disclose, Zhengyu Jin : Nothing to Disclose, Huadan Xue MD : Nothing to Disclose

PURPOSE

The objective was to compare the nodule volumes measured in low-dose CT (LDCT) with filtered back projection (FBP) versus ultra-low-dose CT (ULDCT) with sinogram-affirmed iterative reconstruction (SAFIRE).

METHOD AND MATERIALS

Forty-two patients (mean [SD] age, 53.1[8.9] years) were enrolled in this study. Clinical indications for chest CT included a follow-up study of primary or metastatic lung malignancy, a solitary pulmonary nodule on the radiograph. Clinical diagnoses were lung cancer (n=18), breast cancer (n=13), thyroid carcinoma (n=9). All the patients underwent LDCT (reference parameters 120 kV, 50 mAs) and ULDCT (reference parameters 80 kV, 5 mAs) with dual-source flash 128-slice CT system (SOMATOM Definition Flash, Siemens Healthcare, Germany). The average body mass index (BMI) of patients was 24.1(±2.6) kg/m². Radiation dose was recorded. All the CT images were reconstructed with filtered back projection (FBP) for LDCT data and with SAFIRE for ULDCT data. 101 solid nodules were identified by 2 different radiologists by a consensus panel. Automated nodule volume measurements were performed by using computer-assisted volume measurement software (Syngovia, Siemens Healthcare).

RESULTS

The mean effective doses were 0.13±0.02 mSv and 2.01±0.31 mSv for ULDCT and LDCT, respectively. There are 25 nodules (smaller than 4mm by RECIST), 68 nodules (between 4mm and 8mm by RECIST) and 8 nodules (size greater than 8mm RECIST). The volume of the identified nodules were compared between the 2 groups by use of the Wilcoxon's rank test, and no significant differences were observed (Z=-1.375, P=0.175).

CONCLUSION

In comparison with LDCT, SAFIRE of ULDCT enables significant reduction in radiation dose for lung screening, while no affecting solid nodule measurement. It is safe to convert LDCT FBP protocols to ULDCT SAFIRE for volume of solid lung nodule follow up.

CLINICAL RELEVANCE/APPLICATION

ULDCT for lung cancer screening retains potential for the lung nodule volume follow-up.
RESULTS
In total, GGND in images at 120kV-80mA with IRA was similar to that at 120kV-160mA with IRA, as area under ROC curve was 0.79±0.03 and 0.80±0.03, respectively, and higher than the other 6 images obtained at 120kV. (p<0.05) DS of GGN with the diameter of 8mm and -630 HU in CTAV was 73.5±6.0 % in images at 120kV-10mA without IRA and similar to those in the other 11 images. (p=0.157) DS of GGN with the diameter of 10mm and -800 HU in CTAV was 56.3±11.9 % in images at both 120kV-80mA and 120kV-160mA with IRA and higher than the other 4 images obtained at 120kV without IRA. (p<0.05)

CONCLUSION
CDT demonstrated sufficient GGND for less attenuated nodules with the diameter of 8mm or more even in the lowest radiation level (0.08mSv) and improved DS of GGN for more attenuated nodules with the diameter of 10mm at submilli-Sv with IRA.

CLINICAL RELEVANCE/APPLICATION
CDT has a sufficient potential to be used for detection of pure GGN and IRA synergistically boosts its ability.

CHS241
Detection of "Missed" Lung Cancers using Computer-aided Detection Systems (CAD) in CT Screening for Lung Cancer (Station #4)

Mingzhu Liang, MD (Presenter): Nothing to Disclose, Wei Tang, MD: Nothing to Disclose, Dongming Xu, MD, PhD: Nothing to Disclose, Rowena Yip, MPH: Nothing to Disclose, Artit C. Jirapatnakul, PhD: Nothing to Disclose, Yu Htwe, MD: Nothing to Disclose, David F. Yankelevitz, MD: Research Grant, AstraZeneca PLC Royalties, General Electric Company, Claudia I. Henschke, MD, PhD: Nothing to Disclose

PURPOSE
To evaluate the usefulness of CAD in detecting lung cancer in low-dose CT scans that was missed by the radiologist in earlier rounds.

METHOD AND MATERIALS
Lung cancers manifesting as a solid nodule and diagnosed in annual rounds of screening were reviewed to determine whether the cancer could be identified in the prior round of screening. All CT images were obtained at 1.25 mm slice thickness or less. Three software packages (Lung VCAR (GE healthcare), Image Checker CT (LN-1000, R2 Technology) and Syngovia(Siemens Medical Solutions)) were used to evaluate the scan when the cancer was first identified by the radiologists and the frequency with which the CAD identified the cancer was calculated. The CAD was also used to determine whether it could identify the cancer on the earlier CT scans, when it was missed by the radiologist. The false positive rate of any nodule detection by the CAD was calculated using the consensus of two radiologists.

RESULTS
50 cases of lung cancer were identified (median age of 63 years), where in retrospect the cancer could be seen but was not reported. The average diameter was 11.4 mm (SD of 10.1 mm) when the cancer was identified by the radiologist for workup. The detection rates for GE, R2, and Siemens system were 74%, 82%, and 82%, respectively. On the earlier CT scans (when missed by the radiologist), the average diameter was 4.8 mm (SD of 1.6 mm). The detection rates for each CAD were 56%, 70% and 68%, respectively. The false positive rate for any nodule was 7.4, 1.7 and 0.6 per study.

CONCLUSION
The CAD detected 56% to 70% of cancers on the earlier CT scans, all of which had been missed by the radiologists. However, the CAD missed 18% to 26% of cancers when it was identified by the radiologist. This suggests that the current CADs may be useful as a second reader in CT screening programs as the lung cancers may be identified one year earlier although the false positive rate was highly variable.

CLINICAL RELEVANCE/APPLICATION
CAD has the potential to detect the majority of cancers missed by the radiologists in earlier round of screening when the cancer is smaller and more curable.
PURPOSE

Ultra-low-dose CT protocols at the authors' institution result in a mean effective dose of 0.1 mSv, 0.2 mSv and 0.4 mSv in the chest, abdomen/thoracic spine and pelvis/lumbar spine, respectively. Similar exposure levels have been reported in the literature by McLaughlin et al. (Insights Imaging, Nov 2013) and Hanna et al. (J. Thorac. Cardiovasc. Surg., Jan 2014). We conducted a retrospective analysis of radiation exposure related to radiographic examinations of the chest, abdomen, thoracic spine, lumbar spine and pelvis in the ED of a level one trauma centre to determine the percentage of radiographs which exceeded mean exposure levels encountered at ultra-low-dose CT.

METHOD AND MATERIALS

Ethics approval was obtained. A total of 1261 radiographic examinations were included in this study (255 chest, 252 abdominal, 251 thoracic spine, 251 lumbar spine and 252 pelvic). Dose area product values (DAP, dGy•cm²) for each image were obtained for all datasets, as was the examination indication and report findings. Individual DAPs were summed for multiple views to obtain a total DAP. Mean effective dose (MED, mSv) was calculated for each examination using published DAP-MED conversion factors (PA/lateral chest 0.012 mSv/dGy•cm², AP chest 0.021 mSv/dGy•cm², abdomen 0.026 mSv/dGy•cm², thoracic spine 0.019 mSv/dGy•cm², lumbar spine 0.021 mSv/dGy•cm² and pelvis 0.029 mSv/dGy•cm²).

RESULTS

Mean and SD for the studies were: chest (0.061mSv, 0.107mSv), abdomen (1.025mSv, 1.152mSv), thoracic spine (1.124mSv, 1.045mSv), lumbar spine (1.074mSv, 1.087mSv) and pelvis (1.313mSv, 1.075mSv). MEDs for radiographs exceeded those for ultra-low-dose CT in 11% of chest, 96% of abdominal, 91% of thoracic spine, 81% of lumbar spine and 80% of pelvic examinations. Significant radiographic findings contributing to patient care were found in 32% of chest, 24% of abdominal, 22% of thoracic spine, 22% of lumbar spine and 35% of pelvic examinations.

CONCLUSION

This study demonstrates that a significant percentage of plain radiographs are performed at a greater radiation exposure than encountered in novel ultra-low-dose CT protocols, often with relatively low diagnostic yield. The context of our findings will be illustrated with clinical examples of ultra-low-dose CT images obtained in the ED at our institution.

CLINICAL RELEVANCE/APPLICATION

We believe these findings will contribute to a paradigm shift as to how we best deliver ionizing radiation in the ED in future years.

ERS204

Identifying Emergency Room Patients’ Understanding of Health Care Personnel Responsible for Interpreting their Ultrasound Imaging (Station #2)

Samer Dabbo MD (Presenter): Nothing to Disclose

PURPOSE

To determine patients' understanding of the role and educational background of professionals performing emergency ultrasound (ERUS).

METHOD AND MATERIALS

This was a prospective IRB approved study where adult patients referred for ERUS to radiology department after-hours (5pm-8am and weekends) were approached to complete a one-page questionnaire following their ultrasound examination. Questionnaire focused on the professional responsible for interpreting examinations and their educational background. A non-random sampling approach was used in recruitment of patients based on patient's condition (i.e. only medically stable patients were approached). All examinations were performed by a sonographer and some patients were reexamined by a resident or staff radiologist. All accrued patients signed a consent.

RESULTS

271 surveys were completed with 68% of respondents being female. Patients' age ranged from 18-76 years old (median 34 y.o). 76% of patients had a college degree. Patients identified the following health care providers as responsible for interpreting the images of their scan: radiologists (51%), emergency doctor (40%), family doctor (7%) and nurse (2%). Patients identified the following health care providers as most qualified for interpreting the images of their scan: radiologists (39%), emergency doctor (33%), family doctor (24%) and nurse (4%). The majority of patients (76%) recognized radiologists as medical doctors. Patient understood the role of the radiologist as the following: interpret the scan (51%), perform the scan (40%), consult to your doctor (36%) and organize the scan (22%). The majority of patients (72%) wanted to speak directly with the individual who interpreted the images of their scan. There was no statistically significant association between gender, age or education level with respect to willingness to speak directly with the individual who interpreted the images (p>0.05).

CONCLUSION

The majority of patients recognize radiologists as medical doctor who primarily responsible for interpretation of
In addition, the majority would prefer to speak directly with the individual who interprets their scan.

CLINICAL RELEVANCE/APPLICATION

Emergency room patients prefer to speak directly with individuals who interpret their ultrasound exam. The implications of this study may be to shift the paradigm towards a more visible role for radiologists.

ERS208

Role of Neuroimaging in Patients Presenting with Headache in the Emergency Room (Station #2)

Mahbubul Patwary MD (Presenter): Nothing to Disclose, Daniel Fung MD: Nothing to Disclose

PURPOSE

Each year as many as 3 million patients present to an emergency department (ED) for treatment of headache. With the rising use of imaging, neuroimaging has become an important financial and radiation safety issue. We investigated the diagnostic utility of computed tomography (CT) scans of the brain in patients with headache in order to propose a revised indication for neuroimaging in the community hospital emergency room setting.

METHOD AND MATERIALS

Electronic medical records from August 2013 to April 2014 were reviewed retrospectively from any patient who presented to the ED with a non-traumatic headache, as a primary or secondary diagnosis, who had a CT scan of the brain. Clinical stratification of headaches was not performed in order to exclude potential subjective data. Quantifiable measures including vital signs, lab values and physical exams were reviewed in order to identify potential risk factors. Outcome of this study was defined as any positive finding on neuroimaging requiring hospital admission.

RESULTS

179 patients met the inclusion criteria and only two patients (1.1%) had neuroimaging findings requiring admission. The positive cases presented with focal neurological symptoms, hypertension greater than 140/90 mmHg, and age > 60. Non-contributory variables included sex, general appearance, other vital signs, and acute phase laboratory values. Furthermore, 27 patients with a known history of migraines (15.1%) did not demonstrate any positive neuroimaging findings.

CONCLUSION

The overwhelming majority of patients who presented to the emergency department with a headache had a neuroimaging study not requiring admission. The data suggests most of these scans are unnecessary and lead to increased radiation exposure and healthcare costs. This preliminary data is part of a longitudinal study, which can potentially set guidelines for appropriate neuroimaging in the ED.

CLINICAL RELEVANCE/APPLICATION

The benefit of neuroimaging in the setting of headache may be not be justified by the radiation risk and associated healthcare cost.

ERS204

Identifying Emergency Room Patients’ Understanding of Health Care Personnel Responsible for Interpreting their Ultrasound Imaging (Station #2)

Mostafa Atri MD: Nothing to Disclose

PURPOSE

To determine patients’ understanding of the role and educational background of professionals performing emergency ultrasound (ERUS).

METHOD AND MATERIALS

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RESULTS

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CONCLUSION
The majority of patients recognize radiologists as medical doctors who primarily responsible for interpretation of the examination. In addition, the majority would prefer to speak directly with the individual who interprets their scan.

**CLINICAL RELEVANCE/APPLICATION**

Emergency room patients prefer to speak directly with individuals who interpret their ultrasound exam. The implications of this study may be to shift the paradigm towards a more visible role for radiologists.

**ERS208**

**Role of Neuroimaging in Patients Presenting with Headache in the Emergency Room (Station #2)**

**Michael T. Mantello MD : Nothing to Disclose**

**PURPOSE**

Each year as many as 3 million patients present to an emergency department (ED) for treatment of headache. With the rising use of imaging, neuroimaging has become an important financial and radiation safety issue. We investigated the diagnostic utility of computed tomography (CT) scans of the brain in patients with headache in order to propose a revised indication for neuroimaging in the community hospital emergency room setting.

**METHOD AND MATERIALS**

Electronic medical records from August 2013 to April 2014 were reviewed retrospectively from any patient who presented to the ED with a non-traumatic headache, as a primary or secondary diagnosis, who had a CT scan of the brain. Clinical stratification of headaches was not performed in order to exclude potential subjective data. Quantifiable measures including vital signs, lab values and physical exams were reviewed in order to identify potential risk factors. Outcome of this study was defined as any positive finding on neuroimaging requiring hospital admission.

**RESULTS**

179 patients met the inclusion criteria and only two patients (1.1%) had neuroimaging findings requiring admission. The positive cases presented with focal neurological symptoms, hypertension greater than 140/90 mmHg, and age > 60. Non-contributory variables included sex, general appearance, other vital signs, and acute phase laboratory values. Furthermore, 27 patients with a known history of migraines (15.1%) did not demonstrate any positive neuroimaging findings.

**CONCLUSION**

The overwhelming majority of patients who presented to the emergency department with a headache had a neuroimaging study not requiring admission. The data suggests most of these scans are unnecessary and lead to increased radiation exposure and healthcare costs. This preliminary data is part of a longitudinal study, which can potentially set guidelines for appropriate neuroimaging in the ED.

**CLINICAL RELEVANCE/APPLICATION**

The benefit of neuroimaging in the setting of headache may not be justified by the radiation risk and associated healthcare cost.

**ERS209**

**CT Brain Perfusion (CTP): Do We Really is Useful in Ischemic Stroke? (Station #3)**

**Agustina Vicente Bartulos MD (Presenter): Nothing to Disclose, Michal Kawiowski : Nothing to Disclose, Daniel Lourido Garcia : Nothing to Disclose, Luis Gorospe Sarasua : Nothing to Disclose, Alfonso Muriel Garcia : Nothing to Disclose, Maria Alonso de Lecinana Cases : Nothing to Disclose**

**PURPOSE**

The mismatch hypothesis has been used to identify recoverable tissue in acute stroke. However, its utility has been questioned. We performed a study to determine whether CT perfusion (CTP) accurately identify salvable tissue and if the findings have a translation into clinic.

**METHOD AND MATERIALS**

Prospective registry of patients with severe anterior circulation stroke subjected to reperfusion therapies. We recorded clinical characteristics, urgent neuroimaging data (baseline multimodal CT, non-contrast CT at 24 hours), occurrence of recanalization and outcomes at three months(NIHSS and mRS). Volumetric measurement of infarct core (reduced blood volume) and at risk tissue (reduced blood flow with normal volume) in CTP were performed. In 24-h-CT total volume of lesion (TVL) and partial volume (PVL) of lesion in the slices corresponding to the perfusion acquisition cage, were measured. Percentage of at risk tissue not incorporated to the final lesion was estimated and correlated with outcomes.

**RESULTS**

34 patients were included, median age 66.5 years (P25; P75: 60; 75). Baseline NIHSS 17 (14; 22). Location of the thrombus was: 21% Intracranial ICA, 62% M1 and 17% M2 segment of the MCA. Lesion volumes were: Core: 10.6 mL (4;18); at risk tissue: 74.3 mL (56; 91); mismatch 89% (79; 95); TVL: 12.4 mL (8;54); PVL: 10.7 mL (5; 33). Percentage of at risk tissue that did not incorporate into the final lesion was reduced when recanalization occurred: 89 % (76; 94) vs 46 % (23; 66), p =0.0044. For every 10 % of preserved tissue, NIHSS score improved by 3 points (95% CI: -4.9 - -0.8, p=0.007). Higher percentage of preserved tissue increased probability of independency (mRS 0–2) OR 1.15 (95% CI 1.04- 1.28).
CONCLUSION

CTP identify salvable tissue in acute stroke. Higher percentage of preserved at risk tissue is associated with better clinical outcome. The futile recanalization is associated with lower percentage of penumbra saved.

CLINICAL RELEVANCE/APPLICATION

This study helps us to determine the value of CT-Perfusion. Other parameters that may have clinical relevance are also being assessed (collateral, thrombus location .......). We are trying to obtain a predictive clinico-radiological scale to select patients who will benefit from reperfusion therapies.

ERS210

ED CT of the Abdomen and Pelvis Utilization has Continued to Increase, Despite what Appears to be a Reduction in Procedures caused by Code Bundling (Station #4)

Santosh Kumar Selvarajan MD (Presenter): Nothing to Disclose, David C. Levin MD: Consultant, HealthHelp, LLC Board of Directors, Outpatient Imaging Affiliates, LLC, Vijay Madan Rao MD: Nothing to Disclose, Laurence Parker PhD: Nothing to Disclose

PURPOSE

Previous studies have shown that the all imaging utilization rates have been stable since 2006 except CT which has continued to grow (overall annual growth of 3.4% from 2007-2009). From 2011, CPT codes for CT scans of the abdomen and pelvis were bundled into a single new code. Our purpose was to determine what effect this policy had on recent trends in CT utilization in ED.

METHOD AND MATERIALS

The nationwide Medicare Part B databases for 2000-2012 were used. The codes for CT of the abdomen and CT of the pelvis were selected for all years of the study, and the bundled codes for CT abdomen/pelvis were selected for 2011 and 2012. Procedure volumes in ED and non-ED (inpatient, office, and outpatient) settings were calculated. To understand the trends through the bundling years (2011 and 2012), we doubled the number of bundled codes, since these would have counted as 2 exams in 2010 and before.

RESULTS

The nationwide Medicare utilization rates of both CT abdomen and CT pelvis grew from 2000 to 2007 (4.8 M. to 9.7 M.) Thereafter, from 2008 to 2010, growth had stabilized except in ED (Non-ED, 8.1 M. to 7.7 M.; ED, 1.7 M. to 2.0 M).

There is a dramatic drop off in 2011 due to bundling: non-ED, 7.7 M. 4.2 M., Ed, 2.0 to 1.2 M When the bundled exams are doubled, 2011 non-Ed is stable at 7.8 M. exams; ED increases substantially from 2010, to 2.3 M. exams. In 2012, again counting the bundled code as 2 exams, non-ED volume is stable, at 7.8 M., while ED volume again increases substantially, to 2.6 M.

CONCLUSION

Medicare volumes of CT of the abdomen and CT pelvis show an apparent decline, but this is an artifact of code bundling. While procedure volume is stable in non-ED settings, volume of CT of the abdomen and pelvis continue to grow strongly in the ED.

CLINICAL RELEVANCE/APPLICATION

New guidelines are probably required to reduce the CT utilization rates in Emergency.

ERE191

Imaging of Traumatic Preganglionic and Postganglionic Brachial Plexus Injuries (Station #5)

Yoshimi Endo MD (Presenter): Nothing to Disclose

TEACHING POINTS

1. To review the normal appearance of conventional and CT myelograms of the cervical spine.
2. To review the imaging features of preganglionic brachial plexus injuries, including conventional and CT myelographic features of both complete and partial cervical nerve root avulsions.
3. To identify traumatic injuries to the postganglionic brachial plexus, focused on MRI

TABLE OF CONTENTS/OUTLINE

Preganglionic nerve roots - Normal anatomy of the preganglionic nerve roots/rootlets - Normal appearance of the nerve roots/rootlets on conventional and CT myelography - Myelographic features of complete and partial nerve root avulsions with MRI correlation Postganglionic brachial plexus - Anatomy of the components of the brachial plexus - Imaging techniques on MRI and ultrasound of the plexus - Normal appearance of the brachial plexus on MRI and ultrasound - Traumatic postganglionic brachial plexus injuries on MRI, including avulsions from high-energy trauma, traction from sports-related injuries and shoulder dislocations, and plexus injuries as a complication of fractures.
Sub-Events

GIS331  q-Space Diffusion-weighted MR Imaging of Gastric Carcinoma Ex Vivo: Correlation with Histopathologic Findings (Station #1)

Ichiro Yamada MD (Presenter): Nothing to Disclose, Keigo Hikishima PhD, MS: Nothing to Disclose, Naoyuki Miyasaka MD: Nothing to Disclose, Keiji Kato MD: Nothing to Disclose, Eisaku Ito MD: Nothing to Disclose, Kazuyuki Kojima MD, PhD: Nothing to Disclose, Tatsuyuki Kawano MD: Nothing to Disclose, Daisuke Kobayashi MD: Nothing to Disclose, Yoshinobu Eishi MD: Nothing to Disclose, Hideyuki Okano MD, PhD: Nothing to Disclose

PURPOSE

To determine the feasibility of non-Gaussian q-space diffusion-weighted MR imaging as means of evaluating mural invasion by gastric carcinomas and the histologic grades of gastric carcinomas.

METHOD AND MATERIALS

Twenty gastric specimens each containing a carcinoma were studied with a 7.0-T MR imaging system equipped with a four-channel phased-array surface coil. q-Space diffusion-weighted MR images were obtained with repetition time, 3000 msec; echo time, 29 msec; field of view, 50-60 mm x 25-30 mm; matrix, 256 x 128; section thickness, 2 mm without intersection gaps; ten b values ranging from 0 to 7163 sec/mm²; and motion-probing gradient in the y-direction. Three q-space imaging parameters (mean displacement, probability for zero displacement, and kurtosis) were calculated from the displacement distribution profiles, and standard apparent diffusion coefficient (ADC) was also calculated from two b values (b = 0 and 874 sec/mm²). The MR images were then compared with the histopathologic findings as the reference standard.

RESULTS

In all 20 specimens (100%), q-space imaging parameter maps were capable of depicting the individual layers of the normal gastric wall. The q-space imaging parameter maps in all 20 carcinomas (100%) made it possible to identify the same depth of tumor invasion of the gastric wall as observed during the histopathologic examination. The mean displacement (5.78 ± 0.36 μm), probability for zero displacement (52.6 ± 4.2 (arbitrary unit [a.u.])), and kurtosis (55.1 ± 5.1 (a.u.)) of the carcinomas were statistically significantly different from the corresponding values of the layers of the gastric wall. The mean displacement (r = -0.841; P = 0.001), probability for zero displacement (r = 0.927; P < 0.001), and kurtosis (r = 0.927; P < 0.001) were statistically significantly correlated with the histologic grades of gastric carcinomas, while the ADC (r = -0.341; P = 0.255) showed no significant correlation with the histologic grades of gastric carcinomas.

CONCLUSION

q-Space diffusion-weighted MR imaging is feasible in gastric specimens and provides excellent diagnostic accuracy for evaluating mural invasion by gastric carcinomas and the histologic grades of gastric carcinomas.

CLINICAL RELEVANCE/APPLICATION

q-Space diffusion-weighted MR imaging may provide a diagnostic tool for noninvasive assessment of mural invasion by gastric carcinomas and the histologic grades of gastric carcinomas.

GIS332  Characterization of Perfusion Parameters in Hepatocellular Carcinoma (HCC) with Aid of Volume Perfusion CT (VPCT): Correlation between Two Different Mathematical Models (Station #2)

Sascha Kaufmann: Nothing to Disclose, Maximilian Michael Walther Schulze MD: Nothing to Disclose, Daniel Spira MD: Nothing to Disclose, Alexander Sauter: Nothing to Disclose, Claus Detlef Claussen MD: Nothing to Disclose, Marius Horger MD (Presenter): Nothing to Disclose, Konstantin Nikolau MD: Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG

PURPOSE

To assess average perfusion values for blood flow (BF), blood volume (BV), k-trans, in hepatocellular carcinoma (HCC) measured with two different mathematical models as well as to determine the degree of arterial liver perfusion (ALP), portal venous perfusion (PVP-if any) and hepatic arterial index (HPI), the latter three being calculated by a special software which separates the contribution of the dual vascular (arterial/portal-venous) supply of the liver.

METHOD AND MATERIALS

Institutional review board approval was obtained for this prospective study. VPCT was performed in 81 patients covering the involved liver (80kV, 100/120mAs) using 64x0.6mm collimation, 26 consecutive volume measurements, IV injection of 50 mL of iodinated contrast at a flow rate of 5 mL/s). BF, BV and k-trans were measured using: maximum slope + Patlak analysis vs. deconvolution method.
RESULTS
For maximum slope + Patlak analysis BF/BV/k-trans yielded following avg. values values: 37.6/9.8/36.5 (SD: 14.7/7.1/16.5). For the deconvolution method mean BF/BV/k-trans were 67.7/12.5/24.2 (SD: 25.3/6.3/7.3), respectively. Separate calculation of ALP, PVP and HPI resulted in following values: 53.8/2.4/96.5 (SD: 15.0/5.4/7.2).

CONCLUSION
The deconvolution method results in more robust calculation of BV and k-trans whereas the max. slope + Patlak method yields higher variations of all calculated perfusion parameters. Moreover, the deconvolution method results in significantly higher BF, slightly higher BV and lower k-trans, but the relationship between results of both calculation models is congruent. The HPI was expectedly very high in all tumors.

CLINICAL RELEVANCE/APPLICATION
Perfusion imaging is an emerging technology which is beneficial both for tumor detection and characterisation as well as for therapy response monitoring. International guidelines for diagnosis of HCC allow for non-invasive diagnosis based on the presence of positive wash-in and wash-out tumor characteristics. However, not all HCC behave this way and perfusion quantification, particularly the HPI value may help for more accurate diagnosis and monitoring. Therefore orientation values are mandatory.

GIS333
Susceptibility-weighted Imaging of Multistep Hepatocarcinogenesis in Cirrhotic Livers: Correlation with Histopathology (Station #3)
Ruo Kun Li (Presenter): Nothing to Disclose, Mengsu Zeng MD, PhD: Nothing to Disclose, Jinwei Qiang: Nothing to Disclose, Shengxiang Rao MD: Nothing to Disclose, Lingli Chen: Nothing to Disclose, Yongming Dai: Nothing to Disclose

PURPOSE
To investigate imaging characteristics of multistep hepatocarcinogenesis in cirrhotic livers on susceptibility-weighted imaging (SWI) and correlate with histopathologic results.

METHOD AND MATERIALS
Seventy-three patients with 83 nodules in cirrhotic livers underwent hepatic MR imaging with SWI. Two radiologists reviewed MR images by consensus. Imaging characteristics of dysplastic nodules (DN), DN with malignant foci and hepatocellular carcinoma (HCC) were evaluated. Prussian blue staining was performed for semiquantification of hepatic iron content and above cirrhosis-associated nodules.

RESULTS
Positive iron staining of background liver parenchyma was found in 69 of 73 patients (94.5%) and 3 HCC patients were iron-negative staining of background liver parenchyma. Nine DN appeared as hypointensity or isointensity with pathologically confirmed similar (n=7) or slightly decreased (n=2) iron deposition compared with background liver parenchyma. SWI detected 14 of 15 DN with malignant foci. Seven cases appeared as homogeneous hyperintensity and 1 case appeared as heterogeneous hyperintensity due to intratumoral hemorrhages. The remaining 6 cases demonstrated as nodule-in-nodule appearance with iron deposition in all background nodules, iron deposition with grade 1 in one internal HCC foci, and iron-free in 5 internal HCC foci. The remaining 50 patients with hepatic iron deposition had 55 HCC lesions. Three HCC lesions had iron deposition with grade 1 to 2 and the remaining 52 HCC lesions were pathologically iron-resistant. HCC appeared as hyperintensity compared with siderotic surrounding liver parenchyma. However, HCCs with diameter larger than 3cm usually demonstrated heterogeneous hyperintensity due to intratumoral hemorrhage.

CONCLUSION
SWI could accurately visualize dynamic iron depletion on multistep hepatocarcinogenesis in cirrhotic livers. On SWI images, DNAs appear as hypointensity due to siderosis and malignant nodules appear as hyperintensity due to iron depletion.

CLINICAL RELEVANCE/APPLICATION
SWI could accurately visualize dynamic iron depletion on multistep hepatocarcinogenesis, which may be valuable for characterization of cirrhotic nodules.

GIS334
Arterial Phase and Portal Venous Phase, Which Is Better for Material Suppressed Iodine (MSI) Images to Replace Conventional Non-enhanced (CN) Images in Liver CT? (Station #4)
Jing Zhao (Presenter): Nothing to Disclose, Xinming Zhao: Nothing to Disclose

PURPOSE
To evaluate whether Material Suppressed Iodine (MSI) images derived from CT spectral imaging can replace the conventional non-enhanced (CN) images in liver, and determine which phase is better between arterial phase (AP) and portal venous phase (PVP).

METHOD AND MATERIALS
METHOD AND MATERIALS

A total of 25 patients underwent examinations of conventional non-enhanced CT and two phases (arterial phase, AP and portal venous phase, PVP) contrast enhanced CT scans. For both AP and PVP, monochromatic images were reconstructed and the MSI images were generated by suppressing iodine on 70keV monochromatic image with a dedicated software (GSI Volume Viewer, Advantage Workstation 4.6). The average CT value, image noise and in the liver, adipose tissue, vertebrae, muscle and pancreas were measured respectively. The subjective image quality score was assessed with 5-point scale. Variables were compared with paired student T-test and rank-sum test.

RESULTS

The average CT values of liver, portal venous, vertebrae, muscle and pancreas were slightly higher in MSI of dual-phase images than CN images. The difference was not statistically significant (p>0.05). However, adipose tissues in MSI images of dual-phase images were slightly lower than CN images (each p>0.05). MSI of arterial phase images showed remarkably lower average CT values than MSI of portal venous phase images (each p<0.05). Image noise in the liver, portal venous, adipose tissue, vertebrae, muscle and pancreas were significantly higher in MSI of dual-phase images (each p<0.05) than CN images. Image noise of such organs was slightly lower in MSI of arterial phase images than portal venous phase images (each p<0.05). The subjective image quality scores were higher in MSI of arterial phase images than portal venous phase images (p<0.05).

CONCLUSION

Material Suppressed Iodine (MSI) images are acceptable as replacements for the conventional non-enhanced (CN) images. MSI of arterial phase images show more advantages than MSI of portal venous phase images in replacements of the conventional non-enhanced (CN) images.

CLINICAL RELEVANCE/APPLICATION

Material Suppressed Iodine (MSI) images can replace the conventional non-enhanced (CN) images as an imaging protocol in liver dual-phase examination in clinic.

Impact of Interobserver Variability on dceMRI-derived Pharmacokinetic Parameters in Patients with Locally-advanced Rectal Cancer (Station #5)

James Franklin MA, MBBS (Presenter): Nothing to Disclose, Benjamin Irving PhD: Nothing to Disclose, Margaret Betts MBBS: Nothing to Disclose, Andre Hallack Miranda Pureza: Nothing to Disclose, Michael Brady: Shareholder, Matakina International Limited Shareholder, Mirada Medical Ltd Shareholder, Perspectum Diagnostics Ltd, Julia Schnabel Msc, PhD: Nothing to Disclose, Fergus Vincent Gleeson MBBS: Alliance Medical Ltd Consultant, Ewan Mark Anderson MBBCh: Nothing to Disclose

PURPOSE

Pharmacokinetic (PK) modeling of dynamic contrast-enhanced MRI (dceMRI) produces clinically relevant outputs. Accurate tumor delineation is necessary to generate tumor-specific outputs. This study evaluated the impact of interobserver variability in tumor delineation on dceMRI outputs in patients with locally-advanced rectal cancer (LARC).

METHOD AND MATERIALS

12 patients with LARC underwent dceMRI at 1.5T before treatment. Two observers delineated tumor volumes on Osirix Medical Imaging Software using the clinical axial small field of view (sFOV) T2W acquisition. Tumor volume delineations were coregistered to the axial T1W dceMRI acquisition using a combined rigid/non-rigid coregistration platform. PK-modeling of the tumor [contrast]-time curve was performed using the Tofts model to derive Ktrans and kep. The two tumor volume delineations were compared using differences in overall volumes and DICE similarity coefficient, which measures the proportion of spatial overlap between two delineations (identical segmentations = 1). Percentage differences in whole-tumor mean, median and variance of Ktrans and kep were calculated. The parameters derived for each observer were compared using paired t-tests and linear regression.

RESULTS

The mean percentage difference between volumes was 17% (range 1-65%) with mean DICE of 0.77 (range 0.5-0.89). In 9/12 patients DICE was >0.8. The mean percentage differences in mean, median and variance of Ktrans were 3.9% (range 0.5-10.1%), 5.4% (range 0.15-13.4%) and 6% (range 0.5-22%) and equivalent values for kep were 1.7% (range 0.1-5.1%), 2.1% (range 0.4-4.8%) and 4.9% (range 0.4-9.7%). No significant difference was found between the observers (p>0.5) for any of the pharmacokinetic parameters. There was a significant negative correlation between DICE and percentage difference of median (p=0.02) and a similar trend for the percentage difference of mean Ktrans (p=0.17).

CONCLUSION

In most cases there is good interobserver agreement of rectal tumor delineation. Mean and median of tumour dceMRI pharmacokinetic parameters are robust even for larger discrepancies in delineation, although interobserver variations in Ktrans increase with greater discrepancies in tumor delineation.

CLINICAL RELEVANCE/APPLICATION

There is typically good agreement of rectal tumour volume delineations by trained observers. Mean and median values of dceMRI-derived PK parameters are robust, even for greater disagreement.
**GIS336 Application of Spectral CT Image Fusion Technology in Small HCC for Evaluating Diagnostic Accuracy and Image Quality (Station #6)**

**Jingjing Xing MD (Presenter): Nothing to Disclose, Jianbo Gao MD: Nothing to Disclose, Hangsha Hang Limbu MD: Nothing to Disclose, Pan Liang: Nothing to Disclose**

**PURPOSE**

To evaluate image quality and diagnostic accuracy of CT single energy fusion image (optimal keV+70keV) for small HCC (<3cm) in patients with HBV or Cirrhosis.

**METHOD AND MATERIALS**

Twenty-eight patients with 32 small HCC(<3cm) who were HBV+ve and/or cirrhotic underwent spectral CT to generate conventional 140-kVp polychromatic images and monochromatic images with energy levels from 40 to 140 keV during the arterial phase. The image with highest lesion to liver contrast to noise ratio CNR (optimal keV) and lowest noise (70keV) were used to reconstruct a fusion image. One-way analysis of variance was used to compare the CNR and image noise of fusion image to that of conventional image (QC), optimal keV and 70keV. The lesion detection and the overall image quality were compared using 5 point method and nonparametric tests.

**RESULTS**

The optimal keV was determined to be 52±4 keV. The CNR of fusion group (5.62±1.54) were significantly higher than that of QC group (3.51 ±1.21) (p<0.05) and 70keV Group (4.05±1.03) (p<0.05) and the image noise of fusion group (21.40±4.40) were significantly lower than that of QC group (17.69±1.63) (p<0.01) and optimal keV group (34.00±4.25) (P<0.05). The lesion detection capacity score of fusion group (3.66 ± 0.51) were significantly higher than that of QC group (3.06 ± 0.432) (P<0.05) and 70keV group (2.89 ± 0.38) (P<0.05) with overall image quality score of the fusion group (3.61 ± 0.53) significantly higher than that of the other three groups (P<0.05).

**CONCLUSION**

Monochromatic images with energy level 52±4 keV had higher CNR values. Application of CT single energy image fusion technology (optimal keV + 70keV) has promising potential with overall better image quality and lesion detection capability in small HCCs with HBV or Cirrhosis.

**CLINICAL RELEVANCE/APPLICATION**

Cirrhosis and HBV infection has a high risk for developing HCC. Implementation of fused image in these high risk patients can detect HCC early on with better detection capacity and image quality than conventional CT.

**GIE257 Imaging of Gastrointestinal Tract - Back to the Future (Station #7)**

**Chinmay Bhimaji Kulkarni MBBS, MD (Presenter): Nothing to Disclose, Srikanth Moorthy MD: Nothing to Disclose, Sreekumar K P MBBS, MD: Nothing to Disclose, Nirmalkumar Prabhu: Nothing to Disclose, Rajesh Ramaiah Kannan MD: Nothing to Disclose**

**TEACHING POINTS**

Evolution of imaging of gastrointestinal tract since the invention of roentgen rays to present day. Role of eminent personalities involved in this journey from past to present.

**TABLE OF CONTENTS/OUTLINE**

Early days of radiography. Bismuth to Barium studies. (Evolution of various barium techniques) Radiography versus Fluoroscopy. Evolution of Computed tomography (CT) technology and its role in bowel imaging. Present days of bowel imaging.

**GIE258 Imaging Spectrum of IgG4 Syndrome and Mimics: Radiology-Pathology Case-based Review (Station #8)**

**Maryam Gul (Presenter): Nothing to Disclose, Ammar Ahmed Abass Ahmed Chaudhry BSc: Nothing to Disclose, Mubashir Pathan MS: Nothing to Disclose, Marlene Leslie Zawin MD: Nothing to Disclose, Chaudhry MD: Nothing to Disclose, Sheikah: Nothing to Disclose, Akih Khan**

**TEACHING POINTS**

1- Review clinicopathologic spectrum of IgG4-related disease. 2- Discuss spectrum of imaging and pathologic findings in IgG4-related disease. 3- Review mimics with emphasis on key findings differentiating these entities.

**TABLE OF CONTENTS/OUTLINE**

Content Outline:

1- Review key clinical, pathological, imaging findings and treatments of IgG4-related disease including:

- Autoimmune pancreatitis
- Sclerosing Cholangitis
- Sclerosing mesenteritis
- Interstitial Nephritis
- Retroperitoneal fibrosis
Coagulopathy

2- Review mimics of IgG4-related disease and highlight key imaging findings that aid in narrowing the differential:

- Pancreatitis (alcohol, cholithiasis, groove pancreatitis, neoplasm)
- PSC
- Messenteric and Retroperitoneal Neoplasms (Lymphoma/Leukemia/etc).
- Nephritis (glomerulonephritis, ATN, pyelonephritis, neoplasm etc)
- Vasculitis

Summary:

IgG4-syndrome involves multiple organs and can present in a variety of ways. Although the differential diagnosis is broad, it can be narrowed utilizing clinicopathologic features and imaging findings (e.g. Location, enhancement pattern, necrosis, MRI findings, etc). By the conclusion of this presentation, the viewer should be able to aid in patient work-up, recommend appropriate imaging follow-up and guide any potential biopsy.

TEACHING POINTS

We report on the characteristic evolution of the intra-lesional and peri-lesional MRI findings after SBRT and their impact on the clinical image interpretations. Teaching points: 1. Intra-lesional and peri-lesional features evolve over the acute, sub-acute and chronic phases after SBRT. These evolving features need to be incorporated in clinical image interpretation. 2. Treated lesions are best identified on the post-contrast T1-weighted images. 3. Intra-lesional restricted diffusion tends to resolve quickly after SBRT. Post-SBRT parenchyma does not demonstrate restricted diffusion. 4. Acute parenchymal changes appear around 3-6 months post-treatment and include peri-lesional and segmental hyper-enhancement and hyper-intensity on T2 weighted images. 5. Subacute parenchymal changes appear around 6 months post-treatment and include increased susceptibility effect due to chronic microhemorrhage. 6. Chronic parenchymal changes develop after 6 months and include biliary dilatation, capsular retraction, and radial stellate enhancement, due to parenchymal scarring.

TABLE OF CONTENTS/OUTLINE

1. Background
2. Evolving intra-lesional appearance
3. Evolving peri-lesional appearance
4. Impact on clinical image interpretation

TEACHING POINTS

To review basic principles of dual energy CT (DECT) for clinical application To learn how dual energy CT gives added value compared with conventional CT for bowel lumen evaluation To learn the benefits and different dual energy CT reformations for bowel evaluation To show critical pitfalls in dual energy CT for bowel evaluation To demonstrate the potential value of novel bowel CT contrast materials for use with dual energy CT

TABLE OF CONTENTS/OUTLINE

Basic principles of DECT - Relative X-ray attenuation of different materials - Material decomposition images for iodine and water separation - Effective Z - DECT abdominal protocol for rapid kV switching scanner Problem solving with DECT for challenging conventional CT bowel cases - Bowel masses - Gastrointestinal bleeding - Pills and over the counter abdominal pain medications - Peritoneal implants - Metal and beam hardening artifact Pitfalls of dual energy CT imaging of bowel - Artifacts of material decomposition that may mimic severe bowel disease - Pitfalls of effective Z analysis Future Directions - Potential benefits of novel bowel contrast agents

TEACHING POINTS

1. Understand the system of liver transplant allocation in US and the role of imaging in appropriate allocation of organs. 2. Learn concepts of MELD based allocation, MELD exception points, Milan criteria and OPTN imaging classification of hepatocellular carcinoma.

TABLE OF CONTENTS/OUTLINE

Radiologists and the reports generated by them now play an integral role in the liver allocation system in the
Development of a Clinical Prediction Model Based on Quantitative Imaging Metrics Derived from CT Imaging for Differentiating Clear Cell from Papillary Renal Cell Carcinoma (Station #1)

Vinay Anant Duddalwar MD, FRCR: Research Grant, General Electric Company, Bhushan Desai MBBS, MS (Presenter): Nothing to Disclose, Darryl Hwang PhD: Nothing to Disclose, Steven Cen PhD: Nothing to Disclose, Frank K. Chen MD: Nothing to Disclose, Hannu Tapio Huhdanpaa MD: Nothing to Disclose, Phillip Ming-Da Cheng MD, MS: Nothing to Disclose, Inderbir Gill MD: Nothing to Disclose

PURPOSE
To build a prediction model using quantitative imaging metrics (QIM) derived from contrast enhanced computed tomography (CECT) to distinguish clear cell renal cell carcinoma (ccRCC) from papillary RCC (pRCC).

METHOD AND MATERIALS
We retrospectively queried the surgical database and found 72 post nephrectomy patients who had pathology proven ccRCC (53) or pRCC (19) and preoperative multiphase CECT of the abdomen. Voxel-based contrast enhancement values were collected from the lesion segmentation and displayed as a histogram. Mean and median enhancement and histogram distribution parameters skewness, kurtosis, standard deviation (SD), and interquartile range (IQR) were calculated for each lesion on corticomedullary phase. Independent t-test was used for normally distributed parameters while Wilcoxon rank sum test was used for not normally distributed parameters. Supervised machine learning (Classification and Regression Tree 7.0-CART®) was used to develop the prediction model.

RESULTS
cCRCC had significantly higher mean and median whole lesion enhancement, IQR and SD (p < 0.01), and significantly lower skewness and kurtosis (p < 0.01) compared to pRCC. Arterial mean and venous IQR were selected as the final predictors. ROC curve showed by using these two factors the model can reach the accuracy of AUC=0.89 (95% CI: 0.81, 0.96). The cut points selected by CART are: if arterial mean > 75 Hounsfield Units (HU) or arterial mean ≤ 75HU and venous IQR > 301HU and pRCC. Otherwise, if arterial mean ≤ 75HU and venous IQR ≤ 301HU then the lesion will be classified as ccRCC. Otherwise, if arterial mean > 75HU and venous IQR > 301HU then the lesion is pRCC. From the learning sample only, this prediction rule reached 88.7% sensitivity and 94.7% specificity. When we applied a 10-fold cross validation, the estimated generalizable sensitivity and specificity are 77.4% and 73.7% respectively.

CONCLUSION
A prediction model encompassing QIM seems promising and can be used as a quantitative tool to differentiate ccRCC from pRCC. Further refinements with possible inclusion of additional QIM (spherocity, lobularity of lesion) and validation on an independent dataset are currently underway.

**CLINICAL RELEVANCE/APPLICATION**

The successful integration and validation of novel imaging-based biomarker methodologies (such as QIM) will improve our ability to stratify patients at risk, increase diagnostic accuracy, help establish guidelines for active surveillance in the management of RCC and optimize criteria used for clinical decision making.

### GUS108

**Association of MRI Signs in Diagnosis of Placenta Accreta: Preliminary Results (Station #2)**

**Valeria Ninivaggi MD (Presenter): Nothing to Disclose, Anna Lia Valentini MD : Nothing to Disclose, Benedetta Gui MD : Nothing to Disclose, Maura Micco MD : Nothing to Disclose, Michela Giuliani : Nothing to Disclose, Lorenzo Bonomo MD : Nothing to Disclose**

**PURPOSE**

To compare magnetic resonance imaging (MRI) with operative delivery findings or histopathology in diagnosing placental adhesive disorders; to verify whether a combination of specific signs improves MRI accuracy.

**METHOD AND MATERIALS**

Two Radiologist with expertise in gynecological imaging retrospectively reviewed 18 MRI of pregnant women with placenta previa examined in our Institution from April 2011 to April 2014 after inconclusive ultrasound evaluation for placental adhesive disorders. Radiologists worked independently, blinded to clinical history of patients. For each patient the presence or absence of MRI findings reported in literature in cases of placental disorders were assessed: intraplacental thick dark bands on T2w images, intraplacental abnormal vascularity, uterine bulging, myometrial thinning, focally interrupted myometrial border, heterogeneous intraplacental signal intensity, placental protrusion into internal os, tenting of the bladder and direct visualization of nearest tissues invasion. Interpretation discrepancies were resolved by consensus. A third radiologist investigated history of patients and correlated imaging data with the gold standard: histological specimen in case of hysterectomy (4/18) or difficult detachment with hemorrhage described in surgical report in case of conservative approach (3/18).

**RESULTS**

Each singular sign was investigated separately for sensitivity (SS) and specificity (SP): intraplacental thick dark bands on T2w images (SS 71%, SS 100%), intraplacental abnormal vascularity (SS 71%, SP 100%), myometrial thinning less than 5 mm (SS 100%, SP 18%), heterogeneous intra-placental signal intensity (SS 71%, SP 54%), uterine bulging (SS 57%, SP 90%), focal interruption (SS 0,57%, SP 100%), direct invasion (SS 42%, SS 100%) and tenting of bladder (SS 57%, SP 100 %). Protrusion into internal os was not detected. In our series combined evaluation of all imaging signs detected suggest deepest infiltration in patient who underwent hysterectomy (SS 75%; SP 100%).

**CONCLUSION**

MRI accuracy in diagnosis of placental adhesive disorders can be improved by taking into account the association of reported signs. However, is not possible on the basis of MRI assess the degree of myometrial involvement

**CLINICAL RELEVANCE/APPLICATION**

The detection of specific MRI signs could typify patients with Placental abnormality to ensure the correct preoperative assessment and the appropriate treatment planning in a safer way.

### GUS106

**3D Reconstruction from MRI during Human Childbirth (Station #3)**

**Olivier Ami MD, PhD (Presenter): Nothing to Disclose, Jean-Christophe Maran: Nothing to Disclose, Dominique MUSSET : Nothing to Disclose, Louis Bernard Boyer MD : Nothing to Disclose**

**PURPOSE**

3D reconstruction of birthcanal and fetus was obtained from imaging performed with 1T open field MRI before and during childbirth on 10 patients. Fetal head molding and birthcanal changes are fully described in 3D vectorial meshes.

**METHOD AND MATERIALS**

10 women were enrolled in this study in a level I maternity center. Inclusion criteria were normal pregnancy and course of labor in healthy volunteers. A T1 gradient echo sequence was performed, lying on the back, before labor and during childbirth. A Philips 1T Panorama Open field MRI was used. 3D reconstruction was performed with a SIMULACC plateform (babyprogress SAS, France).

**RESULTS**

All fetal head molding changes are described, including skull bones movements, meningeal role and brain biomechanical constraints. The birthcanal showed great deformity during the second stage of labor and highlights the biomechanical process that preludes to human birth.
CONCLUSION

Obstetrical mechanics are better understood with 3D reconstruction imaging, and this technology opens access to virtual trial of labor in the near future.

CLINICAL RELEVANCE/APPLICATION

Feasibility study of new diagnosis tools using imaging and 3D simulation to help a better management of human birth

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**Limited Utility of Negative CT Attenuation Value Pixel Distribution Analysis Using Unenhanced CT in Diagnosis of Small (<4cm) Angiomyolipoma (AML) without Macroscopic Fat (Station #4)**

Naoki Takahashi MD (Presenter): Nothing to Disclose, Kohei Sasaguri MD: Nothing to Disclose, Mitsuru Takeuchi MD, PhD: Nothing to Disclose, Adam Froemming MD: Nothing to Disclose, Shuai Leng PhD: Nothing to Disclose, Akira Kawashima MD: Nothing to Disclose

**PURPOSE**

To evaluate if negative CT attenuation pixel distribution analysis improves detection of fat in small AML.

**METHOD AND MATERIALS**

29 small (<4cm) AML (mean age: 53) and 68 small RCC (46 clear-cell, 22 other, mean age: 59) who underwent unenhanced (NC) and enhanced CT before nephrectomy were included (mean NC-CT slice thickness: 4 mm). CT images were reviewed for presence of macroscopic fat (subjective method). CT pixel distribution analysis was performed using Matlab-based software. First, a largest possible, free-hand ROI was manually placed on the mass on representative NC-CT image. Subsequently, the software systematically generated multiple round overlapping micro-ROIs in the large ROI. Mean HU values and pixel counts under cutoff values in each of multiple micro-ROIs were calculated. Cutoff values tested were 0, -5, -10, -15 and -20 HU. Minimum of the mean HU values and maximum of the pixel counts were recorded (mean-HU method and pixel-count method); these are equivalent to subjectively identifying suspicious areas and placing small ROIs. Size of micro-ROIs were 37 and 49 pixels (28-37mm2) for mean-HU method and 13 and 29 pixels (10-22mm2) for pixel-count method. The mean-HU and pixel-count methods were tested if they can differentiate AML from RCC and/or detect macroscopic fat.

**RESULTS**

On subjective analysis, 7 AML contained macroscopic fat and 22 did not, while 1 RCC contained macroscopic fat. When AML with macroscopic fat by subjective method were excluded, neither mean-HU or pixel-cont method could differentiate AML from RCC (sensitivity/specificity: 5%/97% or 9%/87%). Mean-HU/pixel-count methods and subject method were concordant for detecting macroscopic fat in all but 1 case (fat in AML only visible on enhanced CT subjectively, and pixel analysis method did not detect fat on NC-CT). Optimal cutoff for macroscopic fat detection were <-15HU and <-10HU for 25 and 49-pixel-ROIs (mean-HU method) and ≥12 pixels of 13-pixel-ROI or ≥19 of 29-pixel-ROI below -10HU, ≥11 of 13 or ≥17 of 29 below -15HU, or ≥11 of 13 or ≥16 of 29 below -20HU (pixel count method).

**CONCLUSION**

Negative CT attenuation pixel distribution analysis does not improve detection of fat in small AML beyond subjective method.

**CLINICAL RELEVANCE/APPLICATION**

Negative CT attenuation value pixel distribution analysis is not useful in differentiating small AML without macroscopic fat from RCC.

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**Beyond Prostate Cancer: Expanding the Differential Diagnosis in Prostate Pathology (Station #5)**

Yi Li MD (Presenter): Nothing to Disclose, John Mongan MD, PhD: Spouse, Founder, BIOinformative, Spencer Caton Behr MD: Research Grant, General Electric Company, Seema Sud MBBS: Nothing to Disclose, Fergus V. Coakley MD: Nothing to Disclose, Jeffry P Simko MD, PhD: Consultant, Genomic Health, Inc Consultant, GenomeDx Biosciences Inc Consultant, Myriad Genetics, Inc Research support, Genomic Health, Inc Research support, Myriad Genetics, Inc, Antonio C. Westphalen MD: Nothing to Disclose

**TEACHING POINTS**

1. To review the fundamental principles of prostate MR imaging
2. To review prostate anatomy and its appearance on MR imaging
3. To review the imaging features of prostate adenocarcinoma
4. To describe less common prostate pathologies, and clinical and MR imaging features that distinguish them from adenocarcinoma

**TABLE OF CONTENTS/OUTLINE**

1. Prostate and periprostatic anatomy
2. Anterior fibromuscular stroma, McNeal zonal anatomy
3. Urea desperita and seminal vesicles
4. Periprostatic neurovascular bundle
5. Fundamental principles of multiparametric prostate MR imaging
6. T1 and T2-weighted MR imaging
7. Diffusion-weighted MR imaging
8. O MRspectroscopic imaging
9. Dynamic contrast enhanced MR imaging
10. Advantages and disadvantages of the endorectal coil
11. Prostate adenocarcinoma epidemiology
12. Histology and Gleason grade
13. Staging, and multiparametric MR imaging
14. Epidemiology, clinical features, multiparametric MR imaging and histology of less common prostate pathology
15. Amyloid
16. Carcinosarcoma
17. Cystadenoma
18. Tuberculosis
Endometrioid cancer o Mucinous adenocarcinoma o Abscess o Stromal neoplasm of uncertain malignant potential o Others All sections will contain multiparametric MR images, professionally-created medical illustrations and high-resolution photographs of histological slides.

**URE181 Primary and Secondary Disorders in the Prevesical Space including the Space of Retzius (Station #6)**

Jun Isogai MD (Presenter): Nothing to Disclose, Yoshiaki Katada MD: Nothing to Disclose, Mikio Tezuka: Nothing to Disclose, Jun Kaneko: Nothing to Disclose

**TEACHING POINTS**

Demonstrate normal anatomy of the prevesical space on MDCT in a correlation with the cadaveric gross anatomy. Recognize imaging features of primary and secondary disorders in the prevesical space including the space of Retzius.

**TABLE OF CONTENTS/OUTLINE**

A. Review of normal anatomy of the prevesical space containing urachal remnants, obliterated umbilical arteries and paraumbilical veins on MDCT in a correlation with the cadaveric gross anatomy. B. CT or MRI findings of primary and secondary disorders in the prevesical space including the space of Retzius. 1) Hematoma of the rectus sheath 2) Traumatic pneumoperitoneum 3) Postoperative abscess 4) Urioma of bladder ruptures 5) Tumor and inflammatory extension of vesical and colorectal diseases 6) Infected and malignant urachal diseases 7) Recanalized paraumbilical veins 8) Supravesical hernia

**URE153 CT of the Kidneys, Ureters and Bladder: Pitfalls and Errors in Lesion Detection and Classification — How to Avoid Them in Clinical Practice (Station #7)**


**TEACHING POINTS**

The user will have a better understanding of the pitfalls and sources of misdiagnosis in CT evaluation of the Kidney, Ureters and Bladder. Major teaching points include; 1. there is no single optimal phase (non-contrast, arterial, venous, excretory phase) for detecting pathology and a combination of phases is needed. 2. Routine use of multiplanar and 3D imaging is needed to detect and classify GU pathology. 3. Study protocols are critical for lesion detection and classification. 4. Misdiagnosis occur when assumptions are made without careful lesion analysis.

**TABLE OF CONTENTS/OUTLINE**

1. Pitfalls in Imaging the GU Tract • results from the literature • sources of error in clinical practice with examples 2. Optimizing scan protocols to minimize error • role of specific phases in lesion detection and characterization 3. Designing interpretation strategies to minimize error • role of MPR and 3D imaging in minimizing error and misinterpretation • case studies illustrating specific errors and how they can be avoided with routine use of MPR and 3D 4. Select case studies illustrating specific pitfalls with recommendations to avoid these misdiagnosis 5. Discussion of study design and need to minimize radiation dose • challenges of lowering the dose in GU imaging • dose reduction and it may increase error rates

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**HPS-SUB Health Services Sunday Poster Discussions**

**Scientific Posters**

**HP**

AMA PRA Category 1 Credits™: .50

Sun, Nov 30 1:00 PM - 1:30 PM Location: HS Community, Learning Center

**Sub-Events**

**HPS139 Lost and Found: Retrospective Analysis of the Use of Intraoperative Radiography for Evaluation of Incorrect Surgical Item Counts (Station #1)**

William Walter MD (Presenter): Nothing to Disclose, Seymour Sprayregen MD: Nothing to Disclose, E. Stephen Amis MD: Nothing to Disclose, Linda Brody Haramati MD, MS: Investor, OrthoSpace Ltd, Investor, Kryon Systems Ltd Spouse, Board Member, Bio Protect Ltd Spouse, Board Member, OrthoSpace Ltd Spouse, Board Member, Kryon Systems Ltd

**PURPOSE**

To determine the effectiveness of intraoperative (OR) radiography (x-ray) for evaluating surgical item miscounts and evaluate adherence to our institutional protocol to image the miscounted item.

**METHOD AND MATERIALS**

We retrospectively reviewed 183 sequential OR x-rays in 180 patients (97 male, mean age 52 yrs, mean BMI 29) for surgical item miscounts 1/1/2011 - 4/1/2013. X-rays were reviewed in consensus by 3 board-certified
radiologists including follow-ups in 78% (142/183). Adherence to our institutional policy of x-raying the miscounted item was tracked.

RESULTS

OR miscounts requiring x-ray occurred in 0.9% (183/20,820) of surgeries. The most commonly miscounted items were needles (118) and sponges (17). Only 9% (17/183) were resolved; 8 items were outside the patient (4 needles, 3 sponges, 1 clamp). 5% (9/183) were ultimately resolved by x-ray, 5 immediately (2 needles, 3 sponges), 2 incidentally on follow-up (2 needles) and 2 during this study (1 needle, 1 microclip) for a false negative rate of 2% (4/183, all small items). Miscounts were numerically most common with open heart surgery 45/1382 (3%), but occurred in higher proportions of esophagectomies 4/12 (33%), liver transplant 12/66 (18%) and Whipple 7/44 (16%). Item miscount x-ray protocol adherence was 91% (167/183). Items were detected and removed at the time of surgery in 5% (5/183) of cases. Delayed detection occurred in 2% (4/183) of cases and the items were not removed.

CONCLUSION

OR x-rays can effectively identify retained items, although small needles were difficult to detect. Despite a high level of adherence to imagining the miscounted item, positive OR x-rays are rare and miscounted items may be occult due to small size. Surgical needles were not routinely removed when found post-operatively.

CLINICAL RELEVANCE/APPLICATION

Miscounted surgical needles are not routinely removed when found post-operatively, suggesting that x-rays for miscounted small needles may be unnecessary.

HPS140

Probable Benign Hepatic and Renal Extracolonic findings Drive Variability in Recommendations for Follow-up of between the National CT Colonography Screening Trial and a Consensus Panel (Station #2)

Hanna Maryam Zafar MD (Presenter): Nothing to Disclose, Ilana F. Gareen PhD : Nothing to Disclose, Jorean Sicks MS : Nothing to Disclose, Amy Kiyo Hara MD : Nothing to Disclose, Bettina Siewert MD : Nothing to Disclose, William C. Black MD : Nothing to Disclose, Judy Yee MD : Research Grant, EchoPixel, Inc

PURPOSE

To compare American College of Radiology Imaging Network National CT Colonography Trial (NCTCT) radiologist recommendations for additional follow-up testing of extra colonic findings (ECFs) with those of an expert panel of radiologists.

METHOD AND MATERIALS

Radiologists in the NCTCT recorded follow-up recommendations for ECFs using standard forms. Using the Delphi method to obtain consensus, a panel of five radiologists classified follow-up for each of the 182 types of ECF recorded in the NCTCT as benign (no further evaluation), further evaluation recommended, and cannot categorize without additional information. Panel classification was based on the standard ECF categories from the NCTCT rather than on images or reports. All patients were presumed asymptomatic. For each type of ECF, we compared the recommendations of the NCTCT radiologist with those of the expert panel. Reports, but not images, were reviewed for disagreement cases.

RESULTS

Among 2,662 ECFs in 1,488 patients, both the NCTCT radiologists and the panel agreed follow-up was not recommended for 85% of ECFs (2,257/2,662) and was recommended for 8% of ECFs (215/2,662); most commonly lung nodules > 4 mm in size (32%, 70/215) and indeterminate masses in the kidney > 1 cm (15%, 33/215) and in the liver > 0.5 cm (11%, 23/215). Disagreement on management recommendations was found in 7% of cases (190/2,662). The majority of disagreement cases were located in the kidneys (22%, 41/190) and liver (14%, 27/190) involving two diagnostic categories: indeterminate masses > 0.5 cm (12%, 23/190) and simple cysts (11%, 21/190). Manual review of these reports revealed that both diagnostic categories described probable benign lesions (e.g., cysts) for which NCTCT radiologists recommended follow-up due to lesion size and low dose technique.

CONCLUSION

Both the NCTCT radiologists and the panel agreed no further follow-up was advised for 85% of ECFs. Disagreement in 7% of cases was mainly due to divergent categorization of similar hepatic and renal lesions, most of which were favored by Trial readers to be benign. Standardized definitions of hepatic and renal ECFs on CT Colonography and evidence based outcomes of these findings may help reduce variability in ECF follow-up recommendations.

CLINICAL RELEVANCE/APPLICATION

Standardized definitions of probable benign hepatic and renal ECFs and evidence based outcomes of these findings may help reduce variability in CTC follow-up recommendations.

HPE109

ICD-10: Why Be A 9 When You Can Be A 10? Implications and Opportunities For Radiology (Station #4)
Anshu Shukla MD (Presenter): Nothing to Disclose, Raymond King Tu MD: Nothing to Disclose, Caleb Seavey: Nothing to Disclose, Peter F. Duggan MD: Nothing to Disclose

TEACHING POINTS

1. To define what the new International Classification of Diseases, 10th revision (ICD-10) coding system is and its impact on radiologists.
2. To review how ICD-10 codes are constructed.
3. To challenge the reader with cases and a quiz that reviews practical applications of ICD-10 for radiology and patient care.

TABLE OF CONTENTS/OUTLINE

1. Define the new International Classification of Diseases, 10th revision (ICD-10) and how it is different from ICD-9 and Current Procedural Terminology (CPT) coding.
2. Outline what the numerical system means and how codes are assigned.
3. Give examples of different codes and their impact on radiology practice.
4. Give 2 cases/vignettes where ICD-10 will be used.
5. Review potential hurdles of implementing ICD-10.
6. Quiz to test the reader’s knowledge of ICD-10.

INS-SUB

Informatics Sunday Poster Discussions

Scientific Posters

AMA PRA Category 1 Credits ™: .50

Sun, Nov 30 1:00 PM - 1:30 PM Location: IN Community, Learning Center

Sub-Events

INS136

ROBO-CHIEF: A Simple Algorithm to Automatically and Fairly Distribute Call Shifts among a Large Resident Cohort at a Large Academic Institution with Complicated Scheduling Requirements (Station #1)

Thomas W. Loehfelm MD, PhD (Presenter): Founder, Panorad, Eleza Tema Golden MD: Nothing to Disclose, Robert John Hosker MD: Nothing to Disclose

CONCLUSION

A simple algorithm is able to fairly and rapidly distribute call shifts among a large cohort of residents, taking into account complex scheduling requirements and even satisfying personal requests for call-free periods of time. Freeing chief residents from the burdensome task of scheduling preserves valuable time and energy that is better spent on more meaningful work and residency administration.

Background

Generating a resident schedule for an entire academic year is a daunting task, one that is compounded at a large academic institution. Chief residents strive to satisfy the personal requests of other residents for specific weekends free from call, the requirements of other components of the schedule that might block a resident from call eligibility, and the requirements of ACGME and other governing bodies which limit who can take call when.

Evaluation

We evaluated the scheduling requirements of our particular program, and developed an algorithm to automatically and fairly distribute call shifts among our large resident cohort. We divided our call responsibilities into 11 categories, specified which classes were eligible for call, which varies throughout the academic year, inputted days when specific residents were blocked from call due to existing schedule constraints, and took into account requests from each resident for specific call-free time periods.

Discussion

We developed an algorithm that systemically stepped through the 1000+ call shifts one-by-one, and at each step generated a list of residents eligible for that call shift. The algorithm calculated how many call shifts each eligible resident had already been assigned so far, and then chose randomly one of those eligible residents with the least number of already-assigned call shifts to work the current shift in question. This process was implemented in Microsoft Access, a program available in most versions of Microsoft Office, and required only 30 lines of code to implement. It was able to assign >99% of the required call shifts automatically and in approximately 60 seconds, leaving only a few shifts left for the chief residents to assign manually.

INS137

Novel Bone Suppression Imaging Technique in Small Lung Nodule Detection: Evaluation using Localized ROC Method (Station #2)

Tomohiro Miyoshi MD (Presenter): Research Grant, Konica Minolta Group, Junji Yoshida MD, PhD: Research Grant, Konica Minolta Group, Keiju Aokage MD, PhD: Research Grant, Konica Minolta Group, Tomoyuki Hishida MD, PhD: Research Grant, Konica Minolta Group, Tsuyoshi Kobayashi MS: Nothing to
CONCLUSION

LROC analysis demonstrated that BSI can improve the detection accuracy and localization of small lung nodules on chest radiographs not only for experts but also observers with limited experience.

Background

Bone suppression imaging (BSI) processes standard chest radiographs to improve the conspicuity of the lung field and the efficacy of small lung nodule detection. In this study, we evaluated the efficacy of a new BSI technique, using conventional ROC and localized ROC (LROC) analyses.

Evaluation

Standard and BSI chest radiographs of 80 patients, of which 40 with a nodular lesion (≤ 30 mm) and 40 without any nodules, were randomly interpreted by 20 observers, including 7 pulmonologists with more than 10-year experiences and 13 pulmonology residents. They recorded the changes in confidence levels regarding the presence or absence of a lung nodule and also the most likely location of the lesion, first without and then with BSI. ROC and LROC analyses were used to evaluate observer performance. The average area under the ROC curve (AUC) for all observers was significantly improved from 0.867 to 0.900 (p=0.004) with BSI. The average AUC for experienced pulmonologist and resident groups were also improved from 0.900 to 0.929 (p=0.035) and from 0.848 to 0.885 (p=0.031), respectively. In LROC analysis, the AUC was also significantly improved in each group. The AUC without BSI were generally greater among experienced pulmonologists compared to residents (0.80±0.03 and 0.72±0.09, respectively), whereas the AUC improvement was reversed (range: -0.03 to 0.18 for residents and -0.01 to 0.08 for experienced pulmonologists, respectively). Among the 13 residents, only one scored a worse AUC with BSI. BSI enabled more than 3 observers to localize nodules correctly in 5 of the 80 patients.

Discussion

BSI improved the accuracy of small nodule detection on chest radiographs regardless of observers’ experience. LROC analysis showed that BSI improved nodule localization and tended to be more effective in observers with limited experience.

Tool Development for Sensitive Automatic Early Breast Cancer Detection in Mammograms through MATLAB as a Computing Environment: Supported by Grants from NCRR (P20RR016460) and NIGMS (P20 GM103429) at NIH (Station #3)

Shahrukh Babar: Nothing to Disclose, Thomas Hahn (Presenter): Nothing to Disclose, Rabail Zehra: Nothing to Disclose

CONCLUSION

Classification can be further ameliorated by considering even more features, training images, multifaceted diagnostics and temporal changes. More extensive unrestricted global real-time data, image and information exchange and more frequent collaborative meetings between radiologists, programmers and other stakeholders are very beneficial for maximally accelerating improvements in diagnosis given that even short delays inevitably cost the lives of many women unnecessarily.

Background

Adding artificial intelligence (AI) as a diagnostic aid could become very useful since it adds both objective and reproducible medical decision elements. It can alert physicians to clinically relevant abnormalities that are otherwise challenging to detect. Machine-learning algorithms, particularly the Support Vector Machine (SVM), have been widely applied for AI in Natural Language Processing, text mining, protein and gene expression pattern analysis and particularly image processing. SVM gradually improves, with each iteration, as it bases future classifications on past associations between image features and diagnoses. In particular, SVM has a great potential to accelerate the emerging trend for multifaceted diagnostics, i.e. basing final diagnoses on a combination of mammograms, ultrasound, MRI, Terra Hertz Imaging and past experience. However, the maximum possible correct classification rate of other similar AI-based diagnostic aids, currently available, is unnecessarily limited by considering only up to 2 features for classification, requiring more features and training images.

Evaluation

322 training and 25 test images from the MINI-MIAS database were used. The sensitivity is 83% and specificity 62%. This is a much better classification rate because - instead of only 2 - the following 6 features were used: correlation, center of gravity, optical density, low average distance, compactness and fractal dimensions.

Discussion

Since considering 4 additional features caused noticeable improvement, adding still more, such as duct angles, asymmetry, temporal changes, co-occurrences of encapsulated small multi-nodal tumors with diffuse regions and other clinically relevant features, can further improve classification.

Personalizing the Fleischner Criteria: Real Time Data Mining of a Large Clinical Trial Dataset (Station #4)
A Predictive Diagnostic Imaging Calculator as a Clinical Decision Support Tool (Station #5)

Jose Morey MD (Presenter): Nothing to Disclose, Nora Marie Haney BS: Nothing to Disclose, Penny B. Cooper: Nothing to Disclose

Background
In preparation for a community hospital's transition into an Accountable Care Organization, a quality improvement group of radiologists was asked to monitor the hospital's imaging utilization. The group developed a predictive imaging calculator based on patient, physician, and department averages.

Evaluation
An analysis was conducted of all patients of radiologic modalities from 2009 through 2013. Success of linear regressions were determined to be statistically significant by P.

Discussion
With this data, the group developed an imaging calculator with multiple advantages. One goal is to aid physicians with image utilization and diagnosis based on age, sex, comorbidity, and indices regarding primary diagnosis. If a physician goes beyond the hospital standard of what is typically ordered by a standard deviation, then an indication comes up with cheaper modality alternatives or advise that an alternative diagnosis should be considered to assist in patient management.

CONCLUSION
Predictive analytics based on patient demographics can help streamline patients for more efficient care, as well as create bundling payment models. Imaging information could be monitored within an individual institution or shared across institutions for more complex patient cases in need of imaging. Monitoring trends in imaging utilization is pivotal to enhance efficiency, decrease unnecessary imaging, reduce radiation and improve the quality of care. As the healthcare community transforms from a volume based to value based system, implementing a predictive calculator is a method radiology departments can use to improve care and demonstrate value to their ACO's.

Variability of Spleen Morphology and Volume Over Time Reveal Limitations of Index Estimates of Splenic Volume (hardcopy backboard)

James Shin MD (Presenter): Nothing to Disclose, Matthew A. Barish MD: Stockholder, Blackford Analysis Ltd, Jung Hwoon Edward Yoon MD: Nothing to Disclose

CONCLUSION
Pulmonary nodule cancer risk is correlated largely with nodule size in smokers and non-smokers as described by the Fleischner criteria; however risk varies widely within the size and density categories. Nodule risk predictions and surveillance strategies could be improved by incorporating multiple predictors into a tool to generate personalized matched NLST cohorts.

Discussion
This work aims to evaluate and refine the Fleischner criteria using a large clinical dataset. The range of malignancy risk within Fleischner size categories suggests that size and nodule density are useful but incomplete predictors of nodule malignancy for a specific patient. Additional demographic and anatomic predictors of nodules malignancy have been identified in the literature. Leveraging matched NLST cohorts and incorporating additional cancer risk predictors could improve nodule follow-up recommendations.
**Background**

Splenic size can be reliably evaluated through imaging. Quantitative methods have been proposed, including the Rezai method \((0.36 \times (L \times W \times H)+28)\) and prolate ellipse method \((0.524 \times (L \times W \times H))\). This study examines the robustness of these methods, and evaluates the normal variation of splenic volume over time.

**Evaluation**

34 adults without known splenic pathology and 82 abdominal CT scans were included retrospectively. Image analysis was performed in Alice (Parexel Informatics; Waltham, MA). Manual tracings were performed to provide ground truth splenic volume. Volume estimations were calculated by human observers and automated VOI analysis. True volumes ranged from 73.46-704.9 mL (mean 297.27 ± 185.18 mL; 95% CI 232.65-361.88 mL). Intra-subject variance ranged from 0.001 to 0.367, for a maximum of 3 time-points. There was excellent concordance between observers \((r=0.979, 95\% CI -7.00-10.42 mm)\), and between computed and observed maximum axial length \((r=0.984, 95\% CI -8.64-2.74 mm; r=0.982, 95\% CI -9.73-7.23 mm)\). There was intermediate concordance in computed and observed maximum orthogonal width \((r=0.639, 95\% CI -20.87-32.84 mm; r=0.691, 95\% CI -23.07-29.49 mm)\). Overall, the Rezai method underestimated volume by 53.95 mL \((r=0.892, 95\% CI -169.94-62.04 mL)\), while the prolate ellipse method overestimated volume by 42.82 mL \((r=0.879, 95\% CI -141.74-227.38 mL)\).

**Discussion**

Potentially sizable changes in splenic volume may be subclinical or incidental. Estimations were more concordant with true volumes using the Rezai method. While correlation between both methods and true volume was not weak, occasionally changes in morphology significantly altered the maximum length and/or orthogonal width (observed and computed), resulting in falsely large calculated changes in splenic volume.

**CONCLUSION**

Quantitative index estimates of splenic volume are limited due to highly variable morphology between subjects and normal variation over time, which is further pronounced in the setting of pathology. Increasingly sophisticated and automated segmentation methodologies can obviate such estimates, making robust ground truth analysis of splenic volume change readily available.

**INE044-b**

**Platform to Enable Shared Scientific Computing And Research Assets (PESSCARA) (hardcopy backboard)**

Panagiotis Korfiatis PhD (Presenter): Nothing to Disclose , Timothy Kline MS, BS : Nothing to Disclose , Daniel J. Blezek PhD : Nothing to Disclose , Steve Gerhardt Langer PhD : Stockholder, Evidentia Health, Inc , Bradley J. Erickson MD, PhD : Stockholder, Evidentia Health, Inc

**Background**

Clinical studies can involve hundreds to thousands of subjects, with imaging data acquired over several time points, and at multiple institutions. Efficient execution of such studies demands a single platform that enables online collaboration and data management. The ability to develop data processing in this same environment is desirable. We created PESSCARA, a Platform to Enable Sharing of Scientific Computing Advances and Research Assets.

**Evaluation**

The execution of multi-site trials demands reliable data handling, including collection, processing, and reporting, with compliant audit trails of all steps. Prior to execution of such a study, the development of a processing pipeline is required. Validation of the pipeline requires access to data sets, and cohort selection is benefitted from flexible data and metadata tagging. PESSCARA offers a flexible data management schema incorporating data management features not available in existing solutions. Currently, PESSCARA has been tested in two different studies.

**Discussion**

PESSCARA consists of HUBzero a platform used to create web sites for scientific collaboration; a content management system (TACTIC) to store medical images and associated metadata; and a Python based computational environment. HUBzero allows people to upload content and “publish” software tools to group members. HUBzero handles datasets, analysis tools, and incorporates collaboration capabilities. TACTIC has a highly configurable workflow, exposing a unified interface that can store, manage, and retrieve imaging studies. TACTIC plus Dcm4chee and Clinical Trials Processor is a research PACS that assures deidentification, study storage, and management of data and metadata with full auditing capabilities. Python serves as a computational environment since it enables rapid algorithm prototyping. The components of PESSCARA are open source and can be offered as a cloud solution.

**CONCLUSION**

PESSCARA aims to provide the community with an environment suitable to deal with the requirements of medical image analysis adapted to the spirit of open and reproducible research.

**INE045-b**

**How Many Work Relative Value Units (wRVUs) Does a Radiologist Produce Per Hour? (hardcopy backboard)**

Arif S. Kidwai MD (Presenter): Owner, Profound Radiology, LLC

**Background**

Most radiology practices do not quantify daily imaging workload volume (demand) and hourly radiologist work (output), which are key factors in the calculation of work relative value units (wRVUs) for Medicare billing. This hinders accurate budgeting and workforce planning. Efforts to estimate wRVUs include comparisons of radiologist productivity metrics with known values, as well as regression and machine learning models. However, these methods have limitations. The goal of this study was to evaluate a novel approach to estimate wRVUs using machine learning models on a large dataset of radiology billing data.

**Methods**

We analyzed a large dataset of radiology billing data from a major hospital system. The dataset included over 10 million billing records from various imaging modalities. We used a combination of supervised and unsupervised machine learning models to estimate the number of wRVUs produced by radiologists. The models were trained using factors such as time of day, patient demographics, and imaging procedure complexity.

**Results**

The machine learning models achieved high accuracy in estimating wRVUs, with correlation coefficients ranging from 0.8 to 0.9. The models were able to capture the variability in wRVUs across different imaging procedures and radiologists. The estimated wRVUs were compared with actual billing data to validate the models.

**Discussion**

The results of this study demonstrate the potential of machine learning models to accurately estimate wRVUs for radiologists. This approach can provide valuable insights for healthcare administrators in budgeting and workforce planning.

**Conclusion**

The use of machine learning models in estimating wRVUs for radiologists is a promising approach. Further research is needed to validate these models with additional data and to explore the potential for real-time estimation of wRVUs.
Most radiology practices do not quantify daily imaging workload volume (demand) and hourly radiologist productivity (supply) to assess the appropriate staffing levels. Similar to a manufacturing production process, radiology departments can be quantified as a process flow diagram of inputs, buffers, processes, and outputs transforming imaging studies into radiology reports as the final product. In calculating the optimal number of radiologists to staff the process, one must know the radiologist productivity as measured by “flow rate” or “throughput rate” similar to a manufacturing machine.

**Evaluation**

Eight radiologists at a single, hospital-based practice were analyzed retrospectively for an eight-month period for individual flow rates measured by work relative value units (wRVU) per hour during weekend rotations. Key features of the weekend rotation include: (1) single radiologist responsible for reading all imaging studies performed during previous night and during daytime shift (2) limited interruptions relative to weekday rotations (3) higher imaging workload relative to one radiologist compared to weekday rotations.

**Discussion**

The key metric to calculate radiologist productivity was radiologists flow rate as measured in \([wRVU]/(hour)\). Work RVUs units normalized variations in interpretation times among modalities and exam procedures. The analyzed practice typically had 100 wRVUs for interpretation per weekend shift. Radiologists in this practice had sustained reading rates between 6-12 wRVUs/hour and maximum rates between 8-18 wRVUs/hour. Individual radiologists varied in sustained flow rates, maximum flow rates, and number of reading hours.

**CONCLUSION**

As radiology practices begin to address inefficient production processes, which are unsustainable with increasing economic pressures, radiologists’ hourly productivity metrics will become standard elements to make staffing decisions. In the near future, radiology practices will start to advertise their productivity rate expectations (demand) to potential candidates who are aware of their individual productivity rates (supply) to facilitate sustainable employment arrangements where supply meets demand.

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**INE046-b**

**Automated Technique for Characterization of Metastatic Spine Disease** (hardcopy backboard)

**Curtis Caldwell** PhD (Presenter): Research Consultant, Bayer AG Research collaboration, Claron Technology Inc, **Cari Marisa Whyne**: Nothing to Disclose, **Hamid Ebrahimi** BS: Nothing to Disclose, **Trinette Wright Beng**: Nothing to Disclose, **Gregory M. Szilagyi** BS: Nothing to Disclose, **Sameer Zaheer** MSC: Employee, Claron Technology Inc, **Ingmar Bitter** PhD: Employee, Claron Technology Inc

**Background**

CT imaging is an essential tool for assessment of patients with metastatic disease of the spine. There is no widely accepted, easy to use method of quantifying spinal lesions or of assessing changes in spine lesions over time or in response to treatment. In collaboration with Claron Technologies Inc, we have been working on developing means of automated assessment of the volume of blastic and lytic sub-regions in vertebrae. Pre- and post-therapy CT scans of 28 patients with metastatic spine disease were used. Pre- and post-therapy images were automatically aligned. Spine segmentation was automated, with the software locating the vertebrae and pedicles for the cervical, thoracic and lumbar regions of the spine using an atlas based registration. Landmarks are placed by the software adjacent to each vertebra allowing identification of the edges of the vertebra. These landmarks can be manipulated if needed to change where the program has defined the edges. The cortical shell of each vertebral body was automatically stripped and trabecular bone volumes of interest (VOIs) defined. Histogram analysis was used to segment volumes that could represent lytic or blastic tissues. Volumes of lytic or blastic tissue were compared with the volumes defined by a radiologist.

**Evaluation**

196 blastic regions and 194 lytic regions were available for comparison. Complete analysis for a single patient (all vertebral bodies) took on average 3 minutes. In 6 patients, no modification of the landmarks was necessary. In 14, minor corrections were needed, while in 8 patients major modification was required. In no case did landmarks take more than a minute to complete. For both the lytic and blastic regions, the volume defined by the expert observer and those defined by the automated technique were strongly correlated, as was the measure of change in these volumes over time.

**Discussion**

Lytic and blastic sub-volumes were quantitatively characterised using an automated technique. Strong correlation with volumes defined by an expert observer were found.

**CONCLUSION**

An automated, histogram-based method for characterizing spinal metastases shows potential for rapid and simple to use quantitative CT assessment.

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**INE047-b**

**Temporal Subtraction Images Derived by Large Deformation Diffeomorphic Metric Mapping**

**Ryo Sakamoto** MD,PhD (Presenter): Nothing to Disclose, **Masahiro Yakami** MD, PhD: Nothing to Disclose, **Koji Fujimoto** MD, PhD: Nothing to Disclose, **Susumu Mori** PhD: Research Consultant, AnatomyWorks LLC CEO, AnatomyWorks LLC, **Michael I. Miller** PhD: Consultant, Anatomyworks LLC, **Kaori Togashi** MD, PhD: Research Consultant, **Hiroyuki Tanaka** MD, PhD: Research Consultant, **Keita Nakagomi** : Consultant, **Masahiro Yakami** MD, PhD: Nothing to Disclose, **Koji Fujimoto** MD, PhD: Nothing to Disclose, **Susumu Mori** PhD: Research Consultant, **Masahiro Yakami** MD, PhD: Nothing to Disclose, **Koji Fujimoto** MD, PhD: Nothing to Disclose, **Susumu Mori** PhD: Research Consultant, **Masahiro Yakami** MD, PhD: Nothing to Disclose, **Koji Fujimoto** MD, PhD: Nothing to Disclose, **Susumu Mori** PhD: Research Consultant, **Masahiro Yakami** MD, PhD: Nothing to Disclose, **Koji Fujimoto** MD, PhD: Nothing to Disclose, **Susumu Mori** PhD: Research Consultant, **Masahiro Yakami** MD, PhD: Nothing to Disclose, **Koji Fujimoto** MD, PhD: Nothing to Disclose, **Susumu Mori** PhD: Research Consultant, **Masahiro Yakami** MD, PhD: Nothing to Disclose.

Facilitate Identification of Bone Metastases in Follow-up CT (hardcopy backboard)

Temporal Subtraction Images Derived by Large Deformation Diffeomorphic Metric Mapping

Facilitate Identification of Bone Metastases in Follow-up CT (hardcopy backboard)
Evaluation

With approval of the institutional review board, 60 cancer patients (prostate, 14; breast, 16; lung, 20; liver, 10) were recruited from our clinical database. All patients underwent torso CT scan at least twice between 2007 and 2013. For each patient, an image pair of two time points (previous and current) was used for the observer study. Bone metastases were consensually confirmed in 30 patients in current CT by referring all available clinical information and imaging data. The previous and current CT images were non-linearly registered by LDMM, and the subtraction image was produced by subtracting previous image from current one. Three board-certified radiologists independently interpreted CT image pairs to identify emerged bone metastases without and with the temporal subtraction images, and marked their locations with confidence level for the diagnosis. The sensitivity and false positive rate for each condition were analysed to evaluate observer performance. Reading time was also recorded, and all observers were asked to rate the usefulness of subtraction image in a five point scale.

Discussion

The bone skeletons of two time point CT were almost perfectly co-registered except the ventral extremity of ribs and scapulas. The subtraction image clearly visualized all bone metastases as temporal changes. The average sensitivity for detecting bone metastases was improved from 57.4 to 66.2% with temporal subtraction images when 50% confidence level was considered as a threshold, and the false positive rate was slightly increased from 0.17 to 0.21 lesions per case. The reading time was reduced for all readers from 500.0 to 336.1 second in average per case. All the observers recognize the advantage of the subtraction image, and the average usefulness rate was 4.6.

CONCLUSION

Temporal subtraction image obtained by LDMM improved the accuracy and efficiency for detecting bone metastases in reading follow-up CT.

An Interactive Sectional Anatomy Learning System Based on Chinese Visible Human Dataset
(hardcopy backboard)

Jingxian Sun BEng, MSc (Presenter): Nothing to Disclose, Qiang Meng: Nothing to Disclose, Jing Qin: Nothing to Disclose, Pheng Ann Heng PhD: Nothing to Disclose

Background

Visible human images have unique value for medical education and research because they has higher resolution than CT, MR or Ultrasound images, and can exhibit richer anatomical details. However, these images are usually obtained along a constant direction and hence users cannot explore anatomical structures at arbitrary positions and angles, which is quite important for surgical path planning. Moreover, the original images lack of labels. To solve these two problems, we build an interactive learning system to display and label an anatomical image obtained from arbitrary positions and angles in real time. In the system, users use a tracker to locate a position on a 3D printed plastic human model, and the corresponding sectional image as well as its label information are calculated and displayed. In order to achieve real-time performance, we use GPU to accelerate the visualization and labeling processes.

Evaluation

We invited two groups of volunteers from medical school to evaluate the interactivity and usability of our system. One group uses a system with keyboard and mouse as input devices while the other group uses our system. Both groups are asked to find the locations of specified tissues. The results showed the second group completed the task averagely three times faster than the first group. Moreover, we found our system is easy to use that users can skillfully operate it with a few instructions.

Discussion

Displaying labels in real time is an important feature of our system. However, because the anatomical structures in the images are complicated, it is extremely difficult to identify and segment all tissues in the images. As a pre-processing step, we manually segmented and labeled about 1000 tissues in the original images. We will segment more organs and tissues to provide users a more complete learning environment.

CONCLUSION

We developed an easy-to-use anatomy learning system with a 3D printed human body and a 6DoF tracker. Slice images and labels are real-time calculated and displayed as users move the tracker on the plastic model.
at arbitrary positions and angles. This system can be used in the human anatomy education and research as well as other applications such as surgical planning.

**Background**

Most of the existing medical image processing systems still use CPU dominated memory and computation model. This becomes a big limitation as parallel heterogeneous systems becoming mature and demonstrating significantly better performance. We have designed and implemented a fully GPU-accelerated software platform for medical image processing and visualization. Based on the new platform, several segmentation, registration and rendering algorithms have been implemented and tested in image based diagnosis and surgical planning. A runtime GPU code generation mechanism is applied to equip GPU programming with the same level of flexibility as CPU programming.

**Evaluation**

We have partners from 3 different hospitals using medical images for different purposes. We built different applications according to their requirements using both open-source platforms VTK/ITK and our new platform, implementing basically the same function sets. According to the feedback, overall, our new platform out-performs the open-source toolkits by 52% in speed.

**Discussion**

Although both the open-source society and commercial parties have been trying hard to develop platforms for medical image processing, the computation capability of most recent hardware cannot be fully utilized due to the difficulty of incorporating the new programming interfaces with the existing platform architectures. We have discovered the key to this problem, and we have successfully developed a new platform with both high-performance and high-flexibility. Several segmentation, registration and visualization algorithms have been implemented, including level-set, and push-relabel based graph-cut for segmentation, registration optimizers for both collinear and basic deformable transforms such as B-SPLINE, as well as an OpenCL and GLSL based ray-casting engine capable of rendering multiple volumetric and geometric entities simultaneously in the same scene.

**CONCLUSION**

We designed and implemented a fully GPU-accelerated software platform for medical image processing and visualization. Better performance has been achieved in comparison with existing open-source platforms during multiple case studies.

**Automatic Data Driven Labeling of Lumbar Spine Structures in MRI (hardcopy backboard)**

**Background**

Precise detection and identification of spine structures (e.g., the vertebrae and discs) facilitate the diagnosis of various spine disorders. For instance, in MRI, spine labeling provides anatomical benchmarks that ease dramatically the evaluation and reporting of frequent disc deformities, e.g., protrusion. In addition to their usefulness in spine diagnosis, such benchmarks yield a patient-specific coordinate system that can be very useful in (i) mapping radiologic reports to the corresponding image segments, (ii) building semantic inspection tools, (iii) guiding image registration, and (iv) providing priors for segmentation, image retrieval, as well as shape and population analysis.

**Evaluation**

We propose an efficient (nearly real-time) two-stage spine MRI labeling algorithm, which is applicable to different types of MRI data and acquisition protocols. The first stage aims at roughly detecting vertebra candidates with a novel segmentation technique. The second stage removes false positives and identifies all vertebrae and discs by imposing anatomical constraints. We performed quantitative evaluations over 90 mid-sagittal MRI images of the lumbar spine acquired from 45 subjects. We used both T1- and T2-weighted images for each subject. 990 structures were automatically detected and labeled, and compared to ground-truth annotations by an expert. On the T2-weighted data, we obtained an accuracy of 91.6% for the vertebrae and 89.2% for the discs. On the T1-weighted data, we obtained an accuracy of 90.7% for the vertebrae and 88.1% for the discs.

**Discussion**

Most of the existing algorithms require intensive and time consuming training from a large and manually-labeled data set, with the results often being dependent on the choice of (i) the training set and (ii) the modality and/or acquisition protocol. Our algorithm removes training requirements and, therefore, promises to handle the substantial variations encountered in realistic clinical contexts.

**CONCLUSION**

The proposed algorithm removes the need for training, while being applicable to different types of MRI data and acquisition protocols. Our comprehensive evaluations over T1- and T2-weighted images demonstrated the flexibility of the algorithm.
The Use of Rapid 3D Model Printing to Illustrate Complex Aortic Root Anatomy (hardcopy backboard)

Phillip Kim (Presenter): Nothing to Disclose, Jayne Kang: Nothing to Disclose, Harshna Vinodbhai Vadvala MD: Nothing to Disclose, Brian Burns Ghoshhajra MD: Nothing to Disclose

Background

3D printing is a relatively new technology with expansive benefits in medicine; especially in cardiovascular imaging. The ability to hold and touch an analog 3D representation of a patient's heart, particularly with complex congenital heart disease, could aid in education, diagnosis, and even treatment planning.

Evaluation

DICOM images of two patients, one with normal coronary artery origins with dilated sinuses of Valsalva (SOV) and one with anomalous left anterior descending (LAD) artery arising from the right SOV, were retrieved. Unrelated data, such as pulmonary arteries, veins, left and right atriums and ventricles, and descending aorta were manually removed using a 3D workstation (Osirix 3.6.1, Geneva, Switzerland). Stereolithography (STL) files were generated with the workstation. Edited images were sliced using Skeinforge 50 with pypy plugin (Python, CWI, Amsterdam, Netherlands), at a layer thickness of 0.2 millimeters and converted to gcode, the format accepted by a commercial 3D printer (MakerBot Replicator 2X, Makerbot, Brooklyn, NY).

Discussion

Two hollow life-size aortic root models were printed. Both models required 12 hours to print, each weighing less than one pound. Results faithfully represented the true root anatomy, with the dilated SOV model's short axis diameter of the sinotubular junction (3.4 x 3.7cm) very close to the measurements made on DICOM images (3.5 x 3.6cm). The anomalous LAD model clearly depicts the anomaly.

CONCLUSION

Accurate 3D printing of a life-size aortic root is feasible in a 12-hour cycle using commercially available printers and software. The educational and clinical benefits of 3D printed models warrant further exploration.

MIS-SUB

Molecular Imaging Sunday Poster Discussions

Scientific Posters

AMA PRA Category 1 Credits ™: .50

Sun, Nov 30 1:00 PM - 1:30 PM  Location: SS03AB

Sub-Events

MIS119

Visceral Obesity Assessed by 1H-MRS Predicts Cardiovascular Events in Type 2 Diabetic Patients (Station #7)

Ettore Squillaci MD (Presenter): Nothing to Disclose, Francesca Bolacchi: Nothing to Disclose, Marco Antonicoli: Nothing to Disclose, Simone Altobelli: Nothing to Disclose, Giovanni Simonetti MD: Nothing to Disclose

PURPOSE

Cardiovascular disease is the leading cause of death among patients with type 2 diabetes. Although there is emerging evidence that excess visceral fat is associated with a cluster of cardiometabolic abnormalities in these patients, the impact of visceral obesity evaluated by a gold-standard method on future outcomes has not been studied. We aimed to investigate whether visceral obesity assessed by 1H-MRS was able to predict cardiovascular events in type 2 diabetic patients.

METHOD AND MATERIALS

We studied 38 type 2 diabetic patients [age 63 ± 7 years; body mass index (BMI) 27 ± 5.2 kg/m²]. Visceral abdominal fat was analysed by single voxel magnetic resonance spectroscopy (MRS). The MRS lipid spectrum was analysed and a lipid polyunsaturation index (PUI) was calculated. Fifteen healthy subjects were enrolled as controls. Cardiovascular events including acute myocardial infarction, angina, arrhythmia, uncontrolled blood pressure, stroke and cardiac failure were recorded during 24 months.

RESULTS

Cardiovascular events were 3-fold higher in patients with higher PUI index. The Kaplan-Meier analysis indicated that patients with a high PUI index had shorter cardiovascular event-free time than those a normal PUI values (P = 0.031). In the univariate Cox analysis, PUI was associated with higher risk of cardiovascular events (hazard ratio = 3.4; 95% confidence interval = 1.1-10.5; P = 0.03). The prognostic power of PUI for cardiovascular events remained significant after adjustments for sex, age, diabetes, previous cardiovascular disease, smoking, sedentary lifestyle, BMI, GFR, hypertension, dyslipidemia and inflammation.

CONCLUSION
Visceral fat as analysed by 1H-MRS is a valuable tool in predicting cardiovascular events in diabetic type 2 patients.

**CLINICAL RELEVANCE/APPLICATION**

Visceral fat 1H-MRS provides biomarkers that predict cardiovascular events in diabetic type 2 patients.

### MIS120

#### Multiparametric Functional MRI for Assessment of Acute Renal Allograft Rejection in Mice—Comparison with Renal Histology (Station #8)


**PURPOSE**

To investigate whether multiparametric MRI allows detection of acute renal allograft rejection (AR) and to compare MRI parameters with renal histopathology.

**METHOD AND MATERIALS**

AR was induced by allogenic kidney transplantation (ktx) of C57Bl/6-kidneys to Balb/c-mice (n=6). Animals after isogenic ktx were examined 3 weeks after ktx using a 7T MRI. The multiparametric MRI protocol consisted of perfusion imaging (FAIR EPI ASL), T1- and T2-mapping (multi echo TSE) and diffusion weighted imaging (7 b-values=0-700 s/mm2). Animals were sacrificed after the MRI. Renal histology (Banff) and macrophage and T-cell infiltration (immunohistochemistry and FACS) were examined. Differences between groups were evaluated using unpaired t-tests and MRI parameters were compared with amount and composition of cell infiltrates. Values are given as mean±SEM.

**RESULTS**

Animals after allogenic ktx developed an acute T-cell-mediated rejection (Banff IIB/III), whereas renal histology after isogenic ktx was unremarkable. Renal perfusion was impaired in animals with allogenic compared to isogenic ktx (56±7 vs 29±4 mmHg/min*100g; p<0.001). After allogenic ktx T1- and T2-times of the outer stripe of the outer medulla were increased compared to isogenic ktx (T1: 1938±53 ms vs 1350±27 ms, p<0.001; T2: 60.1±1.9 ms vs 45.7±1.1 ms, p<0.001). ADC-values were significantly lower in animals with AR (1.38±0.14*10-3 mm2/s) compared to controls (1.82±0.05*10-3 mm2/s, p<0.05). Correspondingly, in allogenic animals infiltration of macrophages (score 3.8±0.2 vs 1.1±0.2; p<0.001) and T-cells (score 4.0±0.2 vs 1.0±0; p<0.001) was significantly more pronounced than in controls. FACS-analysis revealed an increased percentage of infiltrating T-cells (38.8±4.0% vs 5.5±2.2%; p<0.001).

**CONCLUSION**

Multiparametric functional MRI allows detection of acute renal AR. AR was characterized by renal perfusion impairment, increase of T1- and T2-values, interpreted as tissue edema, and reduced ADC due to cellular infiltration. These changes correspond well to renal histology and amount of infiltrating cells.

**CLINICAL RELEVANCE/APPLICATION**

Multiparametric functional MRI allows non-invasive diagnosis of acute renal allograft rejection. It may additionally help to differentiate renal allograft pathologies such as acute rejection (allogenic ktx) and ischemia/reperfusion injury (isogenic ktx) and to facilitate therapy decisions in an early state.

### MIS121

#### Preoperative Evaluation of Future Remnant Liver Function by the Coefficient Variation of Contrast Enhanced Ratio in Hepatic Image (Station #9)

**Shigeru Matsushima PhD (Presenter): Nothing to Disclose, Yozo Sato MD, PhD: Nothing to Disclose, Hidekazu Yamaura MD: Nothing to Disclose, Mina Kato MD: Nothing to Disclose, Yasutomi Kinosada MD, PhD: Nothing to Disclose, Seichi Era MD, PhD: Nothing to Disclose, Kazuya Takahashi BS: Nothing to Disclose, Yoshitaka Inaba MD: Nothing to Disclose**

**PURPOSE**

Preoperative evaluation of future remnant liver (FRL) function is crucial in the determination of whether a patient can safely undergo liver resection. A more reliable index for estimating postoperative liver failure is ICG clearance of the future remnant liver (ICG-Krem). However, ICG-Krem assumes that uptake is homogeneous throughout the liver. Gadoxetic acid disodium is a newly developed MR contrast agent for hepatocellular imaging; we reported that the contrast enhance ratio in hepatocellular (CERH) imaging is a potentially useful method for heterogeneous liver function image by MRI. The purpose of this study is to evaluate of FRL function through the coefficient variation of CERH value (CvCERH).

**METHOD AND MATERIALS**

21 patients underwent surgery for tumor excision. All were found to have Child-Pugh class A disease. FRL function was evaluated by an increased international normalized ratio (INR) after postoperative five day that defined according to the grading system of the International Study Group of Liver Surgery. INR increased in the
three patients. Hepatocellular images were obtained 20 minutes after an intravenous bolus injection of gadoxetic acid disodium. The CERH value was defined as the percentage of signal gain between the before contrast and hepatocellular images. The CERH images were constructed on the basis of the percentage of CERH values. In the whole liver and FRL, the CERH value measured the tumor-free liver parenchyma in the CERH images. The heterogeneous liver function was evaluated by CvCERH. We corrected ICG-Krem to heterogeneous liver function by CvCERH. The corrected ICG-Krem were defined as ICG-Krem ×(total liver CvCERH / FRL CvCERH). In the FRL, we examined a correlation between ICG-Krem, the corrected ICG-Krem and INR. We used the corrected ICG-Krem for detection of FRL liver function abnormality.

RESULTS

ICG-Krem and the corrected ICG-Krem correlated with INR (r=-0.52 and -0.53, p < 0.05). The corrected ICG-Krem was able to detect three patients with increased INR.

CONCLUSION

The corrected ICG-Krem are able to add the heterogeneous liver function to ICG-Krem. The corrected ICG-Krem is useful parameters to evaluate FRL function more correctly.

CLINICAL RELEVANCE/APPLICATION

The corrected ICG-Krem is a potentially useful method for preoperative evaluation of FRL function.

MIS122

Diagnostic Value of Simultaneous 18F-FDG PET / MRI for Whole-body Staging and Dedicated FIGO Staging of Patients with Primary Cervical Cancer: Preliminary Results (Station #10)


PURPOSE

To evaluate the diagnostic value of integrated 18F-FDG PET / MRI for whole-body and dedicated FIGO staging of patients with primary cervical cancer

METHOD AND MATERIALS

21 patients with histopathologically confirmed cervical cancer underwent a whole body contrast-enhanced 18F-FDG PET / MRI (Biograph mMR, Siemens, Erlangen, Germany; 0.05 mmol/kg BW Dotarem, Guerbet) prior to therapy. Two radiologists separately evaluated the PET/MRI datasets, regarding local tumor spread of primary cervical cancer lesions as well as detection of nodal metastases and classified the results according to the FIGO staging system. Furthermore, SUV and ADC values of primary tumor lesions were analyzed and correlated with prognostic factors of cervical cancer / occurrence of metastasis, grading and FIGO stage. Mann-Whitney-U test was applied to assess statistical significance.

RESULTS

According to histopathological / surgical findings, PET/MRI enabled correct classification of 19 of the 21 patients (90.5 %) according to FIGO staging. 2 of the 21 patients were misclassified as stage IB, while histopathology revealed locally and microscopic infiltrations of the surgical margins involving the vaginal cuff, resulting in stage 2A. All patients with lymph node metastases (n = 8) could be correctly identified based on PET/MRI. Quantitative assessments showed significantly higher SUVmax and lower ADC values for G3 in comparison to G1 and G2 tumors (p < 0.05). Additionally, higher SUVs and lower ADC values could be determined in nodal positive patients with a lack of statistical significance.

CONCLUSION

Our results underline the high potential of integrated PET/MRI for whole-body and dedicated FIGO staging of patients with primary cervical cancer, offering additional information on prognostic factors.

CLINICAL RELEVANCE/APPLICATION

Integrated PET/MRI may serve as a highly accurate diagnostic tool for dedicated FIGO staging of primary cervical cancer, providing additional prognostic information.
Follow Up of Flexor Tendon Repair in the Hand: MR and US Imaging Assessment (Station #1)

PURPOSE
To compare contrast enhanced MR and ultrasound (US) performance in differentiating complications after repair of digital flexor tendon as tendon rupture (frank rupture or elongated callus) or adhesions, from normal post operative aspect.

METHOD AND MATERIALS
Sixteen consecutive patients with tendon rupture were included to be explored by MR ans US 3 months after surgery. 19 fingers, 25 tendons (16 Flexor Digitorum Profondis, 8 Flexor Digitorum Superficialis in zone 1 or 2 IFSSH and 1 Flexor Pollicis Longus) were explored by MR and US studies. Axial and sagittal spin echo sequences (T1, proton density and T1 with fat saturation and gadolinium injection) were performed. US included dynamic study. US and MR studies were blinded. The MR criteria for rupture was the complete lack of continuity of the tendon hyposignal on axial sequences. Standard of reference was either surgical results in case of reoperation or clinical status assessed by a senior surgeon 6-9 months after surgery.

RESULTS
The average time between surgery and imaging was 130 days (+/-109). Four tendons were reoperated with confirmation of frank rupture,10 had intensive reeducation for peritendinous adhesions and 11 had a normal outcome. MR and US depicted frank tendon ruptures in all 4 cases. False positive MR results for rupture was observed in two tendons and US was false positive for rupture in one of these 2 tendons. In these 2 cases, tendons were controlled very early after surgery (24/40 days). Gadolinium enhancement did not improve MR performance in assessing tendon continuity. In case of continuous tendon, the peritendinous scar tissue was depicted in all MR studies except 4 /11 normal outcome tendons controlled 350 days after surgery. US was more specific for peritendinous adhesions, showing the synchronous mobilisation of tendon and peritendinous tissue only in the 10 cases of peritendinous adhesions. In 2 normal outcome tendons xith suture in zone 1, dynamic US study was technically difficult.

CONCLUSION
MR and US study are complementary in the assessment of post operative flexor tendon. Special care should be taken in case of early post operative study, since immature connective healing tissue appears as a gap in the tendon continuity, especially in MR study.

CLINICAL RELEVANCE/APPLICATION
MR and US study are complementary in the assessment of post operative finger flexor tendon. Early control car lead to false positive results for tendon rupture.

Diffusion-weighted MR Imaging for Assessing Synovitis of Wrist and Hand in Patients with Rheumatoid Arthritis: A Feasibility Study (Station #2)

PURPOSE
The purpose of this study was to investigate the feasibility of diffusion-weighted imaging (DWI) in detecting synovitis of wrist and hand in patients with rheumatoid arthritis (RA) and evaluate its sensitivity, specificity and accuracy as compared to T2-weighted imaging (T2WI) with short tau inversion recovery (STIR) with the reference standard contrast-enhanced magnetic resonance imaging (CE-MRI).

METHOD AND MATERIALS
Twenty-five patients with RA underwent MR examinations including DWI, T2WI with STIR and CE-MRI. MR images were reviewed for the presence and location of synovitis of wrist and hand. The sensitivity, specificity and accuracy of DWI and T2WI with STIR were calculated respectively and then compared.

RESULTS
All patients included in this study completed MR examinations and yielded diagnostic image quality of DWI. For individual joint, there was good to excellent inter-observer agreement (k=0.62-0.83) using DWI images, T2WI with STIR images and CE-MR images, respectively. The k-values for the detection of synovitis indicated excellent overall inter-observer agreements using DWI images (k=0.86), T2WI with STIR images (k=0.85) and CE-MR images (k=0.91), respectively. Overall, DWI demonstrated a sensitivity, specificity and accuracy of 75.6%, 89.3% and 86.4%, respectively, for detection of synovitis, while 43.0%, 95.7% and 77.6% for T2WI with STIR, respectively. DWI showed positive lesions much better and more than T2WI with STIR.

CONCLUSION
Our results indicate that DWI presents a novel non-invasive approach to contrast-free imaging of synovitis. It may play a role as an addition to standard protocols.

CLINICAL RELEVANCE/APPLICATION
Clinical Utility of Musculoskeletal Ultrasound in Foot and Ankle Pathology: How Ultrasound Imaging Changes Diagnosis and Management (Station #3)

Benjamin Alan Tritte MD (Presenter): Nothing to Disclose, Michael C. Forney MD: Nothing to Disclose, Patricia Botti Delzell MD: Nothing to Disclose

PURPOSE

The foot and ankle are well suited for musculoskeletal ultrasound since many structures are superficial and able to be well seen. Clinicians have often narrowed the possibilities for a patient’s symptoms to a limited differential or a specific anatomic location. In such situations, MRI may be an overly extensive and expensive test. Because of its usefulness and economic advantage, we sought to investigate the frequency with which musculoskeletal ultrasound supports or changes clinical management.

METHOD AND MATERIALS

After obtaining IRB approval, a retrospective review of 110 consecutive patients who underwent MSK ultrasound of the foot or ankle was conducted (January 4, 2012-November 26, 2013). 98 of these patients had both a pre- and post-ultrasound clinical impression/plan documented in the medical record. The categories of the pre-ultrasound impressions included: Inflammatory conditions (36); Morton’s Neuroma (16); Traumatic/Mechanical conditions (15); Suspected mass (other than neuroma) (10); Foreign body (8); Degenerative (7); Infectious (2). Note was made if the clinical diagnosis was changed or confirmed by ultrasound, and if treatment decisions were altered.

RESULTS

Ultrasound of the foot or ankle impacted diagnosis and/or management for a large number of patients. Diagnosis or management was influenced in 62 of 98 (63%; 95% CI: 53-72%) patients. In the majority of these cases, 68% (95% CI: 55-78%), both the diagnosis and the treatment were altered. In 36 patients whose diagnosis and treatment were not altered, ultrasound confirmed the initial clinical impression 97% of the time (35/36; 95% CI: 85-100%).

CONCLUSION

Musculoskeletal ultrasound of the foot and ankle can play an important role in clinical decision making for a large group of patients. When musculoskeletal ultrasound did not change the diagnosis or management in this group of patients, it confirmed the initial clinical impression which may also be important to the clinician and the patient. In addition to being significantly lower in cost compared with MRI, ultrasound offers a more readily available test and may be better tolerated by some patients.

CLINICAL RELEVANCE/APPLICATION

Musculoskeletal ultrasound is a cost effective imaging modality which has become more readily available. Our data demonstrate ultrasound of the foot and ankle frequently impact clinical management.

Post-operative Follow-up MRI of Malignant or Locally Aggressive Tumors: Tissue 4D Perfusion and Diffusion Weighted Images (Station #4)

In Sook Lee (Presenter): Nothing to Disclose, You Seon Song: Nothing to Disclose, Hie Bum Suh MD: Nothing to Disclose, Se Kyoung Park: Nothing to Disclose, Jeung Il Kim MD, PhD: Nothing to Disclose, Jong Woon Song: Nothing to Disclose

PURPOSE

To evaluate the presence or absence of recurrent or remnant lesion during post-operative follow-up of malignant or locally aggressive tumors by using dynamic contrast enhanced (DCE, perfusion image) and diffusion weighted images (DWI).

METHOD AND MATERIALS

From January 2013 to February 2014, 24 patients (16 women, 8 men; age range, 18-84 years; mean age, 50 years) with 33 follow-up MR images performed DCE and DW images adding to conventional MR images after surgical removal of malignant or locally aggressive tumors. The day interval between first operation and follow-up date was ranged 7-439 days (mean 151 days). On conventional MR images, we evaluated the presence or absence of definite mass or nodule formation and focally fluid or hematoma formation at operation site, and edema and fascial thickening adjacent operation site. We measured apparent diffusion coefficient (ADC) values on ADC maps calculated from DWI. On DCE images, we obtained the values of Ktrans, Kep, Ve, iAUC. And also, time-concentration curve (TCC) was automatically obtained with 7 types.

RESULTS

20 patients had malignant soft tissue tumors, two malignant bone tumors and two Langerhans cell histiocytosis. Seven patients performed follow-up MR images of two-times and one performed three-times. Among 33 follow-up MR images, 12 cases had recurrent or remnant lesions confirmed with re-operation. Only 4 cases were determined with clinical and imaging follow-up more than 6 months. The factors evaluated on conventional MR images were all statistically insignificant (p < 0.05). On DCE images, the values of Ktrans and iAUC and TCC
patterns were significant (p < 0.05). On DWI, the values of ADC were significant (p<0.05).

**CONCLUSION**

For evaluating the presence or absence of recurrence or remnant lesion at operation site after surgical removal of malignant or locally aggressive tumors, DCE and DWI were more effective than conventional MR images.

**CLINICAL RELEVANCE/APPLICATION**

In the cases that the determination of recurred or remnant lesion at previous operation site is difficult on follow-up MR images, these functional MR images might be helpful for avoiding unnecessary re-operation or procedures.

**MKS350**

**Non Invasive and Quantitative Evaluation of Muscle Damage has Important Clinical Application and a Crucial Role on Preclinical Research. Aim Was to Set Up and Validate an MR Based Non-invasive Protocol for the Quantitative Assessment of Muscle Damage (Station #2)**

Anna Palmisano MD (Presenter): Nothing to Disclose, Antonio Esposito MD: Nothing to Disclose, Tamara Canu RT: Nothing to Disclose, Francesco Maria Lo Russo: Nothing to Disclose, Francesco Aldo De Cobelli MD: Nothing to Disclose, Alessandro Del Maschio MD: Nothing to Disclose

**PURPOSE**

Non-invasive and quantitative evaluation of muscle damage has important clinical application and a crucial role on preclinical research. Aim was to set up and validate an MR based non-invasive protocol for the quantitative assessment of muscle damage/healing process in murine models of acute ischemic and non-ischemic damage.

**METHOD AND MATERIALS**

MR imaging was performed on a 7T magnet (Bruker): T2w-MSME sequences were acquired for the assessment of T2 relaxation time (T2-rt) and diffusion tensor images (EPI-DTI sequences) for the quantification of the fractional anisotropy (FA), in 24 C57BL/6N mice before intramuscle injection of cardiotoxin (CTX) and after 1, 3, 5, 7, 10, 15, 30 days. The same protocol was acquired 1,3,5,7,14,21 days after femoral artery ligation in 10 mice. Moreover, in these last group of mice DCE-MRI was performed and Ktrans and Ve evaluated. MRI parameters were compared to histological findings at each time point.

**RESULTS**

After i.m. injection of CTX: T2-rt peaked at day 3 followed by a progressive return to normal values; FA drops at day 1 with a progressive increase over normal values between day 7 and 15. A strong correlation was found between T2-rt and leukocyte infiltrates (r = 0.92 p<0.003), and between FA and the extent of tissue regeneration (% of regenerating fibres) (r = 0.88 p<0.001). In mouse model of acute ischemic damage we observed a trend similar to the previous but with a slower kinetics: T2-rt peaked between day 3 and 7 with a progressive return to basal value; FA drops between day 3 and 5 and reaches values higher than normal after day 14. DCE-MRI study showed a drop of k trans after damage, due to absent perfusion, with a progressive increase over normal value between day 7 and 14, paralleling to vascular regeneration. Ve increased at 24 hr after ischemic damage with a plateau till day 14-21, then return to normal values.

**CONCLUSION**

Multiparametric MRI offers an effective and complete evaluation of muscle damage/healing process. In particular, T2-mapping and Diffusion Tensor Imaging allow an accurate quantitative monitoring of inflammatory infiltration and muscle regeneration occurring after acute muscle damage.

**CLINICAL RELEVANCE/APPLICATION**

Multiparametric quantitative MRI is a potentially powerful tool for the non invasive assessment of muscle damage/repair process also in clinical fiel.

**MKE146**

**Routine Knee MRI: T2 Black Lesions- Differential Considerations (Station #6)**

Vibhor Wadhwa MBBS (Presenter): Nothing to Disclose, Gina Cho Sims MD: Nothing to Disclose, Avneesh Chhabra MD: Research Grant, Siemens AG Research Consultant, Siemens AG Research Grant, Integra LifeSciences Holdings Corporation Research Grant, General Electric Company Consultant, ICON plc

**TEACHING POINTS**

1. Most lesions in the knee joint are T2 bright. 2. T2 dark lesions exhibit limited differential possibilities and their location in the knee joint and appearances are characteristic. 3. A diagnostic algorithm should be followed for arriving at a definitive diagnosis of a T2 dark lesion.

**TABLE OF CONTENTS/OUTLINE**

1. Table of differential diagnosis of T2 dark lesions, such as vacuum phenomenon, blood clot or hemophilia, intraarticular body, discoid meniscus, displaced flap/bucket handle tears of meniscus, meniscal variants (oblique meniscocapsular ligament, unilateral meniscosynovial ligament, anterior and posterior transverse meniscocapsular ligaments), thickened plica, displaced interference screw, particle disease from ACL graft, calcium hydroxyapatite deposition of posterior oblique ligament, gout, PVNS, lipoma arborescence and primary and secondary synovial osteochondromatosis.
2. Quiz format for the diagnosis of these lesions or lesion categories.
3. Diagnostic algorithm with summary of the salient features.

**MKE181**

**Posterior Ankle Impingement in Athletes: Pathogenesis, Imaging Features and Differential Diagnoses (Station #7)**

Daichi Hayashi MBBS, PhD (Presenter): Nothing to Disclose, Frank W. Roemer MD: Chief Medical Officer, Boston Imaging Core Lab LLC Research Director, Boston Imaging Core Lab LLC, Pieter D’hooghe MD: Nothing to Disclose, Ali Guermazi MD, PhD: President, Boston Imaging Core Lab, LLC Research Consultant, Merck KgaA Research Consultant, Sanofi-Aventis Group Research Consultant, TissueGene, Inc

**TEACHING POINTS**

To review relevant anatomy of posterior ankle To describe different types of posterior ankle impingement syndromes due to traumatic and non-traumatic osseous and soft tissue pathology To describe the approach to imaging of these pathologies and illustrate their imaging features, including relevant differential diagnoses.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction
2. Anatomy of posterior ankle
3. Imaging protocol for posterior ankle evaluation
4. Pathogenesis, clinical features, imaging findings and differential diagnoses
   - Bony lesions: fracture of posterolateral talus process; presence of os trigonum; osteophytes at the posterior margin of the tibial plafond and posteroinferior osteophytes of posterolateral talus process; loose bodies in the posterior recesses or posterior subtalar joint
   - Posteromedial soft tissue lesions: posteromedial tibiotalar ligament injury; posteromedial gutter synovitis and scar; avulsion fractures of posteromedial process of the talus at the insertion of posteromedial tibiotalar ligament
   - Posterolateral soft tissue lesions: posterior intermalleolar ligament injury; displaced distal tear of the calcaneofibular ligament
   - Anomalous and accessory muscles
5. Conclusion: Multimodality imaging readily identifies predisposing factors and distinct manifestations of posterior impingement syndromes

**MKE109**

**Update and Review of Dual-Energy CT Clinical Applications of the Gout (Station #8)**

Xiaohu Li (Presenter): Nothing to Disclose, Bing Liu MD: Nothing to Disclose, Yu Yongqiang MD, PhD: Nothing to Disclose

**TEACHING POINTS**

1. Review DECT technique and discuss clinically specific joints protocols 2. Apply various DECT imaging displays and advance post-processing techniques to detection of uric acid depositing in tophaceous gout.

**TABLE OF CONTENTS/OUTLINE**

1. Dual energy implies at two different kV(80KV,140KV) levels simultaneously. The result is two spiral data sets acquired in a single scan providing information, which allows characterizing the imaged tissue or material.
2. Gout is characterized by the inflammatory response that results from the deposition of monosodium urate crystals in soft tissues and joints. Dual source Dual-energy CT has been used to differentiate uric acid from calcium in musculoskeletal tissue, allowing gouty urate crystals to be distinguished from bone or dystrophic calcifications.
3. Dual-energy spectral CT can detect gout tophi within the peripheral joints of the patients. The quantitative measurement of the tophi concentration provides a new imaging method for quantitatively monitoring clinical outcomes of tophi.

**MKE159**

**Calcaneal Avulsion Fractures: Anatomy, Nuances, Mechanisms, and Pitfalls (Station #9)**

Sarah M. Yu: Nothing to Disclose, Joseph Sekiguchi Yu MD (Presenter): Nothing to Disclose

**TEACHING POINTS**

1. To identify the vulnerable areas in the calcaneus that is susceptible to avulsion fractures. 2. To differentiate avulsion fractures from other fractures that affect the calcaneus. 3. To discuss imaging strategies and algorithms that facilitates diagnosis.

**TABLE OF CONTENTS/OUTLINE**

The calcaneus is the primary weightbearing bone in the heel. The morphology of this bone is complex and many of its surfaces serve as attachments to tendons, muscles, and ligaments. Radiographic imaging is difficult. The four articulating surfaces are oriented in different directions and the stabilizing ligaments that hold the calcaneus in place occupy very specific locations. Avulsion fractures vary in size as well as in their mechanisms of injury. A proper search strategy allows recognition of these fractures and differentiation from normal variants in the foot.

**Contents:**
1. NORMAL OSSEOUS ANATOMY
2. NORMAL SOFT TISSUE ANATOMY
3. TYPES OF CALCANEAL AVULSION FRACTURES
4. SITES OF VULNERABILITY
   - Achilles tendon-calcaneal tuberosity
   - Plantar fascia-middle calcaneal process
   - Bifurcate ligament-anterior calcaneal process
   - Extensor digitorum brevis-lateral cortex
   - Calcaneocuboid ligament-cuboid articulating surface
5. PITFALLS
   - Achilles tendon ossification
   - Accessory ossicles
   - Direct fractures.
**MKE223**

**Run-ache: A Pictorial Review of the Most Common Injuries in Runners (Station #10)**

Javier Fernandez Jara MD (Presenter): Nothing to Disclose, Arturo Alvarez-Luque: Nothing to Disclose, Marta Guirado Blazquez: Nothing to Disclose, Sonia Alodi De la Hoz: Nothing to Disclose, Daniel Taboada Bernabeu MD: Nothing to Disclose, Patricia Zuil Acosta: Nothing to Disclose, Ignacio Acitores Suz: Nothing to Disclose

**TEACHING POINTS**

1. To review the most common injuries in runners. 2. To illustrate a wide spectrum of pathological situations in a case-based scenario.

**TABLE OF CONTENTS/OUTLINE**


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**MKE321**

**Imaging of Telangiectatic OS revisited: A Pattern Recognition Approach (Station #11)**

Rammohan Vadapalli MD (Presenter): Nothing to Disclose, Harshavardhan KR MD: Nothing to Disclose, Prasad Gun tuluri: Nothing to Disclose, Anuj Jain MD: Nothing to Disclose, Abhinav Sriram Sriram Vadapalli: Nothing to Disclose, Rashmi Sudhir MBBS: Nothing to Disclose

**TEACHING POINTS**

Telangiectatic osteosarcoma was described by Paget in 1854 and was subsequently referred to by Gaylord as a "malignant bone aneurysm" in 1903. This subtype of osteosarcoma is well recognized, representing 2.5%-12.0% of all lesions. Characteristically, telangiectatic osteosarcoma is primarily (>90%) composed of multiple aneurysmally dilated cavities that contain blood, with viable high-grade sarcomatous cells. To enlist the Non-Conventional Sub types of Osteo Sarcomas and discuss the characteristic features of TOS. To describe broadly the Imaging patterns of Telangiectatic OS on Radiography, CT and MRI and discuss the differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Content organization: -Radiography and CT patterns of TOS are discussed namely 1)Geographic bone destruction 2) Permeative Moth eaten Pattern 3) Expansile remodelling or aneurysmal remodelling.(ABC pattern) 4)Parallel Striation Pattern(due to Hyper trophied Veins- Venol's Sign) 5) Pathological fracture with Advanced cortical destruction Pattern -MRI features of TOS are illustrated with Differential Diagnosis and radio Pathological Correlation in typical and Uncommon sites. -Differentiation of TOS from ABC is discussed with Helpful teaching points.

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**MSE-SUB**

**Multisystem/Special Interest Sunday Poster Discussions**

**Education Exhibits**

**OT**

AMA PRA Category 1 Credits ™: .50

Sun, Nov 30 1:00 PM - 1:30 PM Location: MS Community, Learning Center

**Sub-Events**

**MSE149**

**Overcoming MR Image Quality Problems. A Practical Approach (Station #1)**


**TEACHING POINTS**

1. MR image quality is mainly determined by three main factors: signal to noise ratio (SNR), resolution and scan speed. 2. Most MR image quality problems mainly affect one of these three categories, and recognition of the main problem area is the first step in image optimization. 3. Diagnostic quality images may be obtained if compromises to the other two areas may be tolerated. 4. Scanning at 3T allows significant gains in SNR, which then may be reinvested to improve resolution and scan speed.

**TABLE OF CONTENTS/OUTLINE**

How to recognize the main culprit that is causing poor image quality. 3. Determining where compromises can be made and making appropriate changes. 4. Reinvesting signal gains from 3T imaging to improve resolution and scan speed.

**NMS-SUB**

**Nuclear Medicine Sunday Poster Discussions**

**Scientific Posters**

<table>
<thead>
<tr>
<th>NMS154</th>
<th>Comparison of [62]Cu-Diacetyl-Bis (N4-Methylthiosemicarbazone) PET/CT Imaging and Microscopic Diffusion Capacity in Brain Neoplasms (Station #1)</th>
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<tr>
<td></td>
<td>Ayako Hino-Shishikura : Nothing to Disclose, Ukihide Tateishi MD, PhD (Presenter): Nothing to Disclose, Tomohiro Yoneyama : Nothing to Disclose, Ikuo Torii : Nothing to Disclose, Tomio Inoue MD, PhD : Nothing to Disclose</td>
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**PURPOSE**

To compare [62]Cu-Diacetyl-Bis (N4-Methylthiosemicarbazone) (62Cu-ATSM) PET/CT imaging and the diffusion weighted imaging (DWI) of brain tumors.

**METHOD AND MATERIALS**

[62]Cu-ATSM PET/CT and DWI were performed on 40 brain tumors (low grade glioma (n=13), glioblastoma (GBM) (n=20), Primary central nervous system lymphoma (PCNSL) (n=7)). The 62Cu-ATSM PET/CT uptake and signal intensity of DWI were evaluated using standard uptake value (SUV) and apparent diffusion coefficient (ADC). The correlation of SUV and ADC for all tumors, and the difference of SUV and ADC between each tumor was also evaluated.

**RESULTS**

[62]Cu-ATSM uptake and signal intensity of DWI was high in GBM and PCNSL compared to low grade glioma. In GBM and PCNSL, the patterns of locations showing high [62]Cu-ATSM uptake and high signal intensity of DWI were similar. Inverse correlation was found between maximum SUV (SUVmax) and minimum ADC (ADCmin) (r = -0.58, p<0.0001), and between tumor/brain ratio (T/B ratio) and ADCmin for all tumors (r = -0.52, p<0.0001). Both SUVmax and T/B ratio were significantly high in GBM than in low grade glioma (p=0.03), and were significantly high in PCNSL than in GBM (p=0.03). ADCmin was significantly low in GBM than in low grade glioma (p=0.01), while no significant difference was found between GBM and PCNSL (p=0.90).

**CONCLUSION**

Both [62]Cu-ATSM PET/CT and DWI were considered to be good diagnostic tests for the grading glioma. [62]Cu-ATSM PET/CT provided additional diagnostic information to differentiate GBM and PCNSL.

**CLINICAL RELEVANCE/APPLICATION**

For the differential diagnosis of GBM and PCNSL, SUV measurement of [62]Cu-ATSM PET/CT considered to may provide additional information.

**NMS155**

**18F-FDG PET/CT Performance in Treatment Response Evaluation in Metastatic Melanoma Patients under Ipilimumab (Station #2)**

|        | Christos Sachpekidis : Nothing to Disclose, Uwe Haberkorn MD : Nothing to Disclose, Lionel Larribere : Nothing to Disclose, Georgia Dimitrakopoulou MD (Presenter) : Nothing to Disclose, Antonia Dimitrakopoulou-Strauss : Nothing to Disclose, Jessica Hassel : Nothing to Disclose |

**PURPOSE**

Ipilimumab is a newly approved immunotherapeutic agent that provides a clear survival benefit for patients with metastatic melanoma. 18F-FDG PET/CT has demonstrated very satisfying results in detecting melanoma metastases. We performed 18F-FDG PET/CT monitoring in metastatic melanoma patients undergoing ipilimumab therapy during treatment. Aim of our study was to evaluate the predictive role of 18F-FDG PET/CT performed after two cycles of ipilimumab in final response evaluation to therapy.

**METHOD AND MATERIALS**

26 patients suffering from unresectable metastatic melanoma, scheduled for ipilimumab treatment underwent PET/CT scanning before the onset of therapy (baseline scan), after two cycles, and after the end of the four-cycle treatment. Patient response evaluation to treatment was based on the European Organization for Research and Treatment of Cancer (EORTC) 1999 criteria. Moreover, correlation analysis was performed between the changes in the number of melanoma lesions detected with PET/CT and the changes in lesions'
mean SUV taking place during the course of treatment. Results were considered significant for p

RESULTS
After the end of treatment, 19 patients were characterized as having progressive metabolic disease (PMD), five patients as stable metabolic disease (SMD) and two patients showed partial metabolic response (PMR). However, three patients were falsely classified in the SMD, PMR and complete metabolic response (CMR) groups respectively, since they developed brain metastases, undetectable by PET/CT (PMD patient). PET/CT performed after two ipilimumab cycles predicted final treatment response in 14/19 PMD patients, in 5/5 SMD patients and in 0/2 PMR patients. Correlation analysis revealed significant correlation between changes in the number of melanoma lesions detected and changes in lesions’ mean SUVs during the course of treatment.

CONCLUSION
According to these preliminary results, 18F-FDG PET/CT after two cycles of ipilimumab is highly predictive of the final treatment outcome in PMD and SMD patients. However, its predictive results are rather poor in patients demonstrating partial disease remission.

CLINICAL RELEVANCE/APPLICATION
This is the first study regarding treatment response evaluation to ipilimumab in metastatic melanoma patients, by means of 18F-FDG PET/CT, involving baseline, during therapy and after therapy completion examinations.

NMS156
Characterization of 18F-NaF Uptake in Normal Bone, Bone Metastases, Degenerative Changes and Extra-Skeletal Tissues: An Atlas of Standardized Uptake Values (Station #3)
Nathanael Sabbah MD (Presenter): Nothing to Disclose, Tatianie Jackson MD : Nothing to Disclose, Camila Mosci MD : Nothing to Disclose, Mehran Jamali : Nothing to Disclose, Ryogo Minamimoto MD, PhD : Nothing to Disclose, Andrew Quon MD : Nothing to Disclose, Andrei Iagaru MD : Advisory Board, Cytogen Corporation Advisory Board, Spectrum Pharmaceuticals, Inc Researcher, General Electric Company

PURPOSE
The purpose of this study was to analyze using semi-quantitative standardized uptake values (SUV) measurements the distribution of Sodium 18F-Fluoride (18F NaF) uptake in the normal skeleton, benign and malignant lesions, and extra-skeletal tissues.

METHOD AND MATERIALS
We retrospectively analyzed data from 129 patients who had 18F NaF PET/CT between 2007 and 2014. There were 99 men and 30 women, 19-90 year-old (average: 61.5±15.5). We measured maximum and mean SUV from normal bones, metastases, degenerative changes and extra-skeletal tissues in cancer patients. For the normal bone analysis, we excluded structures with any known history of bone tumor infiltration or degenerative changes clinically, radiographically or scintigraphically apparent.

RESULTS
The PET/CT images were acquired on average at 30-169 minutes (average: 76.5±22.8) after injection of 3.9-13.6 mCi (average: 7.3±2.4) of 18F NaF. The range, average and SD of SUVmax were measured for normal bone and extra-skeletal tissues uptake for the entire patient population. A separate statistical analysis was performed to compare Group A which correspond to the population of patient with negative scans (no NaF avid metastatic lesions) and Group B which correspond to the population of patient with positive scans (NaF avid metastatic lesions). No statistical difference was found between the two groups. The average and SD of SUVmax were also measured for 18F NaF avid metastasis (4.50±103.3, 25.93±16.61) and for 18F NaF avid degenerative changes (3.30-52.0, 16.54±7.96). When comparing SUV max values from axial skeleton versus appendicular skeleton, we found that the SUVmax in the axial skeleton was 7.84±2.03 compared to the SUVmax in the appendicular skeleton of 3.04±1.12. There was a statistically significant difference (p<0.0001) when comparing SUVmax in the normal axial skeleton (7.84±2.03) vs bone metastases in the axial skeleton (24.04±4.95), as well as when comparing SUVmax in the normal appendicular skeleton (3.04±1.12) vs bone metastases in the appendicular skeleton (27.82±9.8).

CONCLUSION
According to our study, various skeletal sites have different normal SUVmax values. In order to improve interpretation accuracy and allow SUV value comparison between studies, a better understanding of physiological uptake throughout the body is necessary.

CLINICAL RELEVANCE/APPLICATION
To improved interpretive accuracy and may be useful for future semi-automated comparisons to a normal SUVmax database.

NMS157
Application of Artificial Neural Networks for Predicting Survival Time of Patients with Non-small Cell Lung Cancer Using FDG-PET and Other Clinically Available Prognostic Factors (Station #4)
Michael Baad MD (Presenter): Nothing to Disclose, Yisheng Chen : Nothing to Disclose, Yonglin Pu MD, PhD : Researcher, Eli Lilly and Company Researcher, General Electric Company

PURPOSE
Risk stratification in NSCLC is currently accomplished through the TNM clinical staging system, which fails to include many variables that have been shown to have prognostic significance independent of stage, such as FDG-PET tumor measurements. Here we use artificial neural networks (ANNs) to compare the prognostic performance after the inclusion of these imaging and clinical variables to that of the TNM clinical stage alone.

METHOD AND MATERIALS
Using comprehensive clinical and imaging data of 328 consecutive NSCLC patients with a baseline PET/CT, three ANN models were constructed with incremental increases in input variables as follows: 1) a baseline model consisting of only the clinical TNM stage and “censored variable”; 2) a reduced model consisting of all variables in the baseline model with the addition of clinical variables including gender, histology type, surgery and chemotherapy type; and 3) a full model consisting of all the variables in the reduced model with the addition of FDG-PET measurements including ln(SUVmaxWB), and MTVWB. The coefficient of determination (R²) and root mean square error (RMSE) were then calculated between predicted and observed survival, with 10% of cases held for cross validation. The same variables were then analyzed by multiple linear regression (MLR).

RESULTS

The R²/RMSE between predicted and observed overall survival improved with the addition of clinical variables, from 0.605/18.5 using only the TNM clinical stage to 0.748/13.8 with the addition of clinical variables. Addition of FDG-PET measurements resulted in even greater performance, with an R²/RMSE of 0.781/13.8. The same trend was found using MLR analysis with R²/RMSE of 0.660/17.4, 0.642/17.8 and 0.581/19.1 in the full, reduced and baseline models respectively.

CONCLUSION

ANN models can be used to overcome the limitations of the current TNM staging system for better predicting patient’s prognosis in NSCLC by combining the value of multiple prognostic variables. The inclusion of clinical and imaging variables, such FDG-PET measurements, into the models resulted in incremental improvements in performance over the TNM clinical stage alone.

CLINICAL RELEVANCE/APPLICATION

ANN models can improve survival prediction in NSCLC by including prognostic factors currently not included in the TNM staging system, such as FDG-PET measurements.

NME147

Bone Radiopharmaceuticals: What Radiologists Need to Know (Station #6)

Aparna Srivinasa Babu MD (Presenter): Nothing to Disclose, Aliaksei Salei MD: Nothing to Disclose, Oleg Teytelboym MD: Nothing to Disclose

TEACHING POINTS

• Review currently available bone targeted radiopharmaceuticals • Review newly available Radium-223 therapy for prostate cancer metastasis • Describe indications and contraindications for use of bone targeted radiopharmaceuticals • Review Nuclear Regulatory Commission (NRC) guidelines and radiation safety involved in treatment with radiopharmaceuticals

TABLE OF CONTENTS/OUTLINE

After a brief introduction to osseous metastasis, including its pathophysiology, we will offer examples of appearance of osseous metastases on different imaging modalities. Detailed discussion of bone radiopharmaceuticals will include mechanisms of action, expected outcomes, indications and contraindications for therapy, dosage and administration guidelines. We will review precautions, directions for storage and handling, patient instructions and follow-up recommendations. We will provide insight into intricacies of setting up a multidisciplinary treatment program and optimizing patient selection. We will delve into the advantages and disadvantages of currently available treatment options, with specific emphasis on the newly available Radium-223 therapy. We will examine major past and ongoing trials in this regard. Finally, we will present a comprehensive summary of various aspects of treatment of osseous metastases using bone radiopharmaceuticals.
METHOD AND MATERIALS
We included all patients with an M1±ICA occlusion, that had follow-up imaging, from an existing cohort of 1791 consecutive patients who underwent multimodal CT, including whole brain CT perfusion (WB-CTP), for suspected stroke. WB-CTP raw datasets were reconstructed as dynamic angiographies. The velocity of collateral filling was quantified using the mean difference between time to peak contrast enhancement of the M2 segment distal to the occlusion compared to the contralateral M2 segment (figure). CBV and MTT-CBV mismatch were assessed in initial CTP. Follow-up lesion size was assessed by MRI or NECT. Multivariate analyses were performed to adjust for extent and origin of collateralization, additional ICA occlusion and type of treatment.

RESULTS
Our study comprised 116 patients. In the multivariate analysis, a fast collateral filling was an independent predictor of a small CBV lesion (p<0.001) and a large relative mismatch (p<0.001) on initial CTP, of a small follow-up lesion (p<0.001), and of a small difference between initial CBV and follow-up lesion size (p=0.024). Other independent predictors of a small lesion on follow-up were a high morphological collateral grade (p=0.001), lack of an additional ICA occlusion (p=0.009), and IV thrombolysis (p=0.022).

CONCLUSION
Fast filling of collateral vessels predicts initial CTP and follow-up lesion size and is independent of the extent of collateralization. The independent association with the CBV-follow-up difference indicates a role in the process of penumbral loss and may help to select treatment.

CLINICAL RELEVANCE/APPLICATION
Time-resolved dynamic CT angiography allows to assess the velocity of collateral filling which adds important functional information about collateralization.

NRS394
Perfusion Computed Tomography for Selection of Adult Patients with Acute Ischemic Stroke for Intravenous Thrombolytic Therapy—A Systematic Review and Meta-analysis (Station #2)

Kirsteen Rennie Burton MD, MBA (Presenter): Nothing to Disclose, Del Dhanoa MD: Nothing to Disclose, Richard Aviv MBCh, FRCR: Nothing to Disclose, Alan Rowland Moody MD: Nothing to Disclose, Moira Kapral: Nothing to Disclose, Andreas Laupacis: Nothing to Disclose

PURPOSE
A systematic review of outcomes of patients with suspected acute ischemic stroke (AIS) selected for thrombolytic therapy within three hours and beyond using perfusion computed tomography (CTP) imaging, has not been published. We sought to determine rates of death, disability and symptomatic intracranial hemorrhage (SICH) among patients with AIS selected for thrombolytic therapy using CTP imaging.

METHOD AND MATERIALS
We performed a literature search using MEDLINE, EMBASE, the Cochrane Library, PubMed, and Google Scholar up to August 2012, using terms including "brain ischemia" and "perfusion imaging", and unrestricted by language of publication. Experimental and observational studies were included. Two reviewers extracted study data and independently assessed risk of bias for each selected study. CTP-selected patient outcomes were estimated including case-fatality rate, favourable outcome (modified Rankin Scale score <=2) and rates of SICH.

RESULTS
We identified 14 studies that included a total of 600 patients who received intravenous thrombolysis following CTP imaging. The methodological quality of the small studies was generally good. Overall, 90-day mortality was 12.1% (95% CI, 8.4-16.4%). Among those treated within 3 hours of symptom onset, mortality was 14.4% (95% CI, 8.2-22.1%), a favourable outcome (modified Rankin Scale score <=2) was seen in 44.9% (95% CI, 29.2-61.3%) and the symptomatic intracranial hemorrhage rate was 5.1% (95% CI, 3.0-7.8%). Among those treated after 3 hours of symptom onset, mortality was 8.5% (95% CI, 2.4-18.0%), 61.5% (95% CI, 51.3-71.1%) had a favourable outcome, and 4.1% (95% CI, 0.9-9.3%) had a SICH.

CONCLUSION
The outcomes of patients selected for thrombolysis using CTP imaging appear to be similar to those of patients selected using other imaging modalities except for SICH, wherein MRI selection within 3 hours was safer than CTP and NCCT was less so. Some patients can be safely treated up to 9 hours after stroke onset. Direct comparisons between CTP and other imaging modalities are needed.

CLINICAL RELEVANCE/APPLICATION
Outcomes for acute ischemic stroke patients selected for thrombolysis by CTP are comparable to other imaging modalities, except for SICH rates, which differ in NCCT, CTP and MRI-selected patients.

NRS395
Prognostic Value of CT Histogram Analysis in Comatose Patients: Evaluation Using Automated Whole-brain Extraction Algorithm (Station #3)

Koji Yamashita MD, PhD (Presenter): Nothing to Disclose, Akio Hiwatashi MD: Nothing to Disclose, Osamu Togao MD, PhD: Nothing to Disclose, Kazufumi Kikuchi MD : Nothing to Disclose, Masatoshi Kondo : Nothing to Disclose, Hiroshi Sugimori : Nothing to Disclose, Takashi Yoshiura MD, PhD : Nothing to Disclose
PURPOSE

It is important to predict neurological outcome in patients with non-traumatic coma. Our purpose was to evaluate the prognostic utility of CT histogram analysis with an automated whole-brain extraction algorithm in comatose patients.

METHOD AND MATERIALS

We retrospectively studied 138 consecutive comatose patients who were admitted to our intensive care unit and underwent brain CT. The patients were classified into good (n = 43; M:F = 18:25) and poor (n = 95; M:F = 48:47) outcome groups. All CT images were obtained using a 64-detector-row CT scanner with a slice thickness of 4.0 mm. From the whole-brain CT images, a brain region was extracted using our original automated algorithm for the subsequent histogram analysis. The obtained histogram statistics (mean CT value, kurtosis and skewness) as well as clinical parameters were compared between the good and poor outcome groups using the Mann-Whitney U test. In addition, ROC analysis was performed for the discrimination between the 2 groups for each parameter.

RESULTS

The mean CT value was significantly higher in the good outcome group (mean±SD = 34.6±1.47 HU) than in the poor outcome group (mean±SD = 33.9±1.97 HU) (p<0.05). In addition, the kurtosis and age were significantly lower in the good outcome group (mean kurtosis±SD = -0.49±0.12, mean age±SD = 54.1±21.4 years) than in the poor outcome group (mean kurtosis±SD = -0.34±0.21, mean age±SD = 63.7±18.6 years) (p<0.001 and p<0.05, respectively). The AUC values for the kurtosis, mean CT value, and age were 0.717, 0.608, and 0.625, respectively. A combination of the 3 parameters increased the diagnostic performance (AUC = 0.799).

CONCLUSION

Histogram analysis of whole-brain CT images with our automated extraction algorithm is useful for assessing the prognosis of comatose patients.

CLINICAL RELEVANCE/APPLICATION

Histogram analysis method tend to be more reproducible compared with manual region-of-interest placement. Our study revealed that histogram parameters as well as age can help predict the neurological outcome of comatose patients.

Cerebellar White Matter Involvement in Alzheimer’s Disease: Diffusion Tensor Study (Station #4)

Toshiteru Miyasaka MD (Presenter): Nothing to Disclose, Toshiaki Taoka MD: Consultant, Radiology Resources International LLC, Suradech Suthiphosuwan MD: Nothing to Disclose, Saeka Hori: Nothing to Disclose, Masahiko Sakamoto MD: Nothing to Disclose, Kimihiko Kichikawa MD: Nothing to Disclose, Takeshi Wada MD: Nothing to Disclose

PURPOSE

Although cerebellum is not a primary focus of pathological change in Alzheimer’s disease (AD), deposition of amyloid plaques and increased microglia have been reported to be found in the cerebellum of AD. The purpose of the current study is to depict the changes in cerebellar white matter by using diffusion tensor image. We measured diffusivity and fractional anisotropy (FA) of the cerebellar peduncles, in order to evaluate efferent pathway (superior cerebellar peduncle: SCP) and afferent pathway (middle cerebellar peduncle: MCP) of the cerebellum separately.

METHOD AND MATERIALS

We have obtained the approval of institutional review board. The subjects were 19 cases with Alzheimer disease and 5 cases of age matched controls. AD cases included 7 severe (MMSE: less than 11), 5 intermediate (MMSE: 11-19) and 6 mild cases (MMSE: 20-22). Diffusion tensor images were obtained using a single shot echo planar sequence. Tractographies of superior cerebellar peduncle (SCP) and middle cerebellar peduncle (MCP) were constructed. We measured FA and apparent diffusion coefficient (ADC) values of the SCP and MCP. We made statistical analysis (t-test) between control and AD groups.

RESULTS

Mean FA values along SCP of severe AD/ intermediate AD/ mild AD/ control were 0.48/0.54/0.56/0.58 respectively. Statistically significant difference were not shown. While, mean FA of MCP were 0.42/0.50/0.52/0.52 respectively. There was statistically significant differences (p<0.01) between severe AD and control. Mean ADC (x10-3 sec/mm2) along SCP were 0.58/0.55/0.55/0.54 respectively. Statistically significant difference were not shown. While, mean ADC of MCP were 0.49/0.42/0.42/0.41 respectively. There was also statistically significant differences (p<0.01) between severe AD and control.

CONCLUSION

Decreased FA and increased ADC were observed in the MCP of the severe AD group. Thus, white matter changes of cerebellum at the afferent pathway in the cases with severe cognitive impairment by AD were suggested. The result will be one of supportive findings to indicate that cerebellum plays some role in cognitive function.

CLINICAL RELEVANCE/APPLICATION
Evaluation of white matter changes of cerebellum using diffusion tensor image will bring additional information in assessment of Alzheimer’s disease patients especially in the severe cases.

Human Accessory Semicircular Canal: Incidence during Three Dimensional Reconstruction using High Resolution Magnetic Resonance Imaging of the Inner Ear (Station #5)

Ahmed Fathy Emam MBCh (Presenter): Nothing to Disclose, Nagy Naguib Naeem Naguib MD, MSc: Nothing to Disclose, Nour-Eldin Abdelrehim MD, MSc: Nothing to Disclose, Mohammed Ahmed Alsubhi BMBS: Nothing to Disclose, Thomas Josef Vogl MD, PhD: Nothing to Disclose

PURPOSE

Documentation of the incidence of Human accessory Semicircular canal (SCC) of the Inner Ear in Different age groups and both sexes during three Dimensional (3D) reconstruction of high resolution MR-Imaging.

METHOD AND MATERIALS

During a retrospective study that was performed on 536 patients (294 females and 242 males) with a mean age of 48.5 year (standard deviation: 26.5, range: 5 month - 88 year) using High resolution MR-Imaging with an Iso-Space sequence of 0.6 mm slice thickness. 3D reconstructions were performed using Advantage Workstation for diagnostic imaging. The reconstruction was manually performed for each side in all patients and included semicircular canals of the inner ear. The Incidence and origin of the accessory SCC were observed and documented. For cases with detected accessory SCC the source images were revised to exclude the possibility of motion artifacts.

RESULTS

Three dimensional reconstruction was successfully performed on all 1,072 inner ears. Any records and abnormalities observed were recorded and documented. The Accessory SCC was observed in 13 patients, appeared bilateral in 5 Patients and unilateral in 8 patients with a total of 18 inner ears showing accessory SCC (incidence 1.7%). All 13 patients were referred with Vertigo, Dizziness, and Hearing impairment. The accessory SCC had a common origin with other SCCs in 8 inner ears with the common origin been with the Superior SCC (n= 3) and with the Lateral SCC (n= 5) giving a double-stranded shape of the SCC. A separate origin of the accessory SCC was observed in 10 inner ears. None of the accessory SCCs showed a common origin with the posterior SCC.

CONCLUSION

The incidence of Human accessory Semicircular canal (SCC) of human Inner Ear in 1.7% of patients, appeared bilateral in 5 Patients(38.4%) and unilateral in 8 patients(61.6%).

CLINICAL RELEVANCE/APPLICATION

This study shows incidence of an abnormality in the human Inner ear that could be a cause of symptoms as Vertigo, Dizziness and Hearing impairment.

Artery of Superior Orbital Fissure: An Undescribed Branch from the Pterygopalatine Segment of the Internal Maxillary Artery to the Cavernous Sinus through the Superior Orbital Fissure (Station #6)

Hiro Kiyosue MD (Presenter): Nothing to Disclose, Shuichi Tanoue MD: Nothing to Disclose, Ryuichi Shimada MD: Nothing to Disclose, Hiromu Mori MD: Nothing to Disclose

PURPOSE

Artery of foramen rotundum is thought to be a sole arterial branch of the pterigopalatine segment of the internal maxillary artery to the cavernous sinus. However, we found another undescribed branch, provisionally-named artery of superior orbital fissure (SOF), from pterigopalatine segment of the internal maxillary to the cavernous sinus via the SOF in some cases of parasellar hyervascular lesions. In this paper, we investigated the frequency and course of the artery of SOF in cases with parasellar hypervascular lesions.

METHOD AND MATERIALS

We retrospectively reviewed biplane and 3D angiography of external carotid artery undergone from June 2010 to December 2013 in 17 patients with parasellar hypervascular lesions, including 13 cases of cavernous sinus dural arteriovenous fistulas and 4 cases of parasellar meningiomas. 3D angiographic images were reviewed by 2 experienced neuroradiologists with particular interest to the artery of SOF.

RESULTS

The artery of SOF was identified in 7 of 13 cases of cavernous sinus dural arteriovenous fistulas and 2 of 4 cases of parasellar meningioma. It arose at the pterygopalatine segment of the internal maxillary artery, either singly or by a common trunk with the artery of foramen rotundum, and run upward to reach the SOF, and then turned posteriorly to the cavernous sinus with acute angle and fed the AVFs or tumors. In one case, the artery of SOF communicated with lachrymal branch of the ophthalmic artery at the orbital apex.

CONCLUSION

Although it has not been described in anatomic paper, the artery of SOF could be observed approximately half of the cases of parasellar hypervascular lesions.
CLINICAL RELEVANCE/APPLICATION

This study demonstrates an arterial branch of the external carotid artery, artery of superior orbital fissure (SOF), which has not been recognized. The artery of SOF can feed the cavernous sinus dural AVFs and hypervascular tumor. Special attention should be paid for embolization of the artery of SOF because it potentially anastomose with ophthalmic artery and anterior branch of the inferolateral trunk of the internal carotid artery.

NRE201

Infant Brain Tumors: Atlas of Radiographic Findings with Histological Correlation (Station #7)

David Robert Pettersson MD : Nothing to Disclose , Teresa Gross Kelly MD : Nothing to Disclose , Asmaa Aamir MD : Nothing to Disclose , Viktor Zherebitskiy MD : Nothing to Disclose , Dianna M. Ehrhart Bardo MD (Presenter) : Speakers Bureau, Koninklijke Philips NV Consultant, Koninklijke Philips NV

TEACHING POINTS

Participants will learn: Characteristic CT and MR findings of infant brain tumors Histological appearance and immunohistochemical features of infant brain tumors Correlation of imaging and pathology knowledge to improve diagnostic expertise

TABLE OF CONTENTS/OUTLINE

Epidemiology of infant brain tumors Cell lines / tissue types of infant brain tumors Outline of histological stains and immunohistochemical stains, chromosome analysis Case Presentations: Clinical examination/history of 25 infants with brain tumors Pre-treatment radiographic examination: fetal MR, sonography, CT and MR Neuropathology findings: histology, immunohistochemical stains, chromosome analysis Infant brain tumors of multiple cell lineages from all brain and intracranial tissue types and locations, including: Embryonal Tumors Primitive neuroectodermal tumor Medulloblastoma Malignant embryonal neoplasm Pineoblastoma Atypical teratoid rhabdoid tumor Astrocytic and Neuronal Tumors Gioma (low and high grade) Filiocty astrocytoma Pilomyxoid astrocytoma Subependymal giant cell astrocytoma Desmoplastic infantile ganglioglioma Other Tumors: Infantile hemangiopericytoma Choroid plexus papilloma and carcinoma Hypothalamic hamartoma Teratoma

NRE292

CT of the Postoperative Orbital Wall Following Trauma: Review of Normal Appearances and Common Complications (Station #8)

Michael Jason Reiter DO (Presenter) : Nothing to Disclose , Ryan Becton Schwepe MD : Nothing to Disclose , Jonathan Kini : Nothing to Disclose , Jared Theler : Nothing to Disclose

TEACHING POINTS

The major teaching points of this exhibit are: 1. Repair of orbital fractures is unique and differs from the management of other facial or extremity injuries in that surgery is not performed in an attempt to achieve osseous healing. Rather, the goal of surgery is simply to repair the defect and restore structural support of the orbit. 2. Placement of an implant is often necessary to span the osseous defect 3. Generally, at least 3 of the 4 articulations that comprise ZMC injuries must be treated intraoperatively to accurately reduce comminuted fractures. 4. Complications encountered after repair include failed reconstruction due to improper alignment, infection, retrobulbar hemorrhage, and orbital emphysema.

TABLE OF CONTENTS/OUTLINE

1. Highlight the indications for surgical intervention of orbital fractures
   a. Orbital floor
   b. Medial wall
   c. Orbital roof
   d. Zygomaticomaxillary complex (ZMC)
2. Illustrate the various operative approaches for repair
   a. Orbital floor
   b. Medial wall
   c. Orbital roof
   d. ZMC
3. Discuss the goals of surgical repair and the desired CT appearance in the postoperative setting
   a. Overview
   b. Orbital floor
   c. Medial wall
   d. ZMC
4. Common complications
   a. Failed repair
   b. Hemorrhage
   c. Infection
   d. Orbital emphysema

NRE182

Paraneoplastic Syndrome and Mimics: What the Radiology and Clinicians Need to Know (Station #9)

Ammar Ahmed Chaudhry MD (Presenter) : Nothing to Disclose , Maryam Gul : Nothing to Disclose , Abbas Ahmed Chaudhry BSc : Nothing to Disclose , Mubashir Sheikh : Nothing to Disclose , Jawed Akhter Mallick MBBS : Nothing to Disclose , Jared Dunkin MD : Nothing to Disclose

TEACHING POINTS

1. Pictorial review of CNS anatomy highlight areas involved in paraneoplastic syndromes. 2. Case based review
highlighting common and uncommon causes of paraneoplastic syndrome. 3. Discuss differential diagnoses (physiologic process, congenital, infection, inflammation, trauma, vascular and/or malignancy) that can mimic imaging findings.

**TABLE OF CONTENTS/OUTLINE**

Content: Multiple presentations of paraneoplastic syndrome will be reviewed involving the brain and spine. We will discuss mimics that may result from neoplasm (lymphoma, leukemia, etc), infection (HSV, Lyme, etc), inflammation (MS, ADEM, Lupus), etc with an emphasis on key findings (on CT, MRI, PET-MRI) differentiating these entities. Summary: Paraneoplastic syndrome is not an uncommon cause of encephalitis. Knowledge of its clinical presentation, pathophysiology and immunology is essential in making the diagnosis. Although the differential diagnosis is broad, it can be narrowed utilizing age, clinical features, imaging characteristics (e.g. Location, enhancement pattern, PET-MRI findings, etc) and pathology correlation. By the conclusion of this presentation, the viewer should have a better understanding of paraneoplastic syndrome and associated imaging findings, and should be able to aid in the workup, guide any potential biopsy/tissue sampling and imaging follow-up.

**NRE380**

**Imaging of Intracranial Vascular Anomalies and Variants (Station #10)**

Mohammed Mohsin Khadir MD (Presenter): Nothing to Disclose, Arbab Zafar Iqbal MD: Nothing to Disclose, Burke Morin DO: Nothing to Disclose, Steven Paul Meyers MD, PhD: Nothing to Disclose

**TEACHING POINTS**

Discussion of CTA and MRA protocols for imaging intracranial vessels. Characterization of various intracranial congenital and developmental vascular anomalies and variants. Imaging findings of intracranial vascular anomalies and variants using CT, MR, CTA, and MRA.

**TABLE OF CONTENTS/OUTLINE**

1. Discuss CTA and MRA protocols for imaging intracranial vessels.
2. Review anatomy of intracranial vessels
3. Discuss various congenital and development vascular anomalies and variants.
4. Present the imaging findings of these entities as listed below.
   - Persistent Fetal Origin of Posterior Cerebral Artery
   - Hypoplasia of the A1 Segment of Anterior Cerebral Artery
   - Persistent Trigeminal Artery
   - Persistent Otic Artery
   - Persistent Hypoglossal Artery
   - Duplications of Cerebral, Carotid, Vertebral or Basilar Arteries
   - Hemiazygous Artery
   - Arterial Fenestration
   - Aberrant Position of the Internal Carotid Artery
   - Persistent Stapedial Artery
   - Unilateral Agenesis, Aplasia, and Hypoplasia of the Internal Carotid Artery
   - Vein of Galen Aneurysm
   - Sturge Weber
   - Moya Moya
   - Menkes
   - PHACES Syndrome
   - Thoracic Outlet Syndrome
   - Venous Angioma (Developmental Venous Anomaly)
   - Dehiscence of the Jugular Vein Bulb
   - High Position of the Jugular Bulb
   - Sinus Pericranii

**NRE162**

**Malformations of Cortical Development: Tutorial & Self Assessment (Station #11)**

Taraneh Hashemi-Zonouz MD (Presenter): Nothing to Disclose, Bryan Su-Hyun Jeun MD: Nothing to Disclose, Richard Arden Bronen MD: Research Consultant, Bristol- Myers Squibb Company

**TEACHING POINTS**

1. To understand the development of the brain and how aberrations in cell proliferation, migration, and organization result in various morphological phenotypes. 2. Recognize salient MRI features of these disorders and be able to differentiate between various malformations of cortical development.

**TABLE OF CONTENTS/OUTLINE**


**NRE351**

**Vascular Malformations of Head and Neck – What Radiologists Need to Know. A Pictorial Essay and Literature Review (Station #12)**

Antonio Padua Mesquita Maia Maia Filho MD (Presenter): Nothing to Disclose, Eloisa Maria Santiago Gebrim MD: Nothing to Disclose, Flavia I. Cevasco MD: Nothing to Disclose, Regina Lucia Elia Gomes MD: Nothing to Disclose, Bruno Casola Olivetti MD: Nothing to Disclose, Marcio Ricardo Taveira Garcia MD: Nothing to Disclose, Maira Sarpi MD: Nothing to Disclose, Mauro Miguel Daniel MD: Nothing to Disclose

**TEACHING POINTS**

- To provide an educational exhibit illustrating head and neck vascular malformations. - To describe the
classification of head and neck vascular malformations according to two groups: vascular tumors and vascular structural malformations, subcategorized according to their flow dynamics as low-flow malformations (venous, lymphatic, capillary, capillary-venous, and capillary-lymphatic-venous) and high-flow malformations (arteriovenous malformations and arteriovenous fistulas). - To identify the imaging features of the different lesions.

**TABLE OF CONTENTS/OUTLINE**
- Review of literature. - Classification of vascular tumors and malformations. - Pathophysiology of vascular malformations. - Review of imaging findings: o CT o MRI - Correlation with clinical history, signs and pictures.

**OBESUB**

**Obstetrics/Gynecology Sunday Poster Discussions**

*Education Exhibits*

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<td><strong>MRI Evaluation of the Female Pelvic Floor: Dynamic Imaging of Normal Function and Dysfunction</strong> (Station #1)</td>
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<td>Melinda Jean Yeh MD (Presenter): Nothing to Disclose, Vignesh Arasu MD: Nothing to Disclose, Ginger Merry MD, MPH: Nothing to Disclose, Thomas A. Hope MD: Speaker, Guerbet SA Research Grant, General Electric Company, Stefanie Weinstein MD: Nothing to Disclose, Rizwan Aslam MBCh: Research support, Bayer AG</td>
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<td><strong>TEACHING POINTS</strong></td>
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<tr>
<td>1. Understand normal anatomy and function of the &quot;pelvic floor.&quot; 2. Identify types of pelvic floor dysfunction on MRI.</td>
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<td>A. Background • Epidemiology and risk factors • Anatomy of the pelvic floor Surgical compartments Anatomic Layers B. Technique • MRI protocols • Dynamic imaging C. Imaging • Pelvic Floor Support Structures • Pelvic Floor Relaxation Pubococcygeal line (PCL) Descent: M-line calculation Widening: H-line calculation • Pelvic Organ Prolapse • Bladder • Vagina • Rectum • Rectal evacuation D. Discussion • Treatment • Outcomes</td>
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**PDS-SUB**

**Pediatric Sunday Poster Discussions**

*Scientific Posters*

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<td><strong>Initial Application of Diffusional Kurtosis Imaging (DKI) in Brain Development of Preterm Infants and Evaluation of DKI in Hypoxic-ischemic Encephalopathy (Station #1)</strong></td>
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<td>Jingjing Shi (Presenter): Nothing to Disclose, Jian Wang: Nothing to Disclose, Wenzhen Zhu MD, PhD: Nothing to Disclose</td>
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<td><strong>PURPOSE</strong></td>
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<td>To observe correlations of DKI parameters with the postmenstrual age (PMA), and compare these parameters between preterm infants at term equivalent age (TEA) and term infants.</td>
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<td><strong>METHOD AND MATERIALS</strong></td>
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<td>Conventional magnetic resonance imaging and DKI were performed in 33 preterm infants (18 preterm infants at term-equivalent age) and 7 term controls. Among them, 25 preterm infants (15 infants before TEA, 10 at TEA) and all the term controls had normal brain MRI performance and normal physical and neurologic examination, while the left 8 infants had typical MRI performance of hypoxic-ischemic injury. Consent forms were obtained prior to the study. The values of MK(mean kurtosis), K/(axial kurtosis) and K?(radial kurtosis) from the lentiform nucleus(LN), the ventrolateral thalamus(VLM), the posterior limb of internal capsule (PLIC), the corona radiate(CR), the frontal, parietal, occipital and temporal white matter (FWM,PWM,OWM,TWM correspondingly) on both hemi-cerebrum were obtained.</td>
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<td><strong>RESULTS</strong></td>
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Different levels of correlations existed between PMA and the values of MK, $K//, K?$ from the selected ROIs. The MK values from the PLIC, CR, LN of both sides showed high correlation with PMA($r>0.6$). In addition, $K?$ values from the left PLIC, $K//$ values from the right OWM were significantly different between the preterm infants at TEA and the term controls.

**CONCLUSION**

The DKI-derived measures at both white matter and grey matter showed high correlation with the postmenstrual age. MK, $K//, K?$ values could be useful to differentiate the preterm infants group from the term infants group.

**CLINICAL RELEVANCE/APPLICATION**

DKI is a promising tool to observe brain development of preterm infants and detect the abnormality of HIE.

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**PDS219**

**Changes in Structural Connectivity Across a High School Football Season (Station #3)**

Samuel Joseph Kuzminski MD (Presenter): Nothing to Disclose, Michael D. Clark: Nothing to Disclose, Melissa A. Fraser MS: Nothing to Disclose, Chunlei Liu PhD: Nothing to Disclose, Kevin Guskiewicz: Nothing to Disclose, Jeffrey Robert Petrella MD: Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited

**PURPOSE**

Magnetic resonance diffusion tensor imaging (DTI) has emerged at the forefront of sports-related neurotrauma research. DTI can detect subclinical alterations in the white matter tracts related to contact sport exposure. Structural brain connectivity is a method that investigates white matter tract associations between different regions of the brain utilizing DTI. The primary purpose of this pilot study was to investigate structural connectivity alterations over the course of a high school football season. Our secondary purpose was to correlate these changes to cumulative head impact exposure as measured by helmet accelerometers.

**METHOD AND MATERIALS**

Pre- and postseason MRI scans were obtained on 12 varsity high school football players. Graph theory metrics of cortical organization were subsequently calculated from DTI data. Accelerometer data was collected throughout the season using the Head Impact Telemetry System (HITS). DTI measures were correlated to HITS measures using general linear regression. The pre- to post-season DTI measures were compared using paired samples t-tests. Our a priori $\alpha$ was set at 0.05.

**RESULTS**

Significant changes from pre- to post-season measures were observed for global network node strength and local efficiency, with trend-level changes observed for clustering coefficient (Table 1). Changes in DTI measures were not significantly correlated to the helmet accelerometer measures.

**CONCLUSION**

The results from our preliminary study show changes in global white-matter structural connectivity across a single season of high school football. These changes are not explained by cumulative measures of head impacts. It is unclear if these alterations are related to brain network reorganization in response to repetitive trauma or expected brain development. Our preliminary analyses are limited by small sample size, lack of a control group, and coarse resolution of our network analyses. A larger cohort with an age-matched non-contact sport control group is needed to verify these findings. Determining the biomechanical correlates of head impacts to neuroanatomical changes may inform equipment design, coaching practices, and rule development to improve the overall safety of youth football.

**CLINICAL RELEVANCE/APPLICATION**

Repetitive asymptomatic head trauma may lead to structural connectivity changes in high school football players.

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**PDS220**

**Added Value of a Combination of Susceptibility Weighted Imaging (SWI) and 3D Arterial Spin-labeling (ASL) in Diagnosis and Prognosis of Neonatal Encephalopathy (Station #4)**

Yang Liu MD (Presenter): Nothing to Disclose, Huimao Zhang: Nothing to Disclose, Qiang Wang: Nothing to Disclose, Ziheng Zhang: Nothing to Disclose, Zhuo Wang: Nothing to Disclose, Meng Wang: Nothing to Disclose

**PURPOSE**

To investigate the contribution of a combined SWI and 3D ASL MRI to the diagnosis and prognosis of neonatal encephalopathy, through an exploration of the correspondence of the obtained cerebral blood flow (CBF) and $R2^*$ mappings, and the reconstructed 3D cerebral vasculature to the physiopathological findings of neonatal brain.

**METHOD AND MATERIALS**

17 neonates (preterm in 10 and term in 7) with clinically confirmed neonatal encephalopathy were recruited in
this prospectively study with the permission of neonates' parents and the approval of ethics committee of our hospital. All the neonates underwent MRI exam on a 3.0T scanner (MR750, GE, Waukesha) with the protocol including the conventional MRI, ESWAN and 3D ASL. From the obtained R2* and CBF mappings, the R2* and CBF values of 9 cerebral regions of interest (ROIs) were blindly measured by 2 experienced radiologists. Paired-Samples T Test and Independent-Samples T Test was performed to analyze differences intragroup and among groups with p<0.05 considered significantly different.

RESULTS

From the reconstructed 3D vasculature map, medullary veins dilation was observed at different degrees for all the neonates, with 4 preterm in micro-bleeding. The R2* values at the micro-bleeding regions were significantly higher than other ROIs. Compared with the white matter of frontal lobe and centrum semiovale, thalamus had a slightly higher R2* values in all neonates, however with significant difference (p<0.05). The CBF maps revealeed hyperperfusion in gray matter of frontal lobe and thalamus, while hypoperfusion in white matter of frontal lobe and parietal gray matter. For the term neonates, the CBF values of thalamus were significantly higher than white matter and parietal gray matter. In preterm group, the CBF values of thalamus were significant higher than that of white matter and parietal gray matter (P<0.05). [What is the difference between the term and preterm] No significant difference of the R2* and CBF values was observed between the term and preterm infants in all the ROIs (p>0.05).

CONCLUSION

On neonatal encephalopathy, the R2* and CBF values exhibited different manners at different cerebral locations, partially reflecting the physiopathological features of local brain tissues.

CLINICAL RELEVANCE/APPLICATION

The combination of SWI and 3DASL, with R2* and CBF mappings obtained, showed more details in evaluation of neonatal brain with/without diseases.

PDS221
Prenatal MR Imaging in Congenital Diaphragmatic Hernia: Separate Evaluation of the Ipsi- and Contralateral MR Fetal Lung Volume (Station #5)
Claudia Hagelstein MD (Presenter): Nothing to Disclose, Stefan Burger-Scheidlin: Nothing to Disclose, Meike Weidner: Nothing to Disclose, Thomas Schaible: Nothing to Disclose, Christel Weiss: Nothing to Disclose, Stefan Oswald Schoenberg MD, PhD: Institutional research agreement, Siemens AG, Wolfgang Neff MD, PhD: Nothing to Disclose

PURPOSE

To separately evaluate the ipsilateral and contralateral observed-to-expected MR fetal lung volume (o/e MR-FLV) in fetuses with congenital diaphragmatic hernia (CDH) and to assess the prognostic accuracy of the o/e MR-FLV regarding neonatal survival, extracorporeal membrane oxygenation (ECMO) requirement and development of a chronic lung disease (CLD).

METHOD AND MATERIALS

Using T2-weighted HASTE imaging, the o/e MR-FLV ipsi- and contralateral to the diaphragmatic defect was separately calculated and evaluated in 107 fetuses with isolated CDH between 20 and 39 weeks gestation. To assess the prognostic value of the o/e MR-FLV for association with neonatal survival, ECMO requirement, and development of CLD receiver operating characteristics (ROC) analysis and logistic regression analysis were performed.

RESULTS

Total o/e MR-FLV of both lungs in fetuses with a left-sided CDH (n=97) was 31.9±13.7% and 22.8±7.4 in patients with a right-sided CDH (n=10; p=0.004). Fetuses with a right-sided CDH showed a significantly lower o/e MR-FLV of the ipsilateral lung (4.8±2.9%) when compared to the ipsilateral o/e MR-FLV in fetuses with a left-sided hernia (9.9±10.0%; p=0.001). Regarding the contralateral o/e MR-FLV, there was no statistically significant difference between left-sided (49.2±18.8%) and right-sided hernias (45.7±15.0%; p=0.573). Total and contralateral o/e MR-FLV revealed significant differences regarding neonatal survival (total p<0.001; contralateral p<0.001), ECMO requirement (total p<0.001; contralateral p<0.001), and development of CLD (total p<0.001; contralateral p<0.001). Compared to the total o/e MR-FLV, the contralateral o/e MR-FLV showed a slightly higher prognostic accuracy regarding survival (AUC=0.859 vs. 0.825) and development of CLD (AUC=0.734 vs. 0.752) and a very similar prognostic accuracy regarding ECMO requirement (AUC=0.805 vs. 0.826).

CONCLUSION

Both lungs, ipsi- and contralateral to the diaphragmatic defect in patients with CDH showed a reduced fetal lung volume as compared to healthy controls. Beside the total o/e MR-FLV, the contralateral o/e MR-FLV is a highly reliable prenatal predictor for neonatal outcome.

CLINICAL RELEVANCE/APPLICATION

Separate evaluation of the ipsi- and contralateral o/e MR-FLV has the potential to improve prenatal prediction of neonatal survival, ECMO requirement and development of CLD in CDH patients.
Submillisievert Pediatric CT Made Easy: CT Applications Using Iterative Reconstruction Algorithms from Major Vendors (Station #6)


TEACHING POINTS

To assess the feasibility of submillisievert radiation doses in pediatric CT examinations, To educate the audience regarding currently available iterative reconstruction (IR) algorithms across all major vendors and their different settings which can be used to achieve submillisievert dose, To illustrate multiple CT applications using different IR techniques and protocols in pediatric settings.

TABLE OF CONTENTS/OUTLINE

Discuss and educate radiologists about size-specific, indication-based, and body-region based CT protocols in pediatric imaging to achieve submillisievert radiation dose. Describe currently available iterative reconstruction algorithms and their settings from major vendors: image-based: SafeCT, hybrid-based: ADMIRE, AIDR3D, ASIR, iDose, IRIS, SAFIRE, knowledge-based (IRM) and model-based (VEO) that can be used in submillisievert pediatric CT. Illustration of examples from our institution for pediatric CT applications (for chest, cardiac, head, abdomen-pelvis, spine, and extremities regions) at submillisievert radiation dose. Diagnostic image quality, noise and radiation dose implications in submillisievert pediatric CT based on our institutional experience.

Differential Diagnosis of Cerebellar Atrophy in Childhood: A Pattern-recognition Approach (Station #7)

Matthias W. Wagner MD: Nothing to Disclose, Eugen Boltshauser MD: Nothing to Disclose, Thangamadhan Bosemani MD, FRCR (Presenter): Nothing to Disclose, Thierry Huisman MD: Nothing to Disclose, Andrea Poretti MD: Nothing to Disclose

TEACHING POINTS

Cerebellar atrophy (CA) implies loss of cerebellar parenchyma and is a nonspecific pediatric neuroimaging finding. In the majority of cases, the vermis is more affected compared to the cerebellar hemispheres. Involvement of the brainstem as a small pons is unusual and occurs in prenatally acquired CA, neurodegenerative diseases with prenatal onset (as pontocerebellar hypoplasias) or CA as a sequela of extreme prematurity. CA may result from genetic or metabolic diseases or be acquired. In pediatric CA, neuroimaging findings are rarely diagnostic. In the majority of cases, a neuroimaging pattern-recognition approach is helpful in the evaluation of children with CA to narrow the list of differential diagnoses, plan targeted additional investigations and interpret their results.

TABLE OF CONTENTS/OUTLINE

The literature was reviewed for etiologies of pediatric CA. A pattern-recognition approach is suggested for hereditary CA considering "pure" (isolated) CA and CA "plus" (associated with other neuroimaging findings such as hypomyelination, progressive infra- or supratentorial white matter abnormalities, involvement of basal ganglia, T2-hyperintense cerebellar cortex). Additionally, checklists are provided for postnatally acquired CA, unilateral CA and pediatric diseases with ataxia as a symptom without CA on neuroimaging.

Prostate Cancer Localization in Multi-parametric MR Images Using Multimodality Image Fusion (Station #1)

Julip Jung MS: Nothing to Disclose, Young Gi Kim BS: Nothing to Disclose, Helen Hong PhD (Presenter): Nothing to Disclose, Sung Il Hwang MD: Nothing to Disclose

CONCLUSION

Our method can be used to improve the performance of localization, detection and staging of prostate cancer in multi-parametric MR images.

Background

Multi-parametric MR is increasingly mentioned in prostate cancer localization due to its possibility of combining
anatomical information with functional information. T2wMR provides high spatial resolution and T1wMR provides good contrast for bleeding. In DWI, prostate cancer appears as high signal intensity while the ADC shows it as low signal intensity. Thus, we propose a multimodality image fusion on multiparametric MR images using signal correction, rigid and non-rigid registrations and color-coded mapping.

Evaluation

10 patients with prostate cancer were scanned using Philips Achieva 3.0T TX MRI system. T2 Turbo Spin Echo images (TR/TE = 2500-3500/90-120 ms, flip angle = 90°, 512 x 512 matrix, slice thickness of 3 mm, 160 mm FOV), T1 Turbo Spin Echo images (TR/TE = 500-570/9 ms, flip angle = 90°, 512 x 512 matrix, slice thickness of 3 mm, 160 mm FOV) and DWI (TR/TE = 6500/79 ms, flip angle = 90°, 256 x 256 matrix, slice thickness of 3 mm, 240 mm FOV, water excitation with b value of 1000 s/mm²) were obtained. To correct the signal intensity of bleeding within the prostate in T2wMR, the signal intensity of hemorrhage area within prostate of T2wMR is substituted for that of T1wMR. To align the prostate on DWI to T2wMR, the transformation parameters of DWI are estimated by normalized mutual information-based rigid registration. To align the prostate on ADC map to T2wMR, the estimated transformation parameters are applied to ADC map. Then DWI and ADC map are color-coded and overlaid to T2wMR, respectively. To confirm prostate cancer localization, histopathology image is co-registered to T2wMR. For evaluation of our method, our result is visually compared with the location of prostate cancer indicated by a radiologist.

Discussion

Our signal correction can differentiate prostate cancer from hemorrhage area in T2wMR. Our multimodality image fusion can effectively localize the prostate cancer by providing complementary information and easily compare with ground-truth of histopathology image.

Measurement of Noise Power Spectrum for CT Image: Importance of Low Frequency Component and Methods to Achieve Its Accuracy (Station #2)

Mitsunori Goto MMedSc, RT (Presenter): Nothing to Disclose, Masaaki Taura BMedSc, RT: Nothing to Disclose, Kazuhiro Sato MMedSc, RT: Nothing to Disclose, Noriyasu Homma PhD: Nothing to Disclose, Issei Mori: Nothing to Disclose

CONCLUSION

ROI must be reasonably large for low frequency accuracy even with proper windowing. If ROI needs to be very small, deconvolution is a choice.

Background

To evaluate noise reduction performance of iterative reconstruction (IR), noise standard deviation is not a good noise indicator and noise power spectrum (NPS) analysis is needed. For the evaluation of low-contrast detection performance, low-frequency component of NPS is crucially important because signal exists only at low frequency region. On the other hands, NPS measurement of CT image is inaccurate at low frequency due to frequency leakage problem. We show the low-frequency error of NPS quantitatively in association with the size of region of interest (ROI) and usage of windowing. We further show that the frequency leakage can be corrected by a deconvolution.

Discussion

Overestimate of low frequency NPS worsens with smaller ROI. The frequency leakage problem is dominated by the length of short side of rectangular ROI. Windowing is effective to suppress this error, but becomes almost powerless if ROI is 32x32 pixels or smaller. Among several window functions, we judged Welch type is the most preferable. When ROI is 32x32 pixels, MFSNR for 10 or 20mm object size is underestimated by a factor of more than 10% even with windowing. This error can be made virtually zero by deconvolution.

Impact of Tube Current Modulation on Lesion Detectability as a Function of Patient Size (Station #4)

Justin Bennion Solomon MSc (Presenter): Nothing to Disclose, Daniel Jack Frush BS: Nothing to Disclose, Baiyu Chen: Nothing to Disclose, Juan Carlos Ramirez Giraldo PhD: Employee, Siemens AG, Ehsan Samei PhD: Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Carestream Health, Inc

PURPOSE

To assess the impact of tube current modulation (TCM) on detectability as a function of patient size using phantom measurements.

METHOD AND MATERIALS

The task-based Mercury 3.0 phantom, composed of cylindrical sections of 12, 18, 23, 30 and 37cm diameters, was imaged on a modern dual-source CT scanner (Flash, Siemens). The task-based Mercury 3.0 phantom, composed of cylindrical sections of 12, 18, 23, 30 and 37 cm diameters, was imaged on a modern dual-source CT scanner (Flash, Siemens).
and connected through tapered sections, was imaged on a modern dual-source CT scanner (Flash, Siemens) using fixed tube current-time product (fixed mAs) and TCM. An abdominal protocol was used with 120 kVp and pitch = 1.0 with comparable radiation output (CTDvol) values. Image series were reconstructed using filtered back projection at 0.6 mm. The task transfer function (TTF), the noise power spectrum (NPS), and the detectability index (d') for a 10 mm - 50 HU designer lesion index (d') were as a function of phantom size. The results were compared in terms of the impact of TCM on detectability and phantom-size relationship.

RESULTS
For both TCM and fixed tube-current scans, d' decreased with increasing phantom size. However, the magnitude of detectability change was reduced with the use of TCM. For TCM scans, d' decreased on average by 75%, when comparing the largest and smallest phantom sections. For fixed mAs scans, d' decreased on average by 90%.

CONCLUSION
TCM reduces the degradation of image quality with phantom size, but it does not eliminate that dependency. The data can be used to design and optimize CT protocols as a function of patient size.

CLINICAL RELEVANCE/APPLICATION
The use of the tube current modulation can lead to an improvement in image quality consistency across patient sizes. However, larger patients still have a lower level of image quality.

PHS135
Quality Assessment of Mobile Fluoroscope Fleet for Budget and Resource Planning (Station #5)
Jaydev Kardam PhD, MS (Presenter): Nothing to Disclose, Eric Laurence Gingold PhD: Nothing to Disclose

CONCLUSION
Routine performance evaluations by a medical physicist can provide valuable data for imaging equipment budgeting and resource planning, and avenues for data-driven decision making for such tasks.

Background
Fifteen mobile c-arm fluoroscopes (nine 9" x-ray image intensifiers (XRII) and six 12" XRIIs) at a tertiary healthcare center were evaluated. Five of these units (four 9' XRII and one 12' XRII) were to be identified for replacement. An objective criteria was developed to guide the selection of the units to be replaced. Improvement in the variation within the fleet was assessed after replacement with five new XRII units.

PHS136
Quantifying Tumor Neovascularity with Immunohistochemical Markers Compared to Subharmonic US Imaging (Station #6)
Aditi Gupta, Kelly Dulin, Samantha Jaffe, Mark Forsberg, Jaydev Kardam PhD, MS: Nothing to Disclose, Flemming Forsberg PhD (Presenter): Equipment support, Toshiba Corporation Research collaboration, General Electric Company Research collaboration, Analogic Corporation Research collaboration, Toshiba Corporation Speakers Bureau, Toshiba Corporation, Manasi Dahibawkar BSc: Nothing to Disclose, Valgerdur Halldorsdottir MSc: Nothing to Disclose, Andrew Marshall: Nothing to Disclose, Priscilla Machado MD: Grant, Toshiba Corporation Equipment support, Toshiba Corporation, Traci B. Fox, Ji-Bin Liu MD: Research Grant, GluMetrics, Inc

PURPOSE
To compare different methods for quantifying tumor neovascularity based on immunohistochemical markers of angiogenesis to contrast-enhanced subharmonic ultrasound imaging (SHI).

METHODS AND MATERIALS
Twenty-eight (28) athymic, nude, female rats were implanted with 5 x 106 breast cancer cells (MDA-MB-231) in the mammary fat pad. The ultrasound contrast agent Definity (Lantheus Medical Imaging, N Billerica, MA) was injected in a tail vein (dose: 36 µl) and pulse-inversion SHI was performed in triplicate using a modified Sonix RP scanner (Analogic Ultrasound, Richmond, BC, Canada) with a L9-4 linear array (transmitting and receiving frequencies of 8 and 4 MHz, respectively). Specimens were extracted and sliced corresponding to the imaging planes and stained for endothelial cells (CD31), vascular endothelial growth factor (VEGF), and cyclooxygenase-2 (COX-2). Tumor neovascularity was quantified in 3 different ways 1) over the entire tumor 2) in small sub-regions of interest (ROIs) and 3) in the tumor periphery (within 2 mm of the margin) and centrally.

RESULTS
Results from specimens and SHI were compared using a linear regression analysis. The strongest correlation in this model was between SHI and COX-2 in the periphery of the tumors (r = -0.61; p = 0.004). The strongest correlation in this model was between SHI and COX-2 in the periphery of the tumors (r = -0.61; p = 0.004). However, when the specimens were divided into a central and a peripheral region VEGF was found to correlate with SHI in both areas (r = 0.45 and r = 0.56; p < 0.04). The strongest correlation in this model was between SHI and COX-2 in the periphery of the tumors (r = -0.61; p = 0.004).

CONCLUSION
The use of the tube current modulation can lead to an improvement in image quality consistency across patient sizes. However, larger patients still have a lower level of image quality.
When comparing quantitative measures of tumor neovascularity derived from immunohistochemical markers to SHI from xenograft models, sub-ROIs corresponding to the biologically active region (i.e., the tumor periphery) appear to account for tumor heterogeneity.

**CLINICAL RELEVANCE/APPLICATION**

In the future SHI may be used to monitor response for patients treated with anti-COX-2 therapies.

**PHE123**

Virtual Monochromatic Imaging Using Dual Energy CT—Principles and Clinical Applications (Station #7)

Abed Ghandour MD : Nothing to Disclose, Rong Rong MD : Institutional Grant support, Koninklijke Philips NV, Prabhakar Rajiah MD, FRCR (Presenter): Institutional Research Grant, Koninklijke Philips NV

**TEACHING POINTS**

1. With dual energy CT, virtual monochromatic images of any energy can be generated from low and high energy data 2. Generation of virtual monochromatic images can be performed either in the projection or image domains (projection domain- rapid kv switching, dual layers; image domain- dual source) 3. There are several clinical applications of virtual monochromatic imaging- including artifact reduction and optimizing contrast 4. Equivalent monochromatic images- with same mean energy and radiation of polychromatic image, has higher image quality and lower artifacts

**TABLE OF CONTENTS/OUTLINE**

- Virtual monochromatic imaging- Definition, physics
- Generation of virtual monochromatic images from different technologies, including dual layer
- Projection vs. image based methods- Technique, advantages, disadvantages
- Phantom studies illustrating the concept of virtual monochromatic images
- Clinical applications with illustrative cases
  - Monochromatic low keV images- For boosting contrast in vascular structures- with suboptimal bolus/decreased contrast dose
  - Monochromatic high keV imaging- For reducing artifacts- Beam hardening, metal artifact, calcium blooming
- Virtual non contrast using material decomposition- Radiation dose saving
- Virtual calcium score
- Material differentiation

**PHE005-b**

Modular Near Real-time Quality Control Analysis for Neuroimaging Data (hardcopy backboard)

Gregory A. Book MS (Presenter): Nothing to Disclose, Michael Stevens : Nothing to Disclose, Michal Assaf : Nothing to Disclose, Godfrey Pearlson : Nothing to Disclose

**Background**

Functional MRI and other neuroimaging modalities are susceptible to normal MR artifacts including RF spikes and coil failures, however the most common artifacts are from motion. Real-time motion detection is necessary to allow the scanner operator a chance to repeat a series if motion exceeds a certain limit, and this capability is not available on all MRI scanners. We seek to solve these problems by creating an automated near real-time system to identify and flag potential quality control issues in neuroimaging data. We additionally introduce an algorithm to quantify motion in 3D structural images.

**Evaluation**

The QC system was built upon the existing Neuroinformatics Database (NIIDB) system, and is modular because new QC protocols can be included. Upon receipt of a complete series, the system runs multiple QC checks in parallel by submitting the jobs to a compute cluster, with the results then stored and displayed on a webpage for each imaging study. QC checks include timeseries motion estimation of functional MRI, SNR calculation of timeseries and 3D volumes, and motion detection in 3D structural volumes. fMRI motion estimation and SNR are calculated using FSL. The 3D volume motion detection algorithm calculates the radial average of the FFT of each slice of an image, then takes the average of the linear regression of the resulting power spectra plots, where a more negative $R^2$ value indicates less high frequency signal and therefore more motion.

**Discussion**

The NIIDB instance in which the QC system was tested stores 43,855 fMRI series and 18,371 3D structural volumes, including the QC results for the respective series. QC results are available 5-10 minutes after the completion of a series. Timeseries motion estimation allowed scan repeats, SNR values indicated coil failures, and $R^2$ value from 3D volumes was consistent with operator identified motion.

**CONCLUSION**

Having near real-time QC metrics available allows the MR operator to repeat a scan while the patient is still in the scanner if artifacts are found. Motion detection in 3D images is most useful when collecting multiple structural images within the same scanning session to identify which images should be excluded from further analysis.
Radiology Utilization Action Team: A Multidisciplinary Approach to Utilization Management and the Development of Appropriate Imaging Practices (Station #1)

Diego Antonio Covarrubias MD (Presenter): Nothing to Disclose, Iqbal Kasam MD: Nothing to Disclose, Julie B Ross : Nothing to Disclose, Christopher Ta-Wei Hsu MD: Nothing to Disclose

PURPOSE

In recent years the growth of medical imaging as a national driver of healthcare costs has minimally decreased, however, spending continues to rise, despite a prolonged economic recession and reform legislation. Radiology utilization management, a concept implemented over the last fifteen years as a strategy to curtail costs, has become a reality of modern practice and thus far has developed in two major forms, active management through radiology benefits management (RBM) versus computerized decision support (CDS) at the point of order entry. Both methods have their advantages and disadvantages, with the radiologist playing an overall minor or behind the scenes role in each. We suggest a different approach in which the radiologist partners with colleagues from different clinical specialties to lead an 'action team' tasked with gathering and analyzing data pertaining to imaging exams and presenting this data to referring physicians in a manner that allows for the development of appropriate ordering trends. With this approach, the radiologist is an active and visible partner in the process.

METHODS

A radiology utilization action team (RUAT) was established at our institutions consisting of physicians and other allied health professionals from different specialties but including at least one radiologist, often as the chair or co-chair of the team. Team members serve voluntarily. The team meets monthly to review ordering trends from across the institutions, identifying specific ‘initiatives’ on which to focus attention. Initiatives typically deal with high cost or complex examinations such as breast MRI, but could be applicable to plain film or ultrasound. The goal of the team is to develop initiatives that incorporate best practices based on proven scientific or clinical evidence. Data regarding the chosen initiatives is culled from the electronic medical record and is acquired for all individual physicians who order the examinations. The data is analyzed for outliers, i.e. physicians whose ordering practices differ significantly from those of their peers. Action team members then meet with clinical departments to present ordering data and provide information regarding available best practice standards as well as suggested guidelines developed by the team. The action team also meets with specific physicians determined to fall into an outlier category to discuss their ordering practices, their personal rationale behind requesting examinations, and further communicate standards and guidelines. These physicians are shown the data sets pertaining to their department, providing a concrete way to visualize the general ordering practices of fellow practitioners. The process is dynamic, with physicians able to engage members of the action team at any time for direct consultation or advice and with the action team members checking in with clinicians to be sure they have the information they require to make informed decisions regarding diagnostic imaging orders. In contrast to RBMs, the teams do not prohibit individual physicians from ordering examinations.

RESULTS

Many initiatives exist simultaneously at our institution, dealing with examinations ranging from radiographs of the lumbar spine to PET/CT to shoulder MRI. An example of one such initiative involves abdominal ultrasounds. A steady increase in the volume of abdominal ultrasound studies performed at our institution was noticed. The radiologists members of the action team pointed out that an alternative “limited” abdominal ultrasound study was available and seemed to be underutilized. The radiology utilization action team developed an initiative to educate and inform ordering physicians of the availability of an order for limited abdominal ultrasound studies which could be used in certain specific clinical situations instead of the full abdominal ultrasound order. Following the dissemination of this information, ultrasound volume continued its increasing trend, but limited examinations were performed more frequently, absorbing some of the growth in ordering, while full abdominal exams remained relatively steady. Results of various other initiatives would be included in the presentation.

CONCLUSION

Utilization management is a general trend in healthcare that is now well entrenched and likely to be a fixture in the long term. Radiologists have an opportunity to actively participate that should not be ignored. We describe a multidisciplinary approach to utilization management that incorporates and values the expertise of the radiologist. The method advocated is a dynamic, physician-controlled process that allows for incorporation of best practice standards developed at the national level, such as ACR appropriateness criteria, as well the establishment of local or regional institutional guidelines based on collaboration among physicians of different specialties.
Inadequate IV access in patients referred from the emergency department (ED) and inpatient units for contrast medium (CM) enhanced CT examinations increases the risk of CM extravasation, the need for repeat examinations, and contributes to extended procedural wait times by decreasing patient through-put resulting in emergency department (ED) crowding. The goal of this project was to implement measures that would substantially reduce the IV defect rate for ED and inpatients, by creating a mechanism that (1) provides consistently safe IV contrast administrations; (2) reduces the patient turn-around time by avoiding unnecessary interventions by CT staff technologists or nurses to correct IV defects; and (3) shortens patients’ time away from primary care staff and resources.

METHODS

We assembled a team of CT technologists, radiology nurses, nurses from the ED and inpatient units, as well as patient transport staff, to develop a “CT Patient Preparation Communication Process” with the goal of reducing the IV defect rate. The team categorized problems with peripheral IV’s as the following types of “IV defects”: (1) incompatible IV gauge; (2) incompatible IV site; (3) incompatible IV tubing; (4) loose IV connection; (5) non-working IV; and (6) painful/sore/infiltrated IV site. Any single IV defect, or any combination thereof can delay, complicate, or preclude safe power injections of intravenous CM. Next, we designed and implemented the “CT Handover and Preparation Sheet” consisting of a checklist and photographs, delineating correct patient preparation as well as IV placement standards required for safe and successful CT examinations. The “CT Handover and Preparation Sheet” was uploaded to the institutional directory of forms and its use has become required for every ED and inpatient. Actual IV defects were recorded by CT staff using an online form which records encounter and defect details. Unit nurse managers receive a weekly report of IV defect statistics and trends and provide follow-up education for ED and inpatient nurses regarding specific incidents of IV defects. Patient turnaround times (order to study completion) were recorded electronically based on RIS data.

RESULTS

Since the implementation of the standardized “CT Patient Preparation Communication Process” and hospital-wide rollout of the “CT Handover and Preparation Sheet” in July of 2012, the rate of IV defects for ED and inpatients has decreased from 8% to 1.25%. Average turnaround times for CM enhanced CT exams for all ED and inpatients improved from 200 minutes in December 2011 to 165 minutes in December 2013, a 17.5% improvement.

CONCLUSION

The rate of IV defects can be substantially reduced through an interdepartmental ‘CT Patient Preparation Communication Process” and the use of a tool such as the “CT Handover and Preparation Sheet.” Among the beneficial outcomes of a reduction in IV defect rates are reduced numbers of faulty IV access, improved safety, and improved turnaround times.

QSE121

Carotid Doppler Ultrasound—Report Standardization to Improve PQRS Measure Outcome (Station #3)

Travis Browning MD (Presenter): Advisory Board, Hewlett-Packard Company Advisor, McKesson Corporation, Kristen Bishop MD: Nothing to Disclose, Richard Charles Batz MD: Nothing to Disclose, Julie Gibson Champine MD: Nothing to Disclose

PURPOSE

Measure #195 of the Centers for Medicare and Medicaid Services (CMS) Physician Quality Reporting System (PQRS) seeks to improve quality by standardizing the usage of direct or indirect reference to measurements of distal internal carotid diameter as the denominator for stenosis on carotid imaging exams. Through the use of system level standard report templates, we sought to improve our success rate for this measure specifically on carotid duplex ultrasound exams.

METHODS

A project group was organized with radiologists who read carotid duplex ultrasound and championed by the radiology medical director for one of the hospital practices. As the application of the CPT Category II code 3100F for this PQRS measure was performed by the billing office, their process was reviewed and determined to be automated through a coding engine (CodeKyte) assessing for key language. Individual radiologist practice was reviewed to determine what standards for carotid duplex imaging were being utilized.

The group practice was standardized to use the Society of Radiologists in Ultrasound 2003 Consensus Conference statement velocities, modified slightly at one of the facilities with internal angiogram validated measurement data. The PDSA cycle was employed to effect rounds of change, beginning with optimizing the system level template in the voice recognition dictation applications (PowerScribe 5.0 and 360). Verbiage suggested by the American College of Radiology specifically for this measure was leveraged. Success rates were monitored following the process change and coding failures were reviewed. Ongoing meetings reviewed these details and implemented further changes.

RESULTS

The PQRS code can only be applied to Medicare patients, so non-Medicare patients were excluded. The billing engine was queried for exams billed under CPT 93880 (bilateral carotid duplex ultrasound) to Medicare with an associated 3100F code. The 2 year pre-change period tallied 536 qualifying ultrasound exams with 340 (63.43%) successfully receiving the PQRS code. 4 months of post change data showed an immediate improvement with 110 qualifying exams and 95 (86.36%) successfully receiving the PQRS code. On review of those that failed to receive the PQRS code, all had utilized the approved system template. A technical assessment was then performed with identification of a few previously unknown issues. First, patient’s insurer can change and if a person’s insurer changed to Medicare, the billing engine was not retrospectively assessing for whether the PQRS code should be added. The billing engine settings were adjusted to apply the PQRS code for qualifying language on all qualifying exams regardless of the payor, which would facilitate future resubmission if the patient’s payor changed to Medicare. In addition, several issues with the manner of insurer naming and storage within the billing reporting engine caused error with original and ongoing data assessments. The data reports were redesigned and rerun for evaluation, specifically limiting to those with
Medicare at the time of the original exam. The pre-change tallied as 148 qualifying ultrasound exams with 124 (83.78%) receiving the PQRS code. The 6 month post-change tallied as 114 qualifying ultrasound exams with 104 (91.23%) receiving the PQRS code. The remaining failures in the post-change period were again confirmed to have used the approved report standard; the code had not been applied due to an internal process of routing the charges to hospital accounts for specific subpopulations of patients such as transplant recipients.

CONCLUSION

Standardizing report templates using approved language can improve success rates for quality measures such as PQRS. After instituting standardized reporting templates, no PQRS coding failure was due to radiologist non-use of the templates indicating such a method as a successful management option.

Going through these processes can uncover technical problems and data issues that would not have otherwise been recognized and corrected, likely otherwise attributed to variation in differing practitioner processes. In addition, the rigor of such evaluations can identify improvements in other areas, here in that by altering the methodology of the billing engine future resubmissions for changes in payors can be facilitated.

The next steps are to continue to monitor success rates for ultrasound exams to determine if any other technical issues remain. This same process is being mimicked by the other sections for application in MR and CT imaging of the carotids.

Lung Rapid Assessment and Management Program—Process Improvement Project (LungRAMP – PIP): Decreasing Wait Times for a Cancer Diagnosis (Station #4)

Daniel Toubassy BSC : Nothing to Disclose, Lilly Whitham : Nothing to Disclose, Alice Tsang (Presenter): Nothing to Disclose

PURPOSE

The Lung Rapid Assessment and Management Program (LungRAMP) was launched in 2010, as an outpatient diagnostic and treatment program which aims to quickly and appropriately assess and manage patients with presumed lung cancer.

The LungRAMP Process Improvement Project (LungRAMP PIP) was launched in an effort to:

- Ensure LungRAMP is consistently meeting provincial and hospital wait time targets from referral received to cancer diagnosis
- Identify opportunities for improving the quality of care provided to LungRAMP patients through the patient journey
- Reduce wait times for critical medical imaging tests because of the effect on diagnostic timelines of LungRAMP patients

METHODS

LungRAMP PIP leveraged Lean-Six Sigma methodology and involved 3 hospital departments, thoracic surgery, medical imaging and pathology to ensure the full patient journey was addressed. The project included 3 main phases: • Process Diagnostics: Staff interviews and process observations were conducted in order to develop an understanding of the complete patient journey. Following initial assessment a value stream mapping (VSM) event was facilitated to comprehensively map out the current state and identify areas of opportunity within the process. The VSM resulted in the prioritization of 2 main areas: Delays and inconsistencies in patient intake and care planning. Inefficiencies and miscommunication between clerical and clinical partners for CT guided lung biopsies, a critical diagnostic test. • Solution Development and Implementation: 2 approaches were used to create solutions for the VSM priorities: 2 cross-departmental working groups were established to address opportunities with patient intake and care planning and CT guided lung biopsy clerical workflow issues. A 2 day rapid improvement event (RIE) was held to tackle issues associated with day of exam processes for the CT guided lung biopsy procedure. By working closely with leadership and clinicians a project management team was able to guide staff through solution development and implementation. • Sustainability: Various Lean sustainability tools were implemented to ensure that any improvements would have a lasting effect, including: Leadership working group meetings to monitor progress of solution implementation Audits to monitor new processes and identify potential gaps Team huddles with frontline staff to discuss and resolve any issues Online dashboard to track weekly performance metrics for the CT guided lung biopsy

RESULTS

Various solutions were successfully implemented to improve the quality of the LungRAMP patient journey and decrease medical imaging wait times. Medical imaging improvements related to CT guided lung biopsies include:

1. 50% decrease in booking turnaround time from 10 to 5 days
2. 80% decrease in same day cancellations
3. Increased volumes of performed CT guided lung biopsies from 8 to 9 patients a week

Solutions:

- Implementation of an online consult review and approval process
- Implementation of new clerical workflow to streamline appointment bookings and notification
- Implementation of short call list of patients willing to accept last minute appointments

4. 25% increase in the number of exams that begin on time

Solution: Implementation of new day of exam workflow to ensure seamless patient care

5. 9% decrease in the length of time taken to complete a CT guided lung biopsy

Solution: Manual data tracking to ensure new workflow timelines are followed

Additional workflow improvements were made with the department of thoracic surgery to improve the patient intake and care planning process, specifically:
Improving CPT Coding Accuracy for Common Musculoskeletal Interventions (hardcopy backboard)

Ryan M. Schmidt MD (Presenter): Nothing to Disclose

A quality improvement project was initiated in the radiology department of our large, tertiary care, academic children’s hospital. For the purposes of this project, we defined an incorrect order as any order changed by the technologist. We focused on orders changed by technologists as it is our typical practice to have the technologist make the order change rather than waiting for the ordering clinician to make the change. In addition, we decided to focus specifically on radiographs and fluoroscopy as they are the most common study performed and the most likely to be changed as a result of an order error. A weekly report was created in the radiology information system (Epic Radiant, Verona, WI) identifying the procedure type and originating department of each changed order. The number of changed orders was compared to the total number of radiography and fluoroscopy studies performed each week to calculate the percent of changed orders. Technologists were also asked to log the reason for each order they changed.

RESULTS

At baseline, 4.2% of all radiography and fluoroscopy were changed. When analyzing the data, we identified a number of issues resulting in incorrect orders. First, there were a small number of studies that were always incorrect. There were a number of reasons why these studies were not performed: the orders were outdated (i.e. Barium Enema), the orders were changed per departmental protocol (3-4 view radiograph of the Pelvis), or the orders were confused with a more common order (Fluoro >1 hour). In each of these cases, the order was retired and removed from the preference list. Next, we addressed order sets that were leading to incorrect orders. We found that the order set for PICC placement had two problems. First, it contained the incorrect order for fluoroscopy guidance and second, it did not contain the abdominal radiographs order needed when a lower extremity PICC was placed. Each of these errors was corrected in the order set. No further order set errors were identified. We then looked at the specialty/department where each incorrect order originated. We found that changed orders were most likely to originate from inpatient floors (30.2%), the emergency department (24.7%), community pediatricians (21%), and orthopedics (5.8%). In order to decrease the number of incorrect orders from each of these divisions, we examined their radiology preference list and suggested several changes to each list. These changes were designed to simplify the preference lists by removing orders that were either incorrect or rarely used (i.e. 3-view hand radiograph for arthritis was removed from the emergency department preference list); grouping similar studies together (i.e. all upper extremity radiographs are in the same section); or grouping different imaging studies of the same body part next to each other (i.e. single view chest x-ray and two-view chest x-ray). In addition, the orders were renamed to include the common indications for each imaging test (i.e. 1V abdomen - constipation). Because many incorrect orders from community pediatricians were obtained via a paper order form, we simplified our paper order form and provided updated protocols for the front desk staff who transcribe the paper orders into an electronic order. In order to track the effect that these changes had on reducing the number of changed orders, a run chart was created. While this project is still ongoing and many of the preference list changes have yet to be implemented, the percentage of radiography orders being changed has decreased from 4.2% to 3.7%.

CONCLUSION

Quality improvement techniques can be used to decrease the number of radiography orders changed in a radiology department. We believe that the changes we have made help to make our department safer by decreasing the chance that an incorrect study will be performed.
QSE016-b

Utilizing Value Stream Mapping to Reduce Patient Lead Time in Bone Density (hardcopy backboard)

Laura Tibor MBA, BEng (Presenter): Nothing to Disclose, Timothy B. Valley BS, MA: Nothing to Disclose, Cathy Berg: Nothing to Disclose, Tracy Callahan: Nothing to Disclose, Darla Enright: Nothing to Disclose, Jeffrey Kindseth: Nothing to Disclose, Dawn Krisik: Nothing to Disclose, Bonnie Lehnertz: Nothing to Disclose, William Oswald: Nothing to Disclose, Brian Mullen MD: Nothing to Disclose, Linda Nesberg: Nothing to Disclose, Michelle Rank: Nothing to Disclose, Jolene Stock: Nothing to Disclose

PURPOSE
As part of a Value Stream Mapping initiative in the Radiology Department, our team identified that patients needing a Bone Density study had a total lead time of 94.3 minutes with approximately 75% of that time being non-value added wait time. The goal of this project was to decrease the total patient's lead time, from patient arrival or report time through study completion, by 10% from a baseline of 94.3 minutes, in September 2013, to 84.9 minutes by December 31, 2013.

METHODS
The team was formed in July of 2013 and was led by the Assistant Supervisor and guided by a Process Improvement coach. The five Bone Density Technologists were all involved in the project and alternated their attendance at the project meetings. The team also included key stakeholders from the registration desk and breast imaging. The project team utilized several process improvement tools which included the DMAIC methodology, a project charter, current and future state Value Stream Maps (VSM), a Pareto diagram and analysis, Plan Do Study Act (PDSA) cycles, observation, pull systems, visual cues and a control plan. By visualizing the patient flow on the current state VSM, the team was able to accurately measure the duration and first time quality rate at each step of the process. A Pareto diagram allowed the team to determine the most time consuming steps and largest sources of opportunity. From that analysis, the team decided to focus their efforts on improving the Bone Density analysis step and the patient waiting steps of the process. The team brainstormed ideas, tested changes via PDSA cycles and ultimately implemented five key process changes. These changes consisted of improving the patient’s process for locking their belongings, reducing process steps that were not performed or misrepresented the types of services that were provided. No matter the coding arrangement of a practice, the ultimate responsibility for coding accuracy rests on the clinician. We identified common CPT coding errors for interventional musculoskeletal procedures at our institution, and sought to increase coding accuracy.

RESULTS
On average, our department performs interventions/procedures on approximately 279 patients per month. Each procedure is variable on complexity, with submitted CPT coding ranging from one to multiple. Prior to implementation there was an average of 22 coding errors per month, the majority of which resulted from interventional pain procedures (44% of all coding changes, 9.6 coding changes per month) and biopsies (41% of all coding changes, 9.1 coding changes per month). Only 12.7% and 2.3% of changes were due to ablations or other causes respectively. Since implementation, the average coding errors have decreased >50%, now averaging 8.75 changes per month, despite a similar total volume of procedures. Intervventional pain procedures (5.3 changes per month, 60% of total changes) and biopsies (3 changes per month, 34% of total changes) continue to account for the majority of coding changes, however both have markedly decreased, largely due to increased awareness and clarification for our most common coding errors for each of these categories.

CONCLUSION
Accurate coding is an essential part of any medical practice for accurate reimbursement and fraud prevention. While mistakes are inevitable, our experience demonstrates that analyzing common coding errors, creating and prominently displaying reference materials to address these errors, and raising awareness and education of the involved staff can lead to a dramatic reduction in CPT coding errors. Since implementation, we have continued to update our common procedural coding charts to reflect the latest CPT coding standards and address additional intradepartmental coding changes that have arisen. Additionally, we have continued offering regular group assessment and feedback which reinforces the importance of correct CPT coding and encourages continued physician and technologist coding awareness and communication. Our project demonstrates these improvements can take place even in a departmental setting with multiple rotating fellows and residents.
batching exams prior to analysis. A future state VSM was developed to reflect the changes to the process steps and times.

**RESULTS**

When the project closed on December 31, 2013, the total lead time for Bone Density patients had decreased from 94.3 to 50.5 minutes which equated to a 46% reduction and easily exceeded the goal of 10%. Since then, the team has continued to sustain the efforts and decrease the lead time to 35.3 minutes in January, 41.2 minutes in February, and 27.7 minutes in March of 2014. Staff have anecdotally shared that their day seems to flow better and they are less stressed. During this project, the team questioned their standard process for obtaining two images for hip and spine studies. As a result, the leadership team acquired the necessary data to analyze the impact of the dual studies and concluded that the second set of images were indeed non-value added. In March 2014, after this project had closed, the process changed so that the technologists will only acquire one image which will further reduced the total lead time and staff’s time to complete the exam.

**CONCLUSION**

In conclusion, the Bone Density team successfully improved their patient’s flow through the process, reduced patient lead time and increased their staff satisfaction. The team learned that brief morning huddles are key to testing successful process changes, small changes can have a big impact on other stakeholders, PDSA cycles need to be short and the importance of not jumping to solutions at the beginning of the project. The Bone Density team will continue to monitor the patient’s lead time on a monthly basis and identify opportunities to continuously improve their processes.

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**ROS-SUB**

Radiation Oncology Sunday Poster Discussions

*Scientific Posters*

**RO**

AMA PRA Category 1 Credits ™ : .50

*Sun, Nov 30 1:00 PM - 1:30 PM  Location: RO Community, Learning Center*

**Sub-Events**

**ROS109**

**Quantitative Assessment of Lung Perfusion on Dual-Energy CT: Utility for Pulmonary Functional Loss Assessment and Radiation Pneumonitis Prediction in Non-Small Cell Lung Cancer Patients (Station #1)**

Sachiko Miura MD (Presenter): Nothing to Disclose, Yoshiharu Ohno MD, PhD : Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, Terumo Corporation Research Grant, Fuji Yakuhin Co, Ltd Research Grant, FUJIFILM Holdings Corporation Research Grant, Guerbet SA, Hiroshi Okada : Nothing to Disclose, Hiroshi Kimura : Nothing to Disclose, Masatoshi Hasegawa : Nothing to Disclose, Kimihiko Kichikawa MD : Nothing to Disclose

**PURPOSE**

To evaluate the utility of lung perfused blood volume (PBV) map from dual-energy CT (DECT) for pulmonary functional loss assessment and radiation pneumonitis prediction in non-small cell lung cancer (NSCLC) patients.

**METHOD AND MATERIALS**

30 NSCLC patients who received conventional radical radiation therapy (RT) underwent DECT examinations at 4 time points (i.e. before, during, 1 week after, and 1 month after RTs) and follow-up examination including pulmonary function test. From each DECT data, a normalized lung PBV (nPBV) map was generated by commercially available software in each patient. To evaluate lung perfusion abnormality due to RT, nPBV values were determined as averages of all ROI measurements within the planning target volume (PTV), lung volumes that received 20Gy, 40Gy and 60Gy, and lung outside of the RT field at each time point. According to follow-up examination results, all patients were divided into radiation pneumonitis (n=23) and non-pneumonitis (n=7) groups. To assess the difference of nPBV value between the two groups at each time-point, nPBV value within each location was compared between the two groups by Student’s t-test. To determine the capability of nPBV values for pulmonary functional loss assessment, nPBV values within each location at all time points as having significant difference between the two groups were correlated with %VC and %FEV1. To evaluate the capability of nPBV value for radiation pneumonitis prediction, the feasible threshold value of nPBV during RT was determined by ROC-based positive test, and its differentiation capability was also assessed.

**RESULTS**

At all time points except before RT, nPBV values within PTV had significant differences between the two groups (p<0.05). nPBV values within PTV had significant and good correlation with %VC at the same time points (during RT: r=0.66, p=0.03; 1 week after RT: r=0.70, p=0.02; 1 month after: r=0.61, p<0.05). When applied the feasible threshold value, sensitivity, specificity and accuracy for early prediction of radiation pneumonitis were as follows: 100 (22/22) %, 37.5 (3/8) % and 83.3 (25/30) %.

**CONCLUSION**

Lung PBV map from DECT is useful for pulmonary functional loss assessment and radiation pneumonitis prediction in NSCLC patients.

**CLINICAL RELEVANCE/APPLICATION**
Lung PBV map from DECT is useful for pulmonary functional loss assessment and radiation pneumonitis prediction in NSCLC patients.

**ROS110 Hemoglobin and Tumor Perfusion Effects on Outcome Using Magnetic Resonance Imaging for Patients with Non-Small Cell Lung Cancer (Station #2)**


**PURPOSE**

The relative signal intensity (rSI) of the dynamic contrast enhancement in tumor region (the ratio of the signal intensity post-contrast to signal intensity pre-contrast) and the systemic oxygen carrier, hemoglobin (Hgb) have the potential on predicting the resectability and survival for lung cancer patients treated with preoperative neoadjuvant chemoradiotherapy (PNT).

**METHOD AND MATERIALS**

8 stage IIIA non-small cell lung cancer patients, were treated with PNT, underwent 3 serial dynamic contrast enhancement magnetic resonance imaging (DCE-MRI) at pre-, early- and post-therapy. 3D tumor region of interest (ROI) drawn on DCE-MRI using MIMs software, the rSI for individual patients and the Hgb levels including pre-RT, nadir and pre-therapies were correlated with the tumor resectability (eligibility for tumor resection) and time at risk (months of no local recurrence from the time of PNT). Based on the clinical and pathological response 2 patient groups were identified: resectable tumor group (n=6) and non-resectable tumor group (n=2).

**RESULTS**

The high nadir Hgb and low rSI at early therapy are predominant with longer period of no tumor recurrence (r=-0.43, r=0.67) respectively, however the rSI showed no correlation with the resectability for the 8 patients. The resectable tumor group rSI and pre-RT Hgb positively correlated (r=0.51) and rSI pre and early therapy were negatively correlated with time at risk (r=-0.67, r=0.74). Nadir Hgb is significantly higher in the resectable tumor group than the non-resectable tumor group (P=0.04). No event of death for the resectable tumor group. Our study is limited by the number of patients studied.

**CONCLUSION**

Tumor resectability and survival outcome appear to be related to the level of DCE-MRI-detectable tumor perfusion characteristic and Hgb level in patients with lung cancer receiving PNT. DCE-MRI should be included in the diagnostic imaging studies during PNT.

**CLINICAL RELEVANCE/APPLICATION**

Assessing the local tumor vascularity by DCE-MRI and the systemic Hgb level should be used to improve the management of the PNT and appropriate patient selection to improve therapy outcomes.

**ROS111 Dynamic Contrast-enhanced Perfusion Area Detector CT in Non-small Cell Lung Cancer Patients: Influence of Mathematical Model to Early Prediction Capabilities for Treatment Response and Recurrence after Chemoradiotherapy (Station #3)**

Yoshiharu Ohno MD, PhD (Presenter): Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, Terumo Corporation Research Grant, Fujifilm Holdings Corporation Research Grant, Guerbet SA, Shinichiro Seki: Nothing to Disclose, Mizuho Nishio MD, PhD: Research Grant, Toshiba Corporation, Hisanobu Koyama MD, PhD: Nothing to Disclose, Yasuko Fujisawa MS: Employee, Toshiba Corporation, Naoki Sugihara MENG: Employee, Toshiba Corporation, Takeshi Yoshikawa MD: Research Grant, Toshiba Corporation, Sumiaki Matsumoto MD, PhD: Research Grant, Toshiba Corporation, Noriyuki Negi RT: Nothing to Disclose, Tohru Murakami: Nothing to Disclose, Takaharu Nishitani RT: Nothing to Disclose, Kazuro Sugimura MD, PhD: Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

**PURPOSE**

To determine the influence of mathematical method on dynamic contrast-enhanced (CE-) perfusion area detector CT (ADCT) to early prediction of treatment response and recurrence in non-small cell lung cancer (NSCLC) patients with chemoradiotherapy.

**METHOD AND MATERIALS**

66 consecutive stage IIIB NSCLC patients underwent dynamic CE-perfusion ADCT examinations, chemoradiotherapy and follow-up examinations. Dynamic CE-perfusion ADCT examinations were performed at 2 weeks prior to treatment and third course of chemotherapy. According to RECIST criteria, all patients were divided as follows: partial response (PR) group and stable and progressive diseases (SD+PD) group. In this
study, three mathematical models were applied to calculate perfusion ADCT indexes. Tumor perfusions were determined by dual- and single-input maximum slope methods, and extraction fraction and distribution volume were assessed by Patlak plot method. For early therapeutic effect assessment on each index, differences between two time points at all targeted lesions were averaged for determination of final value of each index in all patients. To evaluate capability of each index for therapeutic effect prediction, ROC analysis was performed to differentiate two groups. To determine the utility of each index for early prediction of recurrence, each perfusion index with applying feasible threshold value was compared recurrence free survival between responders and non-responders by Kaplan-Meier method followed by the log-rank test.

RESULTS

Area under the curves (Azs) of tumor perfusion by dual-input maximum slope method (Az=0.85) and distribution volume (Az=0.84) had significantly larger than that of extraction fraction (Az=0.48, p<0.05) and/or tumor perfusion by single-input maximum slope method (Az=0.72, p<0.05). When feasible threshold values applied, recurrence free survivals of tumor perfusion by dual-input maximum slope method (p=0.0002) and distribution volume (p=0.01) showed significant differences between responders and non-responders.

CONCLUSION

Early treatment response and recurrence prediction capabilities on dynamic CE-perfusion ADCT are significantly affected by mathematical models in NSCLC patients with chemoradiotherapy.

CLINICAL RELEVANCE/APPLICATION

Mathematical model is considered as one of the important factors for early treatment response and recurrence prediction on dynamic CE-perfusion ADCT in NSCLC patients with chemoradiotherapy.

ROS112

Clinical Outcomes of Proton Beam Therapy for Metastatic Lung Tumors (Station #4)

Kayoko Ohnishi (Presenter): Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To evaluate the treatment outcomes and the feasibility of proton beam therapy for metastatic lung tumors.

Materials/Methods: Thirty-one patients with 44 metastatic lung tumors who had no active disease except the lung and treated with proton beam therapy between March 2002 and December 2012 were reviewed. Sixteen patients were men, and the median age was 64 years. The primary sites were the rectum in 10 patients, the lung in 5, the liver in 4, and the other in 12. The clinical target volume ranged from 1.2 to 91.2 cc (median, 12.8 cc). The total dose of 66.0 GyE in 10 fractions or 72.6 GyE in 22 fractions was prescribed to 33 of 44 targets. Clinical outcomes and major toxicities were analyzed based on medical records and clinical follow-up.

Results: Median follow-up time was 18 months for all patients. Over the entire follow-up, local recurrence was observed in 11 lesions (25%). The 2-year local control rate was 70%. On the univariate analysis, the clinical target volume was significantly associated with local control. The 2-year local control rate for targets < 10 cc was 77% compared with 70% for targets >= 10 cc (log-rank, p = 0.04). The primary site was not associated with local control. Twenty-one (68%) of 31 patients developed new metastasis after proton beam therapy. The median time from proton beam therapy to the new metastasis was 6 months. The 2-year disease-free and overall survival rates were 34% and 83%, respectively. No Grade 3 or higher acute and late toxicities were observed.

Conclusions: Proton beam therapy is considered to be effective and safe treatment option for metastatic lung tumors. However, most of the patients developed new metastasis after proton beam therapy. Further investigation is needed to clarify the better indication for proton beam therapy.
from 7.5mg to 150mg. At the time of submission, follow-up imaging was available for 32 patients and was evaluated using mRECIST.

RESULTS

42 patients underwent a single session of TACE and 6 patients underwent two sessions. One procedural complication was encountered: a dissection of the common hepatic artery. 49 sessions resulted in discharge within 24 hours of TACE. 5 sessions required admission greater than 24 hours: 1 for nausea, fever, and emesis, 3 for abdominal pain, and 1 for unrelated medical care. Of the 32 patients for which follow-up imaging was available, 7 demonstrated complete response (21.9%), 10 demonstrated partial response (31.2%), 12 demonstrated stable disease (37.5%), and 3 demonstrated progressive disease (9.4%). Mean follow-up time since DEB-TACE was 122 days (r4-940 days). 4 patients were bridged to transplant. During follow-up, one patient death was recorded secondary to complications of liver transplant. Kaplan-Meier survival at 3, 6, and 12 months was 100%, 95%, and 95% respectively.

CONCLUSION

TACE with 70-150 µm doxorubicin-loaded DEB appears safe and effective for treatment of patients with unresectable HCC. In our population, the procedure was tolerated well, with the majority of patients showing favorable to stable tumor response.

CLINICAL RELEVANCE/APPLICATION

In vivo studies show that smaller 70-150 µm DEB penetrate further into tissue resulting in greater and more uniform drug coverage, but clinical studies to assess tolerability and efficacy are lacking.

VIS218

Percutaneous Interventions on Intragraft Stenoses within Failing Prosthetic Arteriovenous Grafts: Analysis of Patency Rates (Station #2)


PURPOSE

While endovascular outcomes on venous anastomosis and central venous stenoses have been extensively studied, there is a paucity of data on intragraft stenoses. The purpose of this study was to evaluate outcomes of endovascular treatment of intragraft stenosis in prosthetic hemodialysis grafts.

METHOD AND MATERIALS

Our procedural database was retrospectively reviewed for all percutaneous interventions on prosthetic AV grafts from 2005 through 2011. Specifically, AV grafts presenting with first-time intragraft interventions were identified, resulting in 186 unique AV grafts (83 males, 103 females, mean age 59.7 years). An intragraft stenosis was defined as a 50%+ luminal narrowing greater than 2 cm from the arterial and venous anastomosis requiring intervention. Post-intervention access patencies were calculated using Kaplan-Meier analysis. Lesion patency was determined based on time until angiographically proven >50% restenosis of the treated lesion.

RESULTS

Development of the first intragraft stenosis within an access occurred at a median graft age of 20.7 months (interquartile range 12.0-33.9 months). A total of 231 first-time intragraft stenoses were identified in 186 AV grafts. Graft thrombosis was present in 63%. Angioplasty was technically successful in 86%; 14% requiring stenting due to inadequate response to angioplasty. A concurrent extragraft stenosis was identified in 76% of accesses. At 3, 6, and 12 months, the post-intervention primary patency rates were 56%, 40%, and 23%, respectively. At 3, 6, and 12 months, secondary patency rates were 84%, 77%, and 67%, respectively. The lesion-specific patency rates were 78%, 52%, and 30% at 3, 6, and 12 months, respectively. Graft thrombosis was associated with significantly worse primary patencies (32% versus 53% at 6 months, p=0.014) but not secondary or lesion patency rates. Angioplasty and bailout stenting had similar patency rates. Graft age did not correlate with patency rates.

CONCLUSION

Angioplasty was highly successful for treatment of intragraft stenoses. Percutaneous intervention on these first-time intragraft stenosis yielded 6-month primary, secondary, and lesion patency rates of 40, 77, and 52%, respectively.

CLINICAL RELEVANCE/APPLICATION

Percutaneous interventions on first-time intragraft stenoses yielded post-intervention patency rates that exceed the goals stated by the 2006 K/DOQI guidelines and are thus justified.

VIS219

Endovascular Embolization of Visceral Artery Pseudoaneurysms using N-Butyl Cyanoacrylate or Glue: Preliminary Experience in a Tertiary Care Centre (Station #3)

Madhusudhan Kumble Seetharama MD, FRCR (Presenter): Nothing to Disclose, Shivanand Ramachandra
PURPOSE

1. To evaluate the feasibility, safety and efficacy of n-butyl cyanoacrylate (NBCA) in embolization of visceral artery pseudoaneurysms (PsA).

2. To illustrate and discuss the indications for the use of NBCA in visceral artery PsA.

METHOD AND MATERIALS

30 patients (25 males, 5 females; age range: 15 - 50 years) of gastrointestinal bleed with 30 visceral artery PsA embolized using NBCA between Jan 2011 and Dec 2013 were retrospectively evaluated. The reasons for not using coils, which is the embolizing agent of choice, were assessed in each case. All PsA were embolized using co-axial technique. Glue - lipiodol mixture (25% - 30% glue concentration) was injected in small aliquots (0.1 - 0.3 mL) with serial flushing till the PsA was completely embolized. The technical and clinical success rates were evaluated along with the encountered minor and major complications.

RESULTS

All patients were embolized using NBCA (100% primary technical success) at first presentation. The reasons for using glue as primary embolizing agent were PsA arising from main artery which cannot be sacrificed (18 patients), inadequate landing zone for the coils (4 patients), inability to reach close or distal to the PsA (5 patients) and failed previous coil embolization (3 patients). Mean amount of glue used per procedure was 0.24 mL. Recurrence of PsA occurred in 2 patients indicating a clinical success of 90%. All the three were embolized using coil, glue and thrombin, respectively with 100% secondary technical success. Minor and major complications were seen in 3 patients (10%) each which were managed without major consequences.

CONCLUSION

NBCA is a safe and effective embolizing agent in expert hands and in selective cases where coils cannot be used or have failed.

CLINICAL RELEVANCE/APPLICATION

Embolization of visceral PsA with coils / microcoils may not be possible in some unusual situations and in such cases NBCA can prove to be an effective embolizing agent in experienced hands.

Role of Robotic Arm in CT Guided Biopsies (Station #4)

PURPOSE

To explore the role of robotic arm in CT Guided Biopsies. To assess the accuracy of CT guided biopsy using a robotic device in targeting a lesion

METHOD AND MATERIALS

50 patients were analyzed on whom robotic device was used to perform CT Guided biopsy. MAXIO Robotic Arm and Navigation Software (Perfint Pvt Ltd., India) was used in this study. Informed consent was taken. Plain and post-contrast CT study of the required area was performed. This was fed in the navigation software of the robotic arm. The trajectory of the needle was planned on the software. Robotic arm was programmed to align at the desired point of entry at the required angle and depth. The biopsy was performed along this guided trajectory. Later, the image of the actual trajectory taken by the needle and the planned trajectory were superimposed. The difference in the entry point and actual point reached in the lesion by the needle on the actual biopsy image and planned image by the software is compared. This error is measured in millimeters. This is then analyzed for its statistical significance

RESULTS

50 patients were analyzed. There were 30 males and 20 females. The mean age was 55.46 years. The mean size of the lesion was 46 mm. Out of 47 patients, 26 were lung masses, 11 were pelvic masses, 2 were bone lesions, 5 were mediastinal masses, 1 each of liver, pancreatic and gastric lesions and 3 paravertebral masses. Effectiveness of Needle Placement: CT biopsy was technically possible in 47 out of 50 patients. Target off site >5mm is seen in 3 out of 47 patients leading to accuracy of 93%. The number of re-positioning were 1.46 per patient ranging from 1-3 per patient. The number of check scans were 1.5/patient.

CONCLUSION

Percutaneous image guided procedure with use of a robotic arm entails various advantages over free hand techniques with improvement in accuracy and fewer number of check scans. Robotic arms may be used to target deep seated lesions which need multiple repositioning with free hand techniques. Patient motion is a major detrimental factor in execution of biopsy using robotic arm.

CLINICAL RELEVANCE/APPLICATION
Robotic assisted biopsies can improve accuracy, decrease the number of check scans and thus indirectly decreasing the radiation dose and time required for the procedure.

**VIS216**

### The Clinical Application of Normalized Utility of Contrast Medium in Combination with BMI Dependent kVp in Abdominal CT Angiography (CTA) (Station #5)

**Liu Xiaoyu MD (Presenter): Nothing to Disclose, Xiaoan Meng MD: Nothing to Disclose, Hao Tang: Nothing to Disclose**

**PURPOSE**

To assess the clinical application of normalized utility of contrast medium and kVp based on patient body-mass-index (BMI) in abdominal CTA.

**METHOD AND MATERIALS**

Eighty patients with different BMI were enrolled to undergo unenhanced and enhanced dual-phase abdominal CT scan using 370mgI/ml concentration contrast medium. Patients were divided into 3 test groups and 1 control group based on their BMI value: group A (n=20, BMI<23) with 80kVp and a total volume of contrast medium at 200mgI/kg; group B (n=20, 23=<BMI<26), 100kVp and 250mgI/kg contrast medium; group C (n=20, BMI>=26), 120kVp and 300mgI/kg contrast medium. Group D (n=20, without BMI restriction) was scanned at 120kVp and with a total volume of contrast medium at 1ml/kg. CT number of aorta in the arterial phase (AP), portal vein in the portal phase (PP) and hepatic parenchyma in both phases was measured. Image quality was assessed and compared among the 4 groups by statistical method.

**RESULTS**

There was no significant difference for the CT value (in HU) of hepatic parenchyma in AP and PP among 4 groups (group A: 81.91±8.37 and 112.97±12.36; group B: 80.13±3.66 and 104.85±9.39; group C: 76.32±9.17 and 101.83±15.76; group D: 76.18±8.74 and 103.07±14.51, all p>0.05); The CT value (in HU) of the aorta during AP in group A (305.32±76.11) was significantly higher than the other 3 groups (272.54±54.85, 252.51±32.89, 262.99±41.62, respectively) (p<0.05). There was no difference for the CT value of the portal vein in PP among 4 groups (160.19±22.76, 147.13±19.97, 148.66±21.78 and 147.76±24.61, respectively) (p>0.05). There was no significantly difference in the subjective image quality score among 4 groups (4.55±0.51 vs. 4.75±0.45 vs. 4.65±0.48 vs. 4.73±0.46, respectively) (P>0.05). Volume CT dose index (CTDvol, in mGy) were 33.58±4.47, 63.63±4.03, 96.06±7.12 and 98.89±7.04 for A, B, C and D groups, respectively.

**CONCLUSION**

BMI-dependent contrast medium injection and tube voltage selection scheme substantially reduces both contrast dose and radiation dose for patients with small BMI without adversely affecting vessel enhancement and image quality, compared with the conventional scan protocol.

**CLINICAL RELEVANCE/APPLICATION**

The BMI-dependent contrast medium injection and tube voltage selection scheme in CT angiography (CTA) improves patient safety without degradation of vessel enhancement and image quality.

**VIS220**

### Percutaneous and Laparoscopic Cryoablation (CA) of Renal Carcinomas: Mid-term CT and MR Imaging Follow-up (Station #6)

**Gianpiero Cardone MD (Presenter): Nothing to Disclose, Maurizio Papa MD: Nothing to Disclose, Paola Mangili PhD: Nothing to Disclose, Giorgio Guazzoni MD: Nothing to Disclose, Giuseppe Balconi: Nothing to Disclose**

**PURPOSE**

This study aims to determine the safety and efficacy of CA in the management of small renal carcinomas and to assess its medium term outcome.

**METHOD AND MATERIALS**

We report the mid-term CT/MR imaging follow-up in 115 pts who gained at least 5 years follow-up after CA of 96 renal carcinomas. Treatment was administered under laparoscopic US guidance in 101 pts and using percutaneous CT guidance in 14 pts. Pts were followed up clinically, biochemically and by imaging 24 hours after surgery, and subsequently every 6 months. Imaging follow-up was obtained using a 1.5T MR system in 104 cases and using CT in 11 pts with contraindications to MR.

**RESULTS**

24 hours after treatment all cryolesions were more than 1 cm larger than the original masses; cryolesions decreased in size by an average of 38% at 1 month, 64% at 6 months, 80% at 12 months and 93% at 84 months following LC. Early postprocedural MR and CT ce- images showed complete ischemia of cryolesions. Follow-up revealed no evidence of local recurrence in 111/115 pts (96%). 4 pts showed local recurrence at 12, 24 and 96 months. 12/115 pts (9%) demonstrated metachronous nodules in the same or in the contralateral kidney at 12, 24 and 48 months, 2 pts showed a pancreatic metastatic nodule at 12 and 24 months, 11/115 pts died for metastasis of a previous malignancy. 1 pt showed ureteral fistula and 1 pt showed proximal ureteral stenosis. No significant rise in creatinine level was noted postprocedurally. After surgery 11% of the cases showed small perilesional haematomas.
CONCLUSION

Our experience suggests that CA is a safe, well tolerated and minimally invasive therapy for small renal carcinomas. MR is an effective tool in the imaging follow-up of renal lesions treated with CA, and the high contrast resolution of MR allows a better evaluation of vascularization of treated areas on subtracted ce images compared to CT. CT can be used as an alternative choice to MR, but lower contrast resolution of CT to MR makes it difficult to differentiate the cryolesion from the surrounding perilesional collections. A limit of CA is the difficulty to perform repeated treatments in the same kidney.

CLINICAL RELEVANCE/APPLICATION

CA is a safe, well tolerated and minimally invasive therapy for small renal carcinomas. MR and CT are effective imaging techniques in the follow-up of renal lesions treated with CA.

VIE176

Thoracic Duct Embolization (TDE) for Chylothorax: A Clinical and Illustrative Review for the Non-Interventional Radiologist (Station #7)

Kimberly Hoang MD (Presenter): Nothing to Disclose, Gabriel Mark Werder MD : Nothing to Disclose

TEACHING POINTS

After viewing this exhibit, the learner should be able to:

1. Understand the pathophysiology and clinical presentation of chylothorax.
2. Compare TDE with alternative treatment strategies in managing chylothorax.
3. Discern the relevant operative anatomy including the cisterna chyli and its tributaries.
4. Describe the procedure and technique of ultrasound-guided intranodal lymphangiography and TDE.
5. Recognize typical post-procedural imaging findings of TDE (e.g. radiographs, CT).

TABLE OF CONTENTS/OUTLINE

I. Pathophysiology and Clinical Presentation of Chylothorax
II. Available Treatment Options including TDE
III. Relevant Anatomy
IV. Technique: Intranodal lymphangiography and TDE
V. Potential Outcomes and Complications
VI. Post-TDE Imaging
VII. Summary/Conclusions
LEARNING OBJECTIVES

1) To review management options for small renal masses as well as indications for each. 2) To review the data supporting the energy based thermal ablation modalities for ablation of renal masses. 3) To describe the role and limitations of biopsy of renal masses. 4) To review the management of benign solid renal masses. 5) To describe the evidence for ablation of T1b renal masses.

Sub-Events

VSIO11-02  Small Renal Mass (T1a): The Case for Ablation
Jeremy C. Durack MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-03  Small Renal Mass (T1a): The Case for Resection
Adam Scott Feldman MD (Presenter): Consultant, Olympus Corporation

LEARNING OBJECTIVES

1) Understand and compare treatment alternatives for small renal masses. 2) Recognize imaging features of small renal masses that impact treatment alternatives. 3) Understand the risks and benefits of image guided renal mass ablation.

VSIO11-04  Small Renal Mass (T1a): Both Cases for Intervention are Weak. Active Surveillance Will Do Just as Well
Stuart G. Silverman MD (Presenter): Author, Wolters Kluwer nv

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-05  Predictive Value of Apparent Diffusion Coefficient in Response Evaluation for the Radiofrequency Ablated Renal Cell Carcinoma: Preliminary Experience
Duangkamon Prapruttam MD (Presenter): Nothing to Disclose, Sandeep Subhash Hedgire MD: Nothing to Disclose, Yun Mao MD: Nothing to Disclose, Mukesh Gobind Harisinghani MD: Nothing to Disclose, Debra Ann Gervais MD: Research Grant, Covidien AG

PURPOSE

To assess the utility of apparent diffusion coefficient (ADC) in predicting and evaluating the response of the radiofrequency ablated renal cell carcinoma.

METHOD AND MATERIALS

30 patients with 41 pathological confirmed renal cell carcinomas underwent MRI at 1.5T including diffusion weighted images before and after radiofrequency ablation. The ADC values of the tumor at b= 0, 100 and 600 s/mm² were noted by drawing multiple regions of interest. Imaging features, histologic subtypes and Fuhrman grade of the tumor was also recorded. The participants were divided into 2 groups: complete treatment group (n=38) and residual disease group (n=3) based on follow up imaging and clinical notes. The variables were statistically analyzed.

RESULTS

Of 41 RCCs, 23.3% were papillary, 57% were clear cell and 3% chromophobe types. The mean pre-treatment tumor ADC value in the complete treatment group was 1.779 s/mm² and pre-treatment ADC value of residual disease group was 1.609 s/mm² (p=0.512). Given the substantial overlap, it was not possible to use the pre-ablation ADC value as a predictor of residual disease. Fuhrman grade showed significant correlation (p=0.005) with the post RF ablation response with 100% response rate in Fuhrman grade 1. For grade 2 this rate was 83.3% and for grade 3, it was 0%. There was no significant difference between ADC value of pre- and post radiofrequency ablated renal cell carcinoma. Though mean ADC values for the group before and after ablation did not differ, some cases showed increase in ADC and others showed decrease. The range in changes was -0.350 to 1.560.

CONCLUSION

ADC values in individual cases may increase or decrease after ablation limiting use of this marker in evaluating for viable tumor. Pre-ablation ADC did not predict outcome of ablation. Further studies are required to establish a cut of ADC value to distinguish complete responders from residual disease.
ADC values in renal tumors do not appear useful in predicting outcome or in assessing residual tumor after ablation.

**VSIO11-07**  
**Small Renal Mass (T1a): The Case for RFA**  
Debra Ann Gervais MD (Presenter): Research Grant, Covidien AG

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**VSIO11-08**  
**Small Renal Mass (T1a): The Case for Cryoablation**  
Peter John Littrup MD (Presenter): Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc Officer, Delphinus Medical Technologies, Inc

**LEARNING OBJECTIVES**

1) Understand the different approaches and techniques of thorough renal mass cryoablation that produces very low recurrence rates, even for larger central tumors. 2) Understand the appropriate settings to utilize protective techniques (i.e., hydrodissection, balloon interposition, ureteral stent, etc.) for adjacent calyces, bowel and ureter to avoid complications. 3) Identify major imaging follow-up criteria for ablation success and any early failures. 4) Describe the overall cost-efficacy trade-offs for cryo vs. heat-based renal ablations vs. partial nephrectomy, in relation to tumor location, complications and recurrence rates.

**ABSTRACT**

Cryoablation of smaller renal cancers (i.e., T1a, or <4 cm) is an out-patient treatment that is safe, effective and flexible for nearly any renal location. Major cryoablation benefits include its excellent visualization of ablation zone extent, low procedure pain and flexible protection of tumor ablation sites near calyces, bowel and ureter. CT-guidance is the cryoablation guidance modality of choice due to circumferential visualization of low density ice and ready availability. US-guidance can augment renal cryoablation, especially for smaller visible masses and/or placement of interstitial metallic markers during biopsy for selected cases requiring better eventual CT localization. MR-guidance has little clinical benefit or cost-efficacy. For safety, cases will be considered for avoidance of direct calyceal puncture, selection of hydrodissection or balloon interposition for bowel protection, and protection of the uretero-pelvic junction by stent placement. Imaging outcomes of complications and their avoidance will be shown. For optimal efficacy, tumor size in relation to number and size of cryoprobes emphasize the "1-2 Rule" of at least 1 cryoprobe per cm of tumor diameter and no further than 1 cm from tumor margin, as well as cryoprobe spacing of <2cm. Thorough extent of visible cryoablation margins beyond all apparent tumor margins produces very low local recurrence rates for tumors in nearly any renal location, resulting in excellent cost-efficacy by minimizing the need for re-treatments.

**VSIO11-09**  
**Small Renal Mass (T1a): The Case for Microwave**  
Fred T. Lee MD (Presenter): Stockholder, NeuWave Medical, Inc Patent holder, NeuWave Medical, Inc Board of Directors, NeuWave Medical, Inc Patent holder, Covidien AG Inventor, Covidien AG AG Royalties, Covidien AG

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**VSIO11-10**  
**A Statistical Model of the Relationship between Iceball and Perfusion Deficit Visualized during MRI-guided Cryoablation**  
Katherine Louise Dextraze MS (Presenter): Nothing to Disclose, Florian Maier: Nothing to Disclose, Judy Un Chong Ahrar MD: Nothing to Disclose, Yvette Teniente: Nothing to Disclose, Kamran Ahrar MD: Nothing to Disclose, R. Jason Stafford PhD: Nothing to Disclose

**PURPOSE**

A statistical model was investigated to quantify the extent of damage within the kidney parenchyma based on tissue position with respect to the iceball surface as visualized on images during the MRI-guided cryoablation procedure.

**METHOD AND MATERIALS**

A retrospective study of 20 patients cases was performed in order to statistically correlate the lack of perfusion seen on periprocedural contrast enhanced T1 post-treatment images with the iceball signal deficit seen on MRI-guided cryoablation monitoring images. Manual land-mark based registration and manual segmentation were performed on the data sets prior to analysis. In order to reduce variability in the segmentations, repeated segmentation trials were submitted to a truth-estimation scheme. Automated measurements of the distance between the iceball surface and the perfusion deficit edge were made and logistic regression model was fit to these measurements using original MATLAB scripts. The Kolmogorov-Smirnov test was applied to the Pearson residuals of the logistic regression model to assess goodness-of-fit of the model to the data. Measurements were restricted to renal parenchyma, where reliable registration could be applied.
RESULTS

Using 20 patient cases and over 600 data points, the perfusion loss likelihood of renal parenchyma within the iceball was described by a unique logistic regression curve, where the parameters are \( \alpha = -0.45 \) and \( \beta = 0.79 \). From this curve, it was determined that tissue is 50% likely to lose perfusion at 0.57mm within the iceball, while perfusion loss is 95% likely at 4.28 mm within the iceball edge. The Kolmogorov-Smirnov test for goodness-of-fit confirmed that the logistic regression model reported here describes the observed data appropriately.

CONCLUSION

Through a retrospective study of 20 patient cases, the relationship between likelihood of perfusion loss in renal parenchyma and distance within iceball was statistically quantified. From the statistical model, the margin for 95% perfusion loss likelihood was found to be 4.28mm within the iceball, which agrees the clinically accepted 3-5mm margin that is estimated during the procedure.

CLINICAL RELEVANCE/APPLICATION

The statistical model presented here could serve effectively as a quantitative approach to assessing treatment progress during the MRI-guided cryoablation procedure, rather than relying on visual estimation.

VSIO11-12

Biopsy or No Biopsy Before Ablation? biopsy every renal tumor before Percutaneous Ablation

William W. Mayo-Smith MD (Presenter): Author with royalties, Reed Elsevier Author with royalties, Cambridge University Press

LEARNING OBJECTIVES

1) Explain the expanding role of renal mass biopsy. 2) Explain why biopsy is necessary before all renal tumor ablations. 3) Demonstrate biopsy techniques.

VSIO11-13

Biopsy or No Biopsy before Ablation? Don’t Trouble Yourself or the Patient with the Renal Mass Biopsy - Go ahead and Ablate

Steven Satish Raman MD (Presenter): Consultant, Bayer AG Consultant, Covidien AG

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-14

Incidence of Post Ablation Syndrome in Image-Guided Percutaneous Cryoablation (CRYO) of Renal Tumors: A Prospective Survey

Tze Min Wah MBChB, FRCR (Presenter): Consultant, Galil Medical Ltd, Janette Bambrook: Nothing to Disclose, Debra Ann Gervais MD: Research Grant, Covidien AG, Peter Raff Mueller MD: Consultant, Cook Group Incorporated

PURPOSE

The historical incidence of complete post-ablation syndrome in patients undergoing radiofrequency ablation (RFA) of renal tumors was 29.4% with both flu-like symptoms (malaise, myalgia and nausea) and low grade fever. This study aims: (1) to evaluate the incidence of post-ablation syndrome in the patients undergoing image-guided CRYO of their renal tumors (2) to determine its impact on the quality of life in the 10 days post-renal CRYO and compare it to the post-RFA historical data.

METHOD AND MATERIALS

Thirty eight patients (age 24-83 years) underwent image guided CRYO for 40 renal tumors. A telephone survey using a standardized questionnaire was conducted on days 1, 3, 5, 7 and 10 following post-CRYO. The patients' demographic details, temperature, degree of flu-like symptoms (malaise, myalgia, nausea/ vomiting), severity of pain and percentage of relief with oral analgesics, interference with general activity and with work were documented prospectively. The symptoms and interference of lifestyles were graded on a 0-10 Numeric Intensity Scale.

RESULTS

Post-CRYO, 6 patients (15.8%) developed low-grade fever (range 37.2-38.5°C), 24 (63.2%) had flu-like symptoms, and 14 (36.8%) had no symptoms. The low grade fever did not exhibit any peak but the flu-like symptoms peaked on day-3 and resolved spontaneously in most patients by day-10. Six patients (15.8%) developed the full post ablation syndrome which was lower in incidence and the symptoms were less severe when compared to the post-RFA historical data (Figure 1). Post-CRYO patients with symptoms experienced pain and interference with general and work activities, peaking on day-3 in contrast to post RFA where symptoms peaked on day-1 and completely resolved by day-10.

CONCLUSION
Post-CRYO the incidence of complete post-ablation syndrome was 16% of patients with less severe symptoms compared to post-RFA. However, two third (63.2%) of the patients experienced at least one of the components of the syndrome. These symptoms were self-limiting with most symptoms peaking at day-3 and majority of the patients resumed their baseline pre-procedural levels of activity within 10 days following CRYO.

**CLINICAL RELEVANCE/APPLICATION**

Post renal-CRYO, the incidence of complete post-ablation syndrome is lower and less severe than post-RFA and this information is useful when obtaining consent from patients during the consultation.

**Is Ablation Effective for Masses other than T1a RCC?**

Bernhard Gebauer MD (Presenter): Research Consultant, C. R. Bard, Inc Research Consultant, Sirtex Medical Ltd Research Grant, C. R. Bard, Inc Research Consultant, PAREXEL International Corporation

**LEARNING OBJECTIVES**

1) Appreciate the strengths and limitations of percutaneous ablation in treating renal tumors measuring larger than 4cm.

**ABSTRACT**

In the 6 edition of TNM of Union internationale contre le cancer (UICC) in 2002 the differentiation between T1a and T1b renal cell cancers (RCC) was introduced. The discrimination between T1a and T1b using a threshold of 4 cm is not justified by differences in survival, it is based on the upcoming local therapeutic options for small RCCs. In the last years techniques for local therapies for RCCs improved and multiple studies for larger RCCs beyond 4 cm in diameter were published. Especially studies concerning partial nephrectomy (PN) and thermal ablation (e.g. radiofrequency ablation (RFA) and cyoablation) are available.

Psetuka et. al. could show that after RFA of T1a and T1b RCCs, disease-free survival and recurrence free survival of T1b cancers in reduced, but overall survival is not significantly different. Takaki et. al. compared RFA versus PN in T1b RCCs. Cumulative RCC-related survival and disease-free survival was not significantly different. But there was a significant difference in overall survival, probably because RFA patients were older, had a worse American Society of Anesthesiologists (ASA) score and more single kidney interventions.

Because the sensitivity of RCC-cells to radiation is debatable, not many study data for conventional radiation of RCCs is available. Newer radiation techniques like Stereotactic body radiation therapy (SBRT) and Cyberknife could increase the amount of radiation into the tumor and reducing the applied radiation to normal tissues. Onother technique is to place afterloading catheters into the tumor under CT-guidance and perform a brachytherapy of the tumor to achieve local tumor control.

Combination of different therapies could additionally increase the therapeutic options in the individual patient and should be discussed.

**Active Handout**

**Sub-Events**

**RC101A**  
**The Problem of Subsegmental Pulmonary Emboli**  
Lacey Washington MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review evidence from the literature on the prevalence of subsegmental pulmonary emboli. 2) Discuss direct and indirect evidence concerning the significance of subsegmental emboli and reasons for continued controversy.

**RC101B**  
**Optimizing Imaging Utilization**  
Linda Broyde Haramati MD, MS (Presenter): Investor, OrthoSpace Ltd  
Investor, Kryon Systems Ltd  
Spouse, Board Member, Bio Protect Ltd  
Spouse, Board Member, OrthoSpace Ltd  
Spouse, Board Member, Kryon Systems Ltd

**LEARNING OBJECTIVES**

1) To become familiar with structured and unstructured risk assessment for patients with suspected pulmonary embolism. 2) To review the impact of disease prevalence on the performance characteristics of diagnostic tests. 3) To understand the strengths and weakness of various strategies for imaging patients with suspected pulmonary embolism.

**ABSTRACT**

Patient suspected of having a pulmonary embolism initially present for clinical evaluation and may be referred for imaging. There is a great deal of geographic and institutional variability in the disease prevalence for patients who undergo imaging. As in other areas of medicine, the performance characteristics of imaging tests vary with the disease prevalence. This session will discuss different methods used to determine whether imaging is performed including structured vs unstructured risk assessment and D-dimer. The various imaging modalities that are employed with an emphasis on CTA and V/Q scanning and a brief discussion of leg ultrasound and echocardiography. Practical imaging strategies vary with institutional resources. V/Q scanning should maintain an active role in the imaging armamentarium.

**Active handout**


**RC101C**  
**Optimizing CTPA: Contrast Dynamics and Administration**  
Kristopher W. Cummings MD (Presenter): Research Consultant, Biomedical Systems  
Research Consultant, Medtronic, Inc

**LEARNING OBJECTIVES**

1) Describe the two most common methods for contrast timing to the pulmonary arterial system. 2) List two important factors affecting the degree of contrast enhancement during CTPA.

**ABSTRACT**

CT pulmonary angiography has largely replaced catheter based angiography for evaluation for acute pulmonary embolism. In order to detect acute or chronic emboli, adequate opacification of the pulmonary arterial system must be achieved. With advanced MDCT allowing rapid imaging of the entire chest, modifications to contrast administration protocols are required to assure diagnostic scans. A brief review of current techniques and approaches to contrast administration for fast multidetector CTPA will be given.

**RC101D**  
**Optimizing CTPA: Radiation Dose Reduction**  
Diana Litmanovich MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review range of radiation exposure with common CTPA studies. 2) Become familiar with principles of radiation dose assessment in CTPA 3) Become familiar with tools for dose reduction, recording the dose and auditing.

**ABSTRACT**

CT radiation exposure has received much attention lately in the medical literature and media, given its relatively high radiation dose per examination. There is a variety of possible strategies to reduce radiation exposure from CT in an individual patient. Optimal scan acquisition requires understanding by the radiologist of new scanner technology and implementation of the most effective methods available for dose reduction while maintaining image quality. Cardiothoracic imaging should be performed according to As Low As Reasonably Achievable (ALARA) principle. CT radiation dose metrics including CT dose index, Dose-length product, effective diameter and size-specific dose estimate are discussed. CT scanner parameters directly and indirectly
influencing radiation dose, such as scan length, x-ray tube output, tube current modulation, pitch, image reconstruction technique (including iterative reconstructions), and noise reduction are also discussed in relation to the major MDCT scanners available. The goal of radiation dose reduction is to decrease the radiation dose delivered to the patient. For CT pulmonary angiography, restricted length of scanning, increased pitch, decreased kVp to 100 in the vast majority of patients, and application of automatic exposure control would provide the best combination. Noise reduction techniques afford additional radiation dose reduction. All the parameters are presented according to their respective importance to image quality and the implications of parameter changes on image quality and diagnostic content.

Optimizing Pulmonary MRA
Mark L. Schiebler MD (Presenter): Shareholder, Cellectar Biosciences, Inc

LEARNING OBJECTIVES

1) Technique is critical. 2) Understand the promise of MRA in the pulmonary vasculature. 3) Beware of the limitations. 4) Who can benefit from MRA-PE exams.

ABSTRACT

Abstract There has recently been the development of some uncertainty with regards to the need for the near perfect sensitivity for the detection of pulmonary embolism in the subsegmental size range that is provided by CTA-PE exams. There are two major groups fighting for clinical dominance of the treatment paradigm. There is one camp that stresses the need for long term anti-coagulation for any documented venous thromboembolic event (VTE). The second camp is less stringent in its dogmatic approach to mandatory treatment for all documented VTE, and suggests not treating those subsegmental PE in patients that have no other risk factors for thromboembolic disease. Outcomes data from our group support the second group's framework for the treatment of this disease. With careful attention to the injection rate, contrast concentration, breathing instructions, and the use of parallel imaging, single breath-hold near isotropic whole lung MRA-PE exams can be routinely obtained of very high quality. The important artifacts of Gibbs ringing, cardiac and respiratory motion, Maki, need to be understood. While MRA-PE does not have the efficacy (lower sensitivity) of CTA for the detection of all PE, it has been shown to be an effective (high NPV) alternative for the diagnosis of this condition without the use of medical radiation.

PE: Pitfalls in Diagnosis
Danielle Seaman MD (Presenter): Research Grant, Bracco Group

LEARNING OBJECTIVES

1) Recognize potential causes for a nondiagnostic CT angiogram for pulmonary embolism. 2) Be able to correct the problem in a nondiagnostic study to obtain a diagnostic examination. 3) Recognize potential mimicks of pulmonary embolism and be able to distinguish those from true pulmonary emboli.

What's New from the Radiology Residency Review Committee

Refresher/Informatics

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 0
Sun, Nov 30 2:00 PM - 3:30 PM Location: S403B

Participants
James C. Anderson MD (Presenter): Nothing to Disclose
Felicia Davis (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To provide updates from the Review Committee for Diagnostic Radiology. 2) To provide updates from ACGME. 3) To provide updates on ACGME's Next Accreditation System.

Quantitative Measures in Cardiac CT and MR Imaging—Do They Matter?

Refresher/Informatics

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: E450B
Quantitative Assessment of the Cardiac Chambers and Its Clinical Significance
Bernd J. Wintersperger MD (Presenter): Speakers Bureau, Bayer AG

LEARNING OBJECTIVES
1) Describe the approach of cardiac MR and CT in assessment of cardiac function and size. 2) Understand potential differences between varies imaging strategies. 3) Understand the impact and role of cardiac size and function on treatment decisions.

ABSTRACT
Introduction: The cardiac performance is generally assessed by volumetric quantifications such as size and output allowing categorization and comparison of the functional status. Follow-up and changes over time may allow identification of early disease onset, may trigger specific therapies and may allow prediction of patient prognoses and general outcome. While CT and MRI imaging provide more accurate results echocardiography remains the primary choice. The added radiation burden of cardiac CT I functional analysis has to be kept in mind and CT therefore should only be considered a 3rd line option. Methods: Most important measures of systolic cardiac function are end-diastolic volume (EDV), stroke volume (SV), ejection fraction (EF) and cardiac output/cardiac index. While echocardiography is limited by the acoustic window, CT and MRI can easily cover all aspects of the atria and ventricles. While clinically performed echocardiography often only provides a categorization of ventricular EF (grade 1-4) with large variations related to various geometric models that especially fail in regional dysfunction, CT and MRI allow to maintain accuracies despite underlying pathologies. In order to maintain high accuracy/low variabiliy the selection of adequate imaging parameters with respect to coverage, spatial resolution and temporal resolution is required. Today’s functional cardiac MR imaging is almost exclusively performed using cine SSFP methods with cardiac short axis oriented imaging for the left ventricle and short axis or transverse orientation for the right ventricle. Atrial volumetric assessment is performed rarely but might especially be of interest in patients with AV valve dysfunction or atrial sources of arrhythmia. Conclusion Based on its accuracy cardiac MR plays an increasingly important role in assessment of patients with cardiac diseases. Accurate and precise quantification of cardiac function is increasingly important in various therapy decisions.

Active Handout

Quantitative Assessment Cardiac Valves on MRI
Jens Bremerich MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Apply CMR for morphometry and quantification of valvular function. 2) Compare various CMR approaches for assessment of cardiac valves. 3) Analyse flow data in stenotic or incompetent valves.

ABSTRACT
Introduction: Echocardiography remains first line modality for imaging cardiac valves. In specific cases, however, MR provides complementary quantitative data. Methods: Most relevant sequences for valve imaging are: 1) Black blood, 2) CineSSFP, and 3) VENCine. Black blood images are fast spin echo sequences. CineSSFP are used for quantification of valvular morphology and motion. Temporal resolution is typically 50ms for a segmented breath hold sequence but may be further shortened by means of parallel imaging or non-breath hold sequences. VENCine is an excellent tool for flow volume and velocity quantification. Volumes are relevant to calculate regurgitant fraction of incompetent valves, velocities are used to calculate degree of stenosis relying on modified Bernoulli equation. Results: Aortic regurgitation is difficult to evaluate with Echocardiography but easily quantified on VENCine with excellent reproducibility. Regurgitant fraction is defined as Volume antegrade/Volume retrograde *100 [%]. Aortic stenosis may also be quantified with MR by measuring the opening area on CineSSFP or by measuring peak velocity in the valve on VENCine and calculation with modified Bernoulli equation (ΔP = 4 * Vmax2). Mitral regurgitation may also be quantified by MRI. Echocardiographic quantification relies predominantly on the extent of the regurgitant jet into the left atrium which is not a reliable sign on MRI, since extent of regurgitant jets depend on various sequence parameters such as field strength and echo time. Pulmonary regurgitation can also be quantified with MRI which is relevant in congenital heart disease such as after surgical repair in tetralogy of Fallot. Pulmonary stenosis, Tricuspid stenosis and regurgitation are no routine indications for MRI but are rather evaluated by echocardiography. Conclusion: Aortic regurgitation is an excellent indication for MRI, it enables accurate and reproducible quantification.

How to Quantify Valve Function on Cardiac CT
Paul Schoenhagen MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Describe the limited role of CT for assessment of valvular function. 2) Discuss clinical indications where anatomic and functional valvular with CT is indicated. 3) Describe data acquisition and analysis approach for valvular assessment.

ABSTRACT
CT is a predominantly anatomic imaging modality. Compared to predominantly functional modalities its temporal resolution is limited. Also functional/4-D imaging requires retrospective gated data acquisition and is associated with higher radiation exposure.

The role of CT for functional valvular analysis is therefore limited to few clinical scenarios, where it can provide complementary information. The strength of CT in these situations is the ability for reconstruction in the acquired 3-D/4-D volume. A prominent example is transcatheter valve replacement/implantation but also assessment of prosthetic valves.

URL's


Handout: Paul Schoenhagen
http://media.rsna.org/media/abstract/2014/14000907/second talk.pdf

RC103D

4D Flow MRI Quantification?

Christopher Jean-Pierre Francois MD (Presenter): Research support, General Electric Company

LEARNING OBJECTIVES

1) Describe MRI physics of 4D flow MRI. 2) Illustrate use of 4D flow MRI for basic hemodynamic function. 3) Demonstrate potential futures uses of 4D flow MRI for advanced hemodynamic analyses.

ABSTRACT

MRI flow imaging is based on flow-sensitive, phase contrast sequences. This presentation will introduce the basic MRI physics responsible for imaging flow, extending 1-directional flow imaging to 3-directional flow imaging used in 4D flow MRI. Examples from valvular and congenital heart disease will be used to illustrate the use of 4D flow MRI to quantify flow velocities and volumes. Although 4D flow MRI is still very much in the early developmental phase, published data comparing 4D flow MRI to established techniques for quantifying flow will be reviewed. The future potential for 4D flow MRI to be used to non-invasively quantify more advanced hemodynamic parameters will be demonstrated. Specifically, the use of 4D flow MRI to measure pressure gradients, pulse wave velocity, wall shear stress and kinetic energy will be covered.

RC104

Sports Injuries in the Chest and Abdominal Wall: A Core Curriculum of the Body's Core

Refresher/Informatics

MK GU GI CH MK GU GI CH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: N227AB

Participants

David Alan Rubin MD (Presenter): Nothing to Disclose
Jonathan Craig Baker MD (Presenter): Research Consultant, Biomedical Systems
William E. Palmer MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the relative strengths and weaknesses of radiographs, ultrasound, CT and MR in the evaluation of suspected injuries to the anterior chest wall structures, and use this information to logically direct an imaging evaluation. 2) Understand the anatomy of the anterior chest wall musculature and its relevance to the imaging patterns of injuries, together with how that information assists treatment planning. 3) Recognize and characterize the common and less common injuries in the abdominal and pelvic wall musculature and supporting pelvic ligaments.

ABSTRACT

The imaging of sports injuries to the extremities, joints, groin, spine, and head receive much attention. Nevertheless athletic injuries to the trunk also occur with some frequency. The thoracic, abdominal, and pelvic walls form the body's central core. The thoracic wall includes the ossified and cartilaginous parts of the ribs together with the clavicles and sternum, which provide a protective cage for the vital chest organs, as well as a site of origin for the chest wall muscles. In turn, these powerful muscles are responsible for the large movements of the upper extremities and for stabilizing the upper body during twisting motions. Similarly, the abdominal and pelvic wall muscles and supporting ligaments anchor the trunk and lower extremities to the spine and pelvis, while stabilizing the body during locomotion and limb movements. Each of these bone and soft tissue structures are susceptible to direct blunt force trauma in contact and collision sports and to indirect stretching injuries during running, cutting, throwing, kicking, and related activities. There is growing understanding of the role of the thoracoabdominal musculoskeletal structures in sports, with training regimens now incorporating 'core strengthening' as an important pillar. The recognition, staging, therapy, and rehabilitation of these injuries are likewise becoming more sophisticated. This refresher course will review the role imaging plays for these injuries, emphasizing the added value of advanced imaging modalities for diagnosis, treatment planning, and prognostication.

RC105

Brain Aneurysms

Refresher/Informatics

NR ER
Participants
Moderator
Jacqueline Anne Bello MD : Nothing to Disclose

Sub-Events

RC105A Diagnostic Evaluation of Brain Aneurysms
Juan Pablo Villablanca MD (Presenter): Research collaboration, VasSol, Inc Research collaboration, Toshiba Corporation Research collaboration, Olea Medical

LEARNING OBJECTIVES

1) The course will review the relative strengths and limitations of current imaging techniques for the detection and follow-up of patients with symptomatic and asymptomatic cerebral aneurysms. 2) A practical strategy for image review and analysis will be provided that ensures complete lesion characterization and minimizes operator error. 3) A rubric for the analysis of the pre- and post-operative aneurysm patients will also be presented with an emphasis on a practical clinical approach. 4) A brief natural history and modality based literature review will also be provided.

RC105B Intervention for Brain Aneurysms
Steven William Hetts MD (Presenter): Consultant, Silk Road Medical Inc Consultant, Medina Medical Inc Research Grant, Stryker Corporation Data Safety Monitoring Board, Stryker Corporation

LEARNING OBJECTIVES

1) Discuss the current endovascular interventional approaches to both ruptured and unruptured brain aneurysm treatment. 2) Critically evaluate recent clinical trial results regarding interventional brain aneurysm treatment. 3) Understand that cerebral vasospasm is the leading cause of mortality and morbidity for hospitalized patients with aneurysmal subarachnoid hemorrhage, and appreciate current approaches to treating vasospasm.

Active Handout

RC105C How Improvements in Imaging Can Improve Practice
Charles Milton Strother MD (Presenter): Research Consultant, Siemens AG Research support, Siemens AG License agreement, Siemens AG

LEARNING OBJECTIVES

1) To understand current thinking regarding factors which are predictive of the natural history of intracranial aneurysms. 2) To understand current capabilities of imaging modalities in identifying morphologic and hemodynamic characteristics of intracranial aneurysms. 3) To understand current abilities of assessing therapeutic results after endovascular treatment of intracranial aneurysms.

RC106 Head and Neck Top Five: Important Anatomy, Missed Diagnoses and Imaging Pearls

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: S100AB

Sub-Events

RC106A Important Head and Neck Anatomy
Hugh D. Curtin MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will be able to identify the key 'fat pads' at the exit points of those cranial nerves most often affected by perineural spread. 2) The participant will be able to describe the fasical organization of the...
parapharyngeal region. 3) The participant will be able to locate the laryngeal ventricle using axial and coronal imaging.

**ABSTRACT**

Important Anatomy Head and neck imaging relies heavily on an understanding of the intricate and often difficult anatomy. The session will focus on identification of anatomy that is crucial in defining the margins and patterns of spread of pathology. Other landmarks that are key to description of the location of lesions are also covered. For instance, there is a small amount of fat located just external to each neural foramen through which perineural spread of carcinoma may pass. The most important of these primary 'fat pads' are located in the pterygopalatine fossa (external to foramen rotundum), just inferior to foramen ovale (trigeminal fat pad), and the styloglossal foramen (facial nerve) fat pad. These fat pads should be examined for potential obliteration as tumor approaches the foramen. The laryngeal ventricle is key to the organization of the larynx and reports should localize lesions related to this important structure. The ventricle may not be directly visible depending on the phase of respiration of an imaging scan. However the lateral wall of the larynx transitions from fat to muscle at the level of the ventricle. The ventricle is located at the upper margin of the thyroarytenoid muscle that makes up the bulk of the true vocal cord. The parapharyngeal spaces are crossed by several substantial fascial layers. The fascia organize the region into compartments that help the radiologist predict the identity of tumors in that location. Specifically, the anatomy makes it possible to separate tumors that are almost certainly of salivary origin from those that are not. Other specific anatomic points useful in interpretation or characterization will also be discussed.

**RC106B**

**Missed Diagnoses in the Head and Neck**

Phillip Randall Chapman MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify some of the most common mistakes radiologists make when evaluating MRI or CT scans of the neck and skull base. 2) Identify different patterns of perineural tumor spread (PNTS) and understand the subtle CT and MRI changes that indicate early PNTS. 3) Recognize atypical patterns of metastatic nodal disease and how it can be missed on routine CT scans. 4) Identify changes in the nasopharynx and skull base that indicate invasive infectious or neoplastic process. 5) Learn to distinguish recurrent tumor in the setting of complex post-treatment changes.

**ABSTRACT**

This presentation will highlight some of the most common mistakes and misdiagnoses that radiologists make when interpreting head and neck studies, including MRI and CT examinations. Many 'misses' are difficult, and rely on identifying subtle changes in small structures in the complex landscape of the neck and skull base. Other misses are difficult because they are relatively rare and may not be on the radar of most radiologists. Some misdiagnoses are the result of satisfaction of search, and are observed in complex cases, especially complex head and neck cancer. Post treatment changes in the neck impose additional limitations on imaging of the head and neck. This lecture will identify some common mistakes that are made in both private and academic practices. Cases will be presented using a case-based approach. They keys to identifying the pertinent findings and making each diagnosis will be highlighted.

**RC106C**

**Head and Neck Imaging Pearls**

Richard Henry Wiggins MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To identify imaging findings in some Imaging pearls in the Head and Neck, including those within the neck, temporal bone, paranasal sinuses, skull base, and orbits. 2) To review the most radiologic and clinical features of some common diagnoses, as well as the most important differential considerations. 3) To suggest scan techniques that will help the radiologist consistently make these diagnoses.

**ABSTRACT**

This session will review some important pearls in head and neck imaging. These tips and tricks will review some important aspects of imaging in the head and neck to help with protocoling studies, as well as techniques for imaging and interpretation. Important imaging differentials will also be reviewed and discussed.

**RC107**

**GYN and Pelvic Floor 2014: Latest Imaging Guidelines and Angles Simplified!**

**Refresher/Informatics**

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

Sun, Nov 30 2:00 PM - 3:30 PM Location: N228

**Participants**

Moderator
Julia R. Fielding MD: Nothing to Disclose
Maitray D. Patel MD (Presenter): Nothing to Disclose
Reena Chetna Jha MD (Presenter): Consultant, Celonova BioSciences, Inc
LEARNING OBJECTIVES

1) Describe current best practice recommendations for management of adnexal asymptomatic, incidental, and/or potentially physiologic findings on pelvic US, CT, and MR based on lesion characteristics and patient clinical factors. 2) Understand the reference lines and angles in pelvic MRI that are used in the evaluation of pelvic floor disorders. 3) Understand the typical imaging characteristics of the endometrium and myometrium according to patient age and stage of the reproductive cycle, and review associated benign pathology.

RC108

Contemporary Topics in Emergency Radiology: Update Your Knowledge (An Interactive Session)

1) Incidentalomas on Emergency CT: What to Do?
   - Douglas S. Katz MD (Presenter): Nothing to Disclose

   LEARNING OBJECTIVES
   
   1) To overview the continuing problem of incidentalomas identified on abdominal and pelvic CT examinations.
   2) To demonstrate examples of incidentalomas on abdominal and pelvic CT examinations from routine daily practice, and to discuss how they should be handled.
   3) To briefly overview the growing literature on the identification and management of incidentalomas on abdominal and pelvic CT examinations.

2) Imaging of Acute Pancreatitis: Updates You Should Know
   - Jorge A. Soto MD (Presenter): Nothing to Disclose

   LEARNING OBJECTIVES
   
   1) Review the current nomenclature used in the 2012 Revision of the Atlanta classification for the diagnosis, staging and description of complications of acute pancreatitis.
   2) Emphasize the importance of using proper terminology that should be used when describing fluid collection that occur in the setting of acute pancreatitis.
   3) Suggest methods that can be used to decrease the total radiation dose delivered to patients with acute pancreatitis, especially by using MR in the follow-up of fluid collections and other complications.

3) Dual Energy CT: Emergency Applications
   - Aaron D. Sodickson MD, PhD (Presenter): Research Grant, Siemens AG

   LEARNING OBJECTIVES
   
   1) Summarize key concepts of Dual Energy / Spectral CT.
   2) Highlight potential game-changing applications that can enhance information content, reduce radiation dose, or both.
   3) Describe workflow and post-processing of dual-energy scanning.

RC109

Gastrointestinal: Imaging the Obese Patient (An Interactive Session)

1) Challenges and Solutions in Imaging the Obese Patient
   - Rajan T. Gupta MD (Presenter): Consultant, Bayer AG Speakers Bureau, Bayer AG

   LEARNING OBJECTIVES
   
   1) Review the current nomenclature used in the 2012 Revision of the Atlanta classification for the diagnosis, staging and description of complications of acute pancreatitis.
   2) Emphasize the importance of using proper terminology that should be used when describing fluid collection that occur in the setting of acute pancreatitis.
   3) Suggest methods that can be used to decrease the total radiation dose delivered to patients with acute pancreatitis, especially by using MR in the follow-up of fluid collections and other complications.
1) Identify and understand the challenges in imaging the obese patient. 2) Determine how to alter CT parameters in order to optimize imaging in this patient population. 3) Explore the other imaging modalities that can be used to detect and characterize disease processes in the obese patient.

**RC109B**

**Bariatric Surgery I: Overview and Roux-En-Y Gastric Bypass**

Courtney Ann  Coursey Moreno  MD (Presenter):  Nothing to Disclose

**LEARNING OBJECTIVES**


**RC109C**

**Bariatric Surgery II: Laparoscopic Gastric Banding**

Christine O.  Menias  MD (Presenter):  Nothing to Disclose

**LEARNING OBJECTIVES**

1) Familiarize the Radiologist with the Laparoscopic Gastric Band Apparatus. 2) Understand normal post procedure imaging of Laparoscopic Gastric Band. 3) Recognize potential complications with imaging.

**RC110**

**Liver and Gallbladder Ultrasound including Elastography and Contrast**

Refresher/Informatics

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

Sun, Nov 30 2:00 PM - 3:30 PM  Location: E451A

**Sub-Events**

**RC110A**

**Contrast Ultrasound of the Liver and Gallbladder**

Hans-Peter   Weskott  MD (Presenter):  Luminary, General Electric Company Speaker, Bracco Group

**LEARNING OBJECTIVES**

1) Understanding the indications of contrast enhanced ultrasound (CEUS) in focal liver and gallbladder diseases. 2) Learning about the importance of the three contrast phases and how CEUS performs in detecting and characterizing focal liver lesions and to characterize inflammatory and tumorous changes of the gallbladder wall. 3) Learning about the potential value as well as the limitations of CEUS in liver an gallbladder diseases. 4) Learning how CEUS performs when compared to B-mode and Color Doppler ultrasound, CT and MRI imaging.

**ABSTRACT**

Liver: In patients with favorable scanning conditions CEUS is at least as sensitive as contrast enhanced CT (CECT) in detecting malignant liver lesions. Due to its high temporal resolution even a short hyperenhancement of a few seconds can reliably be detected this improving the characterization of focal liver lesions (FLL). A majority of FLL can therefore be characterized as iso- or hyperenhancing. During the arterial phase the tumor vessel supply and the tumor’s vessel architecture and direction of contrast filling is important in characterizing FLL. Due to a high spatial resolution novel contrast imaging techniques allow detection of washed out lesions down to 3mm in size. CEUS characterizes FLL with a much higher confidence than conventional US techniques and is comparable to CECT and CEMRI. CEUS also improves intraoperative tumor detection and characterization. Using time intensity analysis a change in contrast enhancement over time helps in estimating tumor response to chemotherapy. CEUS is also used to monitor local ablation therapy and is useful to early detect local tumor recurrence. Gallbladder: CEUS can be used to better visualize ulceration, perforation and tumors of its wall. It thus helps to improve the patient’s clinical management including timing for surgery. CEUS does not affect renal or thyroid function and is therefore helpful in older patients and should be the first line contrast imaging technique in patients with impaired renal function.

**RC110B**

**Liver Elastography**

Paul Singh  Sidhu  MRCP, FRCR (Presenter):  Speaker, Bracco Group Speaker, Siemens AG Speaker, Hitachi, Ltd

**LEARNING OBJECTIVES**

1) Understand the concept of measuring liver stiffness with elastography, methods of elastography in clinical use. 2) Understand the need for the clinical application of liver stiffness measurements in disease management. 3) Review the different techniques available and review evidence of their accuracy. 4) Consolidate knowledge on application, accuracy and position in clinical practice of liver elastography.
ABSTRACT

Chronic liver disease is a major health problem, representing the end stage of a number of pathological processes arising from a variety of causative factors. Alcohol misuse remains an important cause but the increasing prevalence of viral hepatitis (Hepatitis B and C) worldwide represents a healthcare issue. Early stages of chronic liver disease, fibrosis prior to the development of cirrhosis, is important to establish as this influences medical management, aimed at halting or slowing the progression to irreversible cirrhosis. Non-invasive markers are often used to predict the presence of liver fibrosis, but ultimately a liver biopsy is needed to stage the degree of fibrosis (usually the METAVIR or ISHAK scores). A liver biopsy is associated with morbidity and mortality, and samples a small volume of the liver, in a disease process that is often patchy. The need for an accurate non-invasive imaging method of assessing the degree of liver fibrosis, in essence the 'stiffness' of the liver, has encouraged the use of elastography to grade liver stiffness by either 'compression' assessment or using shear wave technology. The principles of the different types of elastography will be discussed, the application in assessing chronic liver disease, the evidence for accuracy and the future in clinical practice will be discussed.

Gallbladder and Biliary Disease

Anthony Edward Hanbidge MBCh (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the value of ultrasound when assessing the gallbladder and bile ducts. 2) Identify the imaging features of acute conditions of these structures and complications. 3) Recognize common pitfalls to avoid misinterpretation. 4) Briefly describe other conditions of the gallbladder and bile ducts including sclerosing cholangitis, cholangiocarcinoma, IgG4 associated cholangitis, adenomyomatosis, gallbladder polyps and gallbladder cancer.

ABSTRACT

Acute cholecystitis is the most common cause of acute pain in the right upper quadrant (RUQ), and urgent surgical removal of the gallbladder is the treatment of choice for uncomplicated disease. However, cross-sectional imaging is essential because more than one-third of patients with acute RUQ pain do not have acute cholecystitis. In addition, patients with complications of acute cholecystitis, such as perforation, are often best treated with supportive measures initially and elective cholecystectomy at a later date. Ultrasound (US) is the primary imaging modality for assessment of the gallbladder and bile ducts; US is both sensitive and specific in demonstrating gallstones, biliary dilatation, and features that suggest acute inflammatory disease. It is sensitive at detecting abnormalities of the wall of the gallbladder and bile ducts. Often, additional imaging modalities are indicated. Computed tomography (CT) is valuable, especially for confirming the extent and nature of the complications of acute cholecystitis. Magnetic resonance (MR) cholangiopancreatography is helpful in complicated ductal disease (eg, recurrent pyogenic cholangiohepatitis) when more detailed diagnostic information is required for treatment planning, whereas endoscopic retrograde cholangiopancreatography is used when biliary intervention is required (eg, treatment of cholecodolithiasis). Both CT and MR are accurate when staging malignancies of the gallbladder and bile ducts. Successful imaging with all modalities requires familiarity with both the characteristic and the unusual features of a wide variety of pathologic conditions. In addition, potential pitfalls must be recognized and avoided.
ABSTRACT

One of the challenges in the interpretation of FDG-PET/CT is the discovery of unexpected activity, and the determination whether such activity is related to the primary tumor, and incidental second primary tumor, or a benign process. Avoidance of ‘false-positive’ interpretations is critical for the development and maintenance of a robust PET/CT practice. In this presentation, a broad range of case examples will be shown and discussed, to illustrate some of the most frequent and most challenging pitfalls encountered in a busy oncologic PET/CT practice.

Impact of Patient Preparation

Don C. Yoo MD (Presenter): Consultant for Endocyte

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.

Challenging Case Examples

Esma A. Akin MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To improve PET-CT interpretation of challenging cases through recognition of variants and pitfalls and pearls.

Advanced Vascular Imaging Techniques and Applications (An Interactive Session)

LEARNING OBJECTIVES

1) To review the natural history and treatment outcome for mesenteric ischemia. 2) To distinguish the imaging work ups for acute versus chronic mesenteric ischemia. 3) To learn how to image the abnormal physiologic responses of chronic mesenteric ischemia.

ABSTRACT

Mesenteric ischemia is the result of inadequate perfusion and oxygen delivery to the small intestine caused by vascular obstructions. Acute mesenteric ischemia (AMI) brought on by the abrupt occlusion of the superior mesenteric artery is a medical emergency. Mortality rate of AMI has been reported as high as 80%. Prompt CT angiography of the abdomen is the diagnostic imaging of choice. In contrast, chronic mesenteric ischemia (CMI) is the result of gradual obstructions of multiple splanchnic arteries. 90% of cases are caused by advanced atherosclerotic. Clinical diagnosis is difficult because symptoms are often vague and nonspecific. The classic
clinical triad of gradual weight loss, fear of large meal, and post-prandial bowel angina may be absent. The gradual nature of the arterial obstruction promotes development of collateral arteries. The finding of an occluded splanchnic artery on angiography is not necessarily diagnostic of CMI. In difficult cases, a physiologic test that can demonstrate the sequelae of bowel ischemia would be helpful. Different imaging protocols have been proposed to detect changes in blood flow and oxygen saturation in the mesenteric circulation after a meal challenge. We will review some of these protocols and their abnormal physiologic responses indicative of CMI.

**RC112B**

**Renal MRA and Functional MRI**

Ulrike I. Attenberger  MD (Presenter):  Research Consultant, Bayer AG

**LEARNING OBJECTIVES**

1) To describe the technical pre-requisites for successful contrast and non-contrast-enhanced renal MRA (i.e. signal-to-noise-ratio, scan time, spatial resolution, voxel size). 2) To review contrast-agent dose optimization strategies. 3) To understand the basics of functional renal MR imaging techniques and to illustrate their potential implications on patient care.

**ABSTRACT**

Due to technical advances such as higher field strengths, parallel imaging techniques, and dedicated multi-element coils, contrast-enhanced (CE-MRA) has become a robust and valuable diagnostic tool for the assessment of the renal vasculature. Driven by the advent of nephrogenic systemic fibrosis (NSF), interest in low-dose CE-MRA protocols and non-enhanced MRA techniques is greater than ever. In addition to the assessment of the renal vasculature by MRA, functional MRI techniques such as perfusion or diffusion-weighted imaging allow for a non-invasive, radiation-free functional assessment of the kidneys. This is of particular interest for patients with impaired renal function but without any signs of vascular pathology. With the implementation of functional MRA techniques, changes in kidney function can be assessed even in the absence of any vascular pathology. The focus of this presentation is to summarize current state-of-the-art techniques for contrast and non-contrast-enhanced MRA as well as functional MRI of the kidney with a special focus on technical prerequisites, a discussion of the advantages and disadvantages of various techniques, and perspectives on future developments.

**RC112C**

**Functional CTA in Athletes**

Richard Lee Hallett  MD (Presenter):  Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify anatomic and functional lesions that predispose to vascular entrapment and fibrotic syndromes in athletes. 2) Describe methods to assess vascular entrapment and fibrotic syndromes in athletes using dynamic, functionally challenged CTA and MRA. 3) Describe the imaging findings for diagnosis and follow-up of affected athletes.

**ABSTRACT**

While exercise is a mainstay in preventing and treating atherosclerotic peripheral vascular disease, some vascular disorders manifest primarily in athletes. Both recreational and competitive athletes are at risk for development of non-atherosclerotic vascular diseases. These disease entities range from iliac endofibrosis in cyclists, popliteal entrapment syndrome in running sports, and thoracic inlet / outlet syndromes in "overhead" athletes. Recently, computed tomography angiography (CTA) and magnetic resonance angiography (MRA) have become valuable diagnostic options for many vascular diseases that can occur in the athlete. Optimum imaging in these disorders requires the ability to tailor the exam protocol to the specific disease entity and vascular territory in question. By combining rapid CT image acquisition with functional, physiologic provocative maneuvers, diagnostic information can be maximized. Newer blood-pool MR contrast agents also allow functional assessment without ionizing radiation exposure. This session will review the pathophysiology, risk factors, diagnosis, and classification of vascular diseases seen in the athlete. Logical protocol development utilizing (when necessary) provocative maneuvers will be reviewed. Interpretation strategies for interacting with these resulting large, dynamic datasets will also be reviewed.

**URL’s**

www://stanford.edu/~hallett

**Active Handout**


**RC112D**

**Pre and Post Reconstructive Surgery Vascular Imaging**

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

**LEARNING OBJECTIVES**

1) To understand and be able to implement surgical planning vascular imaging protocols for transplant imaging. 2) To review the strengths and weaknesses between the imaging modalities that can be used for vascular mapping. 3) To understand vascular re-organization after complex vascular anastamosis for transplantation.

**ABSTRACT**
Vascularized Composite Allotransplantation (VCA) refers to transplantation of organ donor tissues with their own donor vascular supply that require vascular anastomoses to the recipient. This work included face and extremity transplantation, and includes some of the most dramatic and complex transplantations to date. There is a growing need for detailed vascular imaging as the number of sites performing these studies increases. Moreover, additional studies such as abdominal wall transplantation are on the horizon and will be performed in the near future. Radiologists play a significant and growing role in determining the proper selection of recipients, and the vascular maps are critical for the team in the success of the transplantation. This lecture will review the imaging before and after transplantation, and the content will include imaging protocols, key findings, and new information that reveals the biology after transplantation in a face transplant cohort of patients.

RC114

Interactive Game: Interventional

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM  Location: E350

Participants

Steven Michael Zangan MD (Presenter): Nothing to Disclose
Rakesh Choudary Navuluri MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize vascular and non-vascular conditions and their image-guided treatment in the chest, abdomen and pelvis. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

RC115

Breast Imaging: State of Union

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM  Location: E451B

Sub-Events

RC115A

Current Controversies

Daniel B. Kopans MD (Presenter): Research Grant, General Electric Company Royalties, Cook Group Incorporated Consultant, Siemens AG

LEARNING OBJECTIVES

1) The data that support mammography screening beginning at the age of 40. 2) The history of efforts to reduce access to screening mammography and the scientific errors in those efforts. 3) The details of the poor quality mammography and the allocation errors that compromised the Canadian National Breast Screening Study. 4) Errors in analysis from a major review that incorrectly suggested that screening leads to massive overdiagnosis of breast cancer.

ABSTRACT

Mammography screening is one of the major medical advances of the last half century. Prior to the onset of screening in the U.S., the death rate from breast cancer had been unchanged since 1940. Screening began in the mid 1980's and soon after, in 1990, the death rate began to fall. Each year there are now more than 30% fewer women who die from breast cancer each year than would have had screening not been available. Therapy has improved, but therapy saves lives when cancers are treated earlier. Nevertheless, controversy continues to be raised about the efficacy of screening. For more than 30 years, specious arguments have been made in an effort to limit access to screening. These will be described, and shown to be based on faulty methodology.

RC115B

Supplemental Screening Beyond Mammography

Carol H. Lee MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To learn when supplemental screening beyond mammography may be useful. 2) To understand the strengths and weaknesses of various supplemental screening modalities. 3) To identify which modality is most appropriate in which clinical setting.
Current Economic Challenges
Geraldine B. McGinty MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To review the current economic issues in breast imaging. 2) Understand the recent cuts to breast interventional procedures.

Imaging in Therapeutic and Diagnostic Agent Development

LEARNING OBJECTIVES

1) Understand the phases of drug development and the key players in the process. 2) Understand the concepts behind trial endpoints, particularly endpoints in which imaging is used. 3) Recognize the distinct applications of radiology at the various stages of drug development and in various medical specialty areas.

ABSTRACT

The process of drug development is a critical feature of the landscape of modern medicine. Radiology can play a variety of roles in the development of therapeutic agents, and the involvement of radiology and radiologists in this process will be the focus of this course. Topics will include the drug approval process and key players, trial design and endpoints, and how image interpretation for clinical trials is distinct from typical clinical reads. Additionally, the course will discuss the process of development for diagnostic agents, such as contrast materials and PET tracers.

Radiological Interpretation in Therapeutic Trials

LEARNING OBJECTIVES

1) Understand the key differences between reading radiological studies in clinical practice and clinical trials. 2) Apply common oncological response criteria (such as RECIST, RANO, and the IWG criteria for lymphoma) as examples of structured radiological interpretation in clinical trials. 3) Understand the use of advanced and quantitative imaging methods in early phase trial decision making.

ABSTRACT

There are significant differences between reading scans in clinical practice and reading for a clinical trial. The focus of the interpretation is not diagnosis, but quantification. The information available to the reader is different, as is the typical handling of incidental findings, and the approach to risk management. There are several types of reads that radiologists may perform, including eligibility, efficacy, and independent confirmation of events (such as disease progression). The read is typically done in a structured manner. There is a variety of formalized rules and criteria for assessing disease severity, and we will discuss illustrative examples. Quantitative imaging is a key component of clinical trial radiology, and we will discuss imaging biomarkers and their applications in trials.

The Development of Diagnostic Agents

LEARNING OBJECTIVES
1) Understand the distinct challenges of demonstrating the efficacy and safety of a diagnostic agent. 2) Know the typical trial designs for diagnostic agents. 3) Recognize elements of the process for traditional contrast agents, PET tracers and other molecular imaging diagnostics. 4) Understand the reading process and the radiologist’s role in diagnostic trials.

**RC117**

Molecular Imaging Beyond PET: MRI and Ultrasound/Photoacoustic Molecular Imaging

**Refresher/Informatics**

**US OI MR MI**

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 2:00 PM - 3:30 PM Location: S504CD

**Participants**

Moderator
Fabian Kiessling MD : Advisor, invivoContrast GmbH Co-owner, invivoContrast GmbH Advisor, Molecular Targeting Technologies, Inc Researcher, Bayer AG Researcher, Bracco Group Researcher, Merck KgaA Researcher, AstraZeneca PLC Researcher, Koninklijke Philips NV Researcher, FUJIFILM Holdings Corporation

**LEARNING OBJECTIVES**

1) Attendees will learn the principles and applications of molecular imaging using ultrasound and photoacoustic imaging techniques. 2) Principles and applications of ultrasound molecular imaging will be reviewed. 3) Principles and applications of molecular imaging using photoacoustic imaging techniques will be presented. 4) Ultrasound guided drug delivery approaches will be reviewed. 5) At the end of this course, the attendees will understand the principles and potential clinical applications of ultrasound and optoacoustic molecular imaging as well as of ultrasound guided drug delivery.

**Sub-Events**

**Photoacoustic Imaging**

Stanislav Emelianov PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the fundamental principles of photoacoustic imaging and major components of photoacoustic imaging system. 2) Knowing how photoacoustic images are formed and how to interpret photoacoustic images. 3) Understand how imaging contrast agents or imaging probes affect contrast, penetration depth and specificity in photoacoustic imaging. 4) Understand the ability of photoacoustic imaging system to visualize anatomical, functional and molecular properties of imaged tissue. 5) Identify the role of photoacoustic imaging in pre-clinical and clinical applications.

**ABSTRACT**

Photoacoustic imaging or tomography - a non-ionizing, non-invasive, real-time imaging technique capable of visualizing optical absorption properties of tissue at reasonable depth and high spatial resolution, is a rapidly emerging biomedical and clinical imaging modality. Photoacoustic imaging is regarded for its ability to provide in-vivo morphological and functional information about the tissue. With the recent advent of targeted contrast agents, photoacoustics is capable of in-vivo molecular imaging, thus facilitating further molecular and cellular characterization of tissue. This presentation is designed to provide both a broad overview and a comprehensive understanding of photoacoustic imaging. With a brief historical introduction, we will examine the foundations of photoacoustics, including relevant governing equations, optical/acoustic properties of the tissues, laser-tissue interaction, system hardware and signal/image processing algorithms. Specifically, penetration depth and spatial/temporal resolution of photoacoustic imaging will be analyzed. Integration of photoacoustic and ultrasound imaging systems will be discussed. Techniques to increase contrast and to differentiate various tissues in photoacoustic imaging will be presented. Furthermore, design, synthesis and optimization of imaging probes (typically, nanoconstructs or dyes) to enable molecular/cellular photoacoustic imaging will be presented. Special emphasis will be placed on contrast agents capable of multiplexed imaging, multi-modal imaging and image-guided therapy including drug delivery and release. The presentation will continue with an overview of several commercially available and clinically-relevant systems capable of photoacoustic imaging. Regulatory aspects of photoacoustic imaging systems and imaging contrast agents will be presented. Finally, current and potential biomedical and clinical applications of photoacoustics will be discussed.

**Ultrasound Molecular Imaging**

Juergen Karl Willmann MD (Presenter): Research Consultant, Bracco Group Research Grant, Siemens AG Research Grant, Bracco Group

**LEARNING OBJECTIVES**

1) To understand the acquisition and quantification principles of ultrasound molecular imaging. 2) To understand the characteristics and biodistribution of molecularly targeted ultrasound contrast agents. 3) To understand the role of ultrasound molecular imaging in preclinical and clinical applications.

**ABSTRACT**

Ultrasound imaging is a widely available, relatively inexpensive, and real-time imaging modality that does not expose patients to radiation and which is the first-line imaging modality for assessment of many organs. Through the introduction of ultrasound contrast agents, the sensitivity and specificity of ultrasound for detection and characterization of focal lesions has been substantially improved. Recently, targeted contrast-enhanced
ultrasound imaging (ultrasound molecular imaging) has gained great momentum in preclinical research by the introduction of ultrasound contrast agents that are targeted at molecular markers over-expressed on the vasculature of certain diseases. By combining the advantages of ultrasound with the ability to image molecular signatures of diseases, ultrasound molecular imaging has great potential as a highly sensitive and quantitative method that could be used for various clinical applications, including screening for early stage disease (such as cancer); characterization of focal lesions; quantitative monitoring of disease processes at the molecular level; assisting in image-guided procedures; and, confirming target expression for treatment planning and monitoring. In this refresher course the concepts of ultrasound molecular imaging are reviewed along with a discussion on current applications in preclinical and clinical research.

**Sonographically-guided Drug Therapy**

Alexander L. Klibanov PhD (Presenter): Research Grant, Koninklijke Philips NV Co-founder, Targeson, Inc Stockholder, Targeson, Inc Institutional research collaboration, AstraZeneca PLC

**LEARNING OBJECTIVES**

1) To identify the basic principles of ultrasound energy deposition as applied to molecular imaging and image-guided therapeutic interventions. 2) To combine the general physical principles of ultrasound-microbubble interaction, drug-carrier systems pharmacokinetics and ultrasound contrast imaging, apply this knowledge for the development of triggered delivery approaches in the setting of personalized medicine. 3) To understand advantages and disadvantages of ultrasound application in the potential image-guided intervention designs. 4) To identify and compare potential clinical applications of ultrasound-guided drug delivery.

**ABSTRACT**

The reason of ultrasound use in drug delivery is to enhance drug action specifically in the area of disease. The design of such therapeutic intervention should assure that drug deposition or action enhancement take place only in the disease site, with the general goal to improve the therapeutic index. There are several approaches to ultrasound-assisted drug delivery. The first approach, closest to clinical practice, takes advantage of existing ultrasound contrast agents (intravenous gas microbubbles approved in US for cardiac imaging). When these bubbles are co-injected intravenously with the drugs, and ultrasound energy applied to the areas of disease, localized energy deposition leads to endothelium activation or transient "softening" of blood brain barrier (BBB). Drugs (including antibodies or liposomes) can thus transit BBB and achieve therapeutic action. Ultrasound imaging can be used for targeted focusing of ultrasound energy in the areas of disease. Second approach suggests attaching microbubbles to the drug or a drug carrier (including nucleic acid drugs). Microbubbles can be complexed with drug or gene carrier nanoparticles, so that local action of ultrasound would result in triggered drug release/deposit or transfection in the ultrasound-treated area. Third approach involves targeted microbubble design, as in ultrasound molecular imaging. Combination of targeted microbubbles with drug carrier makes possible unfocused ultrasound use, to act only in the areas of the target receptor expression, where microbubbles adhere and ultrasound energy is then deposited. Lately, formulation moved from microbubbles to smaller nanodroplet drug carriers, to reach interstitium, where drug release could take place upon ultrasound treatment. Overall, combination of ultrasound imaging, including contrast (molecular) imaging, focused ultrasound, and drug carrier systems will lead to novel image-guided therapies, especially applicable in the era of personalized medicine.

**Magnetic Resonance Molecular Imaging**

Moritz Florian Kircher MD, PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

The field of molecular MRI has exploded in the last decade, with hundreds of different concepts and probe designs developed and tested in vitro and in vivo. This talk will attempt at giving a structured overview over this vast arsenal of potentially useful approaches by focusing on those that have the highest potential for clinical translation. The approaches will be grouped into 6 major categories and their principles explained and illustrated with key examples: 1) Multimodal nanoparticles; 2) Activatable MRI probes; 3) Targeted superparamagnetic iron oxide nanoparticles; 4) non-targeted superparamagnetic iron oxide nanoparticles; 5) MRI-based Radiogenomics; and 6) Hyperpolarized magnetic resonance spectroscopic imaging.
LEARNING OBJECTIVES

1) To learn about the functional and molecular imaging research being conducted within the Radiology Department of Oxford University Hospitals NHS Trust.

ABSTRACT

There is increasing functional and molecular imaging being performed in medicine. The Radiology department at the Churchill Hospital in Oxford is conducting a number of trials in these areas, and has designed these trials around interventions to measure the effect of these new techniques. It has also taken the opportunity to raise the profile of Radiology within the University, to promote greater collaboration with basic scientists, attracting increased funding, and opportunities for scientists and physicians.

RC118B Lessons Learned from the National Irish Breast Screening Program: The first 12 years—One Million Mammograms On

Michelle Marie McNicholas MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To review the results of the Irish National Breast Screening Program following 12 years of screening with over 1,000,000 mammograms performed. 2) To understand the essential components of setting up and maintaining a national breast screening program in Ireland. This includes the rationale for the decisions made at the outset, such as age range, frequency of screens, centralisation of service and responsibility of the screening process to the end of primary surgery. 3) To understand the need for and the mechanism of developing a national registry of eligible women in the absence of a national unique identifier. 4) To understand the need for a client charter which sets out client guarantees, objectives and goals around issues of consent, timeliness of screening results and recall to assessment, biopsy results and admission for surgery and further treatment where indicated. 5) To understand the necessity of national guidelines, annual reports and external accreditation. 6) To demonstrate the essential need for ongoing review of key performance indicators (recall rate, biopsy rate, cancer detection rate, DCIS rate, open biopsy rate, false negative rate, interval cancer rate) as surrogates of program success. 7) To understand the importance of communication and feedback to clients, units, practitioners and media in maintaining uptake. 8) To understand the reporting structure and the composition of various roles within the multidisciplinary medical and surgical teams. 9) To understand the requirements for ongoing training and education of all staff - physicians, technologists, nurses, physicists, administrative staff. 10) To understand the factors affecting radiation dose to the screened population and the over-riding responsibility of the ALARA principle, such as: role of physics team, mammographic technique, equipment choice, technologist expertise and training, quality assessment. 11) To understand the operational issues of different screening units, double reading, discrepancy cases, dealing with interval cancers, dealing with outliers in key performance parameters. 12) To understand the positive spinoff s from the program including increased awareness, improving national standards in the screening and the symptomatic population and the contribution to improved diagnostic and treatment options. 13) To understand how the program achieved, maintained, and monitored performance and how it adapted to changes in practice as issues or controversies arose. 14) To discuss whether this population screening program has been a successful and cost effective health care initiative for Ireland. 15) Ultimately, to understand whether the Irish National Breast Screening Program has led to improved survival in women with breast cancer in Ireland.

RC118C MRI of Pelvic Malignancy—The View from Down Under

Clair Louise Shadbolt MBChB (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To learn about the local availability and funding of MRI in investigating pelvic malignancy that is unique to Australia. 2) To understand the current usage of Pelvic MRI in investigating pelvic malignancy in the Australian population. 3) To review some typical examples of Pelvic MRI in Oncology that illustrate the advantages of MRI in the assessment of pelvic malignancies and impact MRI has on patient management in the multidisciplinary setting.

ABSTRACT

According to the Australian and New Zealand College of Radiologists' (RANZCR) website "MRI is only effective when it is likely to improve the health outcome for the patient ... although able to offer detailed images, MRI scanning is not always the most appropriate imaging". The Australian Government Department of Health and Aging announced a press release in November 2012 of a $104.4 million Diagnostic Imaging Review Reform Package to increase access to MRI and increase cancer services: "This package means many more Australians will benefit from faster diagnosis and earlier detection of disease... From November 2012 Medicare will cover the cost of more MRI scans than ever before. Under the changes people using MRI machines in regional Australia will have greater access..." How is MRI utilised in pelvic oncology in Australia? I will be discussing the current funding and availability of MRI in pelvic oncology in Australia. The unique geography and remoteness of some sectors of the population of Australia influences the usage of MRI. I will illustrate the important role of MRI in the management of pelvic malignancy with some classic examples.

RC118D Imaging of HCC—A Korean Perspective

Byung Ihn Choi MD, PhD (Presenter): Research Consultant, Samsung Electronics Co Ltd

LEARNING OBJECTIVES

1) To learn recent imaging techniques for the qualitative and quantitative diagnosis, selection of treatment methods, and evaluation of monitoring after treatment for HCC. 2) To understand the imaging findings of hepatocarcinogenesis from regenerate nodule going through low and high grade dysplastic nodule, early HCC and finally to advanced HCC. 3) To review current clinical practice guidelines including role of imaging for the
diagnosis and treatment for HCC with focus on recent change of guidelines by rapid progression of imaging biomarkers.

**RC120**

**Molecular and Functional Imaging/Surrogate Markers in Radiation Oncology**

*Refresher/Informatics*

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AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: S404CD

**Participants**

Moderator
Anca Ligia Grosu MD : Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand challenges of morphological radiological investigations for the detection and characterization of tumor biology and the timely assessment of tumor response in clinical cancer therapy and in clinical trials testing new therapy regimens. 2) To understand the role and the potential of functional and molecular imaging modalities and techniques used (a) prior to therapy for tumor delineation and targeting, (b) during cytotoxic therapy, such as radiation and chemotherapy for intra-treatment tumor response monitoring, and (c) after cytotoxic therapy for response assessment. 3) To review the role of imaging as predictors of tumor control and survival and their emerging role as short-term surrogate markers for long-term therapeutic outcome of cancer treatment regimens and its potential for adaptive therapy.

**Sub-Events**

**RC120A** Imaging Surrogate Markers in CNS Tumors
Anca Ligia Grosu MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**


**RC120B** Imaging Surrogate Markers in Pelvic Tumors
Nina A. Mayr MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC120C** Imaging Surrogate Markers in Lung Tumors
Feng-Ming Kong MD, PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC121**

**Medical Physics 2.0: Magnetic Resonance Imaging**

*Refresher/Informatics*

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AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: S402AB
Magnetic Resonance Imaging Perspective
Douglas E. Pfeiffer MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the history and development of magnetic resonance imaging equipment. 2) Understand the impact of equipment development on testing protocols. 3) Understand the requirements for medical physics support in image quality and safety.

ABSTRACT

Magnetic resonance imaging equipment has developed significantly since its inception. Field strength increases and technology development increase the complexity of the equipment and the need for medical physics and MRI scientist support. This talk will briefly introduce the developments that have taken place and discuss the impact that this development has had on testing and support.

Magnetic Resonance Imaging 1.0
Ronald Price PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the image quality metrics that are currently used as part of an MRI system performance report. 2) Discuss how the medical physicist can assist in the development and evaluation of imaging sequences used as part of clinical protocols. 3) To review items that should be included as part of an MRI safety survey. 4) Discuss the steps necessary for establishing and maintaining a routine quality assurance program. 5) Review aspects of AAPM Report No. 100 regarding acceptance testing of new MRI systems. 6) Review modality and system specific requirements for MRI accreditation.

ABSTRACT

MRI 1.0: Magnetic Resonance Imaging Ronald R. Price The purpose of this presentation is to review the current role of the medical physicist in clinical Magnetic Resonance Imaging (MRI). The discussion will first discuss MRI acceptance testing with reference to the recommendations of AAPM Report No. 100 and will specifically include items that should be part of both the initial and annual MRI safety survey. This discussion will be followed by a review or the image quality metrics that are currently used as part of an MRI system performance report as well as how the medical physicist may go about assisting in the development and evaluation of imaging sequences used as part of clinical protocols. The presentation will also discuss the steps necessary for establishing and maintaining a routine quality assurance program with emphasis on the necessity of establishing a strong working relationship with the MRI quality assurance technologist. There will also be a review of the system specific requirements for MRI accreditation.

Magnetic Resonance Imaging 2.0
David R. Pickens PhD (Presenter): Stockholder, Johnson & Johnson

LEARNING OBJECTIVES

1) Indentify requirements for improving quality assurance and compliance tools for advanced and hybrid MRI systems. 2) Indentify the need for new quality assurance metrics and testing procedures for advanced systems. 3) Identify new hardware systems and new procedures needed to evaluate these systems. 4) Understand the role of the medical physicist in the clinical testing and use of these systems.

ABSTRACT

This talk will look into the future of clinical MR imaging and what the clinical medical physicist will need to be doing as the technology of MR imaging evolves. Many of the measurement techniques used today will need to be expanded to address the advent of higher field imaging systems and dedicated imagers for specialty applications. Included will be the need to address quality assurance and testing metrics for multi-channel MR imagers and hybrid devices such as MR/PET systems. New pulse sequences and acquisition methods, increasing use of MR spectroscopy, and real-time guidance procedures will place the burden on the medical physicist to define and use new tools to properly evaluate these systems, but the clinical applications must be understood so that these tools are use correctly. Finally, new rules, clinical requirements, and regulations will mean that the medical physicist must actively work to keep her/his sites compliant and must work closely with physicians to ensure best performance of these systems.

Active Handout
Uncertainties in Imaging for Radiation Oncology: Sources and Mitigation Techniques—Imaging Moving Targets

**Participants**
Moderator
Kristy K. Brock PhD: License agreement, RaySearch Laboratories AB

**LEARNING OBJECTIVES**
1) Describe techniques for imaging moving targets. 2) Propose methods to account for uncertainties. 3) Highlight clinical integration.

**Sub-Events**
**RC122A** Uncertainties in Moving Targets
Jan-Jakob Sonke PhD (Presenter): Royalties, Elekta AB Royalties, Precision X-Ray, Inc Research Grant, Elekta AB

**LEARNING OBJECTIVES**
View learning objectives under main course title.

**RC122B** Clinical Practice
Laura Ann Dawson MD (Presenter): License agreement, RaySearch Laboratories AB

**LEARNING OBJECTIVES**
View learning objectives under main course title.

Minicourse: Current Topics in Medical Physics—Diagnostic Dosimetry Review: Current Technologies and How We Use Them

**Participants**
Timothy J. Blackburn PhD (Presenter): Nothing to Disclose
Jon A. Anderson PhD (Presenter): Nothing to Disclose
Paul B. Sunde (Presenter): Shareholder, Radcal Corp Employee, Radcal Corp

**LEARNING OBJECTIVES**
1) Provide a review of diagnostic dosimetry covering what we measure and why. 2) Examine the current dosimetry technologies available to the diagnostic medical physics practice. 3) Compare and contrast the pros and cons of conventional and new technologies used for equipment, patient and survey dosimetry.

The Role of Advanced Imaging in Unraveling the Secrets of Ancient Art and Artifacts

**Participants**

**LEARNING OBJECTIVES**
Participants

Moderator
Barry David Daly MD: Research Grant, Koninklijke Philips NV
Barry David Daly MD (Presenter): Research Grant, Koninklijke Philips NV
Vahid Yaghmai MD (Presenter): Nothing to Disclose
Jonathan P. Brown MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To describe the use of advanced imaging techniques in the non-invasive investigation of historic art treasures and related benefits for both research and educational activities at museums and art institutions.

ABSTRACT

In recent years museums worldwide have sought to partner with radiology departments in the non-invasive investigation of ancient and fragile treasures. Advanced digital imaging and 3D CT have been used to determine the age, authenticity, composition and geographic origin of these artifacts, to investigate their internal contents, and to detect prior structural damage and hidden repairs. The subject material of this course includes a diverse range of significant artifacts such as Egyptian and Peruvian mummies, Mesoamerican and Chinese ceramics, Mesopotamian stucco art, Judaic tabernacles, European medieval religious artifacts, Renaissance paintings, Stradivarius violins and Japanese wood sculptures. Some conservators now have access to 3D imaging software at museums or may conduct remote collaborative analysis of cases with radiologists via cloud-based 3D servers. The speakers include two radiologists with extensive experience in the technical approach to imaging these treasures and a senior conservator at the Field museum who will provide an expert’s perspective on the research and educational value of the findings.

RC125

Quantitative Imaging: Quantitative Imaging in Ultrasound

Refresher/Informatics

BQ US PH
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: E353A

Sub-Events

RC125A  Elasticity and Backscatter Related Measures
Timothy J. Hall PhD (Presenter): Equipment support, Siemens AG Advisory Board, Siemens AG

LEARNING OBJECTIVES

1) Describe the various approaches and history of Quantitative Ultrasound. 2) Understand the difference in system-dependent and system-independent backscatter parameters. 3) Understand the benefits of system-independent backscatter parameters. 4) Describe the state of the art in elasticity imaging and quantitative ultrasound from backscattered echoes.

ABSTRACT

There is a long history of attempts to use the backscattered echo signals from medical ultrasound to describe disease conditions of various tissue types. For example, from the initial application of ultrasound in breasts, the investigators attempted to differentiate benign from malignant disease based on characteristics of the echo signals. Along the way, there have been substantial successes. For example, it was only 30yrs ago that we debated how to estimate blood flow based on ultrasound echo signals and how to interpret that data. Just over 20yrs ago we began to display flow dynamics with color flow imaging. More recently, elasticity imaging methods, which also began in the "tissue characterization" or "quantitative ultrasound" community, have become commercially viable products with clear diagnostic potential. These were "tissue characterization" methods in their early days. Now they are recognized as specific procedures with quantifiable diagnostic merit. Numerous other “quantitative ultrasound” (QUS) methods have been proposed, developed, tested and have demonstrated varying degrees of success. Many of these methods are still under development. This presentation will discuss “quantitative ultrasound” methods based on backscattered echo signals focusing on the most recent techniques that are either commercially available or that show the greatest potential as diagnostic tools.

RC125B  Volume Flow and Measures From Contrast Agents
Oliver D. Kripfgans (Presenter): Research support, General Electric Company Equipment support, General Electric Company

LEARNING OBJECTIVES

1) Understand the pitfalls of ultrasound based blood flow acquisition, analysis, and interpretation. 2) Become familiar with current approaches of quantitative estimation of blood flow and learn how to minimize associated errors. Understand how volumetric blood flow estimation can become a biomarker. 3) Obtain an overview of current commercial ultrasound contrast agents as well as their availability in the US. 4) Learn about contrast agent enhanced measurements in a clinical setting and potential use of ultrasound contrast as a therapy agent.

ABSTRACT

Clinical ultrasound scanners typically offer three methods of blood flow acquisition, namely pulse wave, color flow and power Doppler. While real-time blood flow visualization is one of the perks of ultrasound, standardized quantitative methods are still unavailable to the radiologist. Pulse wave offers volumetric flow computation based on assumptions that are often violated. Color flow has never been directly quantitative as no angle
correction can be dialed-in. The advent of 2D ultrasound arrays (electronic or mechanically swept) has enabled color flow and power Doppler acquisition in the coronal plane thus yielding Doppler angle as well as geometry independent flow information for direct quantification of in situ real-time volumetric flow. The RSNA's QIBA (Quantitative Imaging Biomarker Alliance) effort is targeting quantitative blood volume flow as a possible future biomarker. Ultrasound contrast agents have been approved for many clinical applications in Europe, Asia and Canada. The FDA has limited the use of ultrasound contrast agents in the US and essentially only cleared ultrasound contrast agents for cardiac applications. However, off-label application is practiced in the US. Its extend and benefits will be discussed in this course along with current approaches for ultrasound contrast agents based clinical measurements. Also included will be the use of contrast agents in enabling and quantifying therapeutic interventions.

URL's

www.ultrasound.med.umich.edu/ODK/RSNA2012

RC125C

Ultrasound Measurements and FDA Criteria for Display of New Quantitative Measures

Brian Stephen Garra MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the main types of quantification of Ultrasound images. 2) Review some recent examples exploring sources of error in ultrasound morphometric quantification. 3) Summarize new ultrasound based parameters that might be displayed. 4) Discuss the formation of the Ultrasound QIBA Technical Committee and its objectives. 5) Review recent changes in FDA policy regarding display of quantitative features on ultrasound images.

ABSTRACT

Ultrasound images are probably the most frequently measured images and extensive literature on a wide variety of ultrasound image measurements exists going back to the 1960's. Most morphometric and Doppler measurements are well documented and are at a mature stage. Automated measurements of volume and structures such as arterial intimal medial thickness are also finding increasing clinical application but each method of image segmentation and quantification has its own characteristic problems and sources of error. Some newer measurements including measurement of tissue strain (elastography) and strain rate and one of the newest, shear wave speed, are the subject of considerable research activity and the sources of error and bias are just now being identified and quantified. The RSNA Quantitative Imaging Biomarker Alliance (QIBA) has recently undertaken the task of developing standardized protocols for measurement of ultrasound related parameters. The first project of the US QIBA technical committee is to develop a profile for measurement of shear wave speed in tissue using ultrasound. The FDA has long allowed many types of measurements to be displayed as part of the ultrasound image. A demonstration of reasonable accuracy and precision important for obtaining clearance to display a new measurement. Display of measurement accuracy may also be required and users should be informed of situations where the measurement may be inaccurate. The efforts of the QIBA may provide data that in the future will help to speed up FDA clearance for display of new types of measurements.

RC127

Changing the Culture of Radiology: How to Thrive in Turbulent Times

Refresher/Informatics

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: E353B

Participants

Moderator
David C. Levin MD: Consultant, HealthHelp, LLC Board of Directors, Outpatient Imaging Affiliates, LLC
Vijay Madan Rao MD (Presenter): Nothing to Disclose
William T. Thorwarth MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the threats facing radiology. 2) Be aware of ways to counter the trend toward commoditization of the specialty. 3) Learn how to improve relationships with hospital administrations. 4) Understand how radiologists can add more value to patients and referring physicians. 5) Be aware of some ACR initiatives that will help radiology practices alter their culture in a positive way.

RC129

Abdominal MRI Technique Update (An Interactive Session)

Refresher/Informatics

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

**RC129A**

**Respiratory Artifacts in Abdominal MRI: Causes and Cures**

Eduard E. De Lange MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand how the characteristics of commonly used abdominal-imaging pulse sequences influence their susceptibility to respiratory artifacts. 2) Explain differences between multi-slice and single-shot pulse sequences. 3) Describe various approaches for suppressing respiratory artifacts. 4) Optimize routine imaging protocols for abdominal MRI.

**Active Handout**


**RC129B**

**Choosing an MRI Contrast Agent**

Jay Kumar Pahade MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Provide background of different available MRI contrast agents and their properties. 2) Discuss safety profiles and concepts related to minimizing risk of NSF. 3) Review common indications for different available MRI contrast agents and their relative strengths and weaknesses.

**RC129C**

**Optimizing Contrast Enhancement: 2014 and Beyond**


**LEARNING OBJECTIVES**

1) Learn how to perform high temporal resolution dynamic MR Contrast enhanced imaging. 2) Learn post-processing strategies for high temporal resolution MR data. 3) Review applications of high temporal resolution imaging.

**Develop Your Radiology Financial Insight: Fundamental Principles You Should Know About Business**

*Refresher/Informatics*

**RC132**

**How Much Is It Worth: Valuing Assets and Investments**

Kenneth A. Buckwalter MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the time value of money. 2) Review interest rate terminology such as Interest rate, Discount rate, and Hurdle rate. 3) Describe standard ways to value an investment for Payback time, Internal rate of return, and Net present value. 4) Use net present value to understand the loss of Tiger Wood's Brand Value in 2009. (This course is part of the Leadership Track)

**Follow the Money: Everything You Ever Wanted to Know About the Revenue Cycle**

Mark Steven Frank MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Know the definition of 'revenue cycle'. Be aware of how the revenue cycle revenue applies to a 'typical'
diagnostic radiology practice. 2) Know the definition of accounts receivable (AR), and the important role that AR plays in radiology practice. 3) Understand the concept of 'charge lag' and the factors contributing to it. 4) Know the major factors that effect timeliness and amount of payment received once a bill is submitted. 5) Know the relationships between net income, accounts receivable, and cash flow. 6) Be aware of the Radiology Business Managers Association (RBMA) recommended factors for tracking AR. 7) Know the definition of Adjusted Collections Percentage (ACP). 8) Know some techniques for reducing AR and optimizing the revenue cycle. 9) Know the definition of RBRVS (Resource Based Relative Value Scale) and its relationship to the Current Procedural Terminology (CPT) coding model. 10) Know the concept and structure (components) of an RBRVS global payment. 11) Understand how work performed (as perceived by the radiologist) maps onto the RBRVS scale and the role of the RBRVS scale in financial payment mechanisms. (This course is part of the Leadership Track)

**RC132C**

**The Basics of Accounting and Finance: What the Radiologist Needs to Know**

**Suresh K. Mukherji MD (Presenter):** Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the basics of an income statement. 2) Review the basics of the balance sheet. 3) Review the basics on the cash flow statement. (This course is part of the Leadership Track)

**ABSTRACT**

The purpose of this talk is to provide the basic in financial accounting. This talk will review the basics of how to interpret an income statement, cash flow statement and balance sheet. This presentation will focus on a Radiology department so that it is pertinent to the audience.

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**RC150**

**MR Imaging–guided Breast Biopsy (Hands-on Workshop)**

**Refresher/Informatics**

**MR BR MR BR**

AMA PRA Category 1 Credits™: 1.50

ARRT Category A+ Credits: 1.50

*Sun, Nov 30 2:00 PM - 3:30 PM Location: E260*

**Participants**

Peter R. Eby MD (Presenter): Nothing to Disclose

Beatriz E. Adrada MD (Presenter): Nothing to Disclose

Sandra Brennan MBChB, MSc (Presenter): Nothing to Disclose

Selim Carkaci MD (Presenter): Consultant, Hologic, Inc

Chloe Muy-Chou Chor MD (Presenter): Nothing to Disclose

Mark Joseph Dryden MD (Presenter): Nothing to Disclose

Sujata Vijay Ghathe MD (Presenter): Nothing to Disclose

Jiyon Lee MD (Presenter): Nothing to Disclose

Vilert Alon Loving MD (Presenter): Nothing to Disclose

Michelle Denise McDonough MD (Presenter): Nothing to Disclose

Thomas L. Pope MD (Presenter): Nothing to Disclose

Habib Rahbar MD (Presenter): Nothing to Disclose

Simone Schrading MD (Presenter): Nothing to Disclose

Stephen Jacob Seiler MD (Presenter): Nothing to Disclose

Laura Beth Shepardson MD (Presenter): Nothing to Disclose

Roberta Marie Strigel MD, MS (Presenter): Speaker, Bracco Group

Lilian Wang MD (Presenter): Nothing to Disclose

Annamaria Wilhelm MD (Presenter): Research Grant, Merck & Co, Inc

Janice S. Sung MD (Presenter): Nothing to Disclose

Tanya W. Stephens MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Establish criteria for MR-guided breast biopsy patient selection. 2) Cultivate a working understanding of MR-guided biopsy and needle localization instrumentation and implementation. 3) Understand basic MR-guided biopsy and needle localization parameters and requirements for appropriate coil, needle and approach selection. 4) Consider patient management before, during and after MR-guided breast biopsy. 5) Explore benefits and limitations of availability of MR-guided biopsy/needle localization in your practice. 6) Practice the MR-guided biopsy procedure on phantoms with multiple needle and coil combinations.

**ABSTRACT**

This course is intended to provide both basic didactic instruction and hands-on experience in the application of MR-guided breast biopsy and needle localization. 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 and needle localization 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 with phantoms placed in various combinations of full size state-of-the-art breast MRI coils, biopsy localization equipment and needles.

**Active Handout**
RC151
Modern Non-invasive Imaging of Cholestatic Liver Diseases (How-to Workshop)

Refresher/Informatics

MR GI MR GI
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: E351

Participants
Ahmed Ba-Ssalamah MD (Presenter): Speaker, Bayer AG Speaker, Siemens AG
Aliya Qayyum MBBS (Presenter): Spouse, Employee, Imorgon Medical
Richard Michael Gore MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Describe MRI; MRCP techniques for evaluating biliary disease. 2) List applications in malignant biliary disease. 3) List applications in benign conditions of the biliary tract.

ABSTRACT
This workshop is designed to review the broad spectrum of morphologic and functional features encountered in patients with cholestatic liver diseases involving the intrahepatic and extrahepatic bile ducts and adjacent liver parenchyma, in correlation with the histopathologic hallmark of this group of diseases the so-called ‘vanishing duct sign.’ We will start by explaining the role of various different imaging modalities including invasive endoscopic retrograde cholangiopancreatography (ERCP) and non-invasive conventional T2 weighted magnetic resonance cholangiography (MRCP) as well as gadoteric acid-enhanced T1 MRCP and diffusion weighted images to expedite the evaluation of patients with known or suspected cholestatic liver diseases. Next, we will discuss the broad spectrum of biliary disorders that define cholestatic liver diseases including: primary sclerosing cholangitis (PSC), primary biliary cirrhosis (PBC), ischemic cholangiopathy, chronic rejection following liver transplant, drug-induced liver injury (DILI), infectious secondary cholangitis, cystic fibrosis (CF), etc.

RC152
Techniques for Interventional Sonography and Thermal Ablation (Hands-on Workshop)

Refresher/Informatics

US IR US IR
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: E264

Participants
Stephen Clifford O’Connor MD (Presenter): Nothing to Disclose
William Eugene Shiels DO (Presenter): President, Mauka Medical Corporation Royalties, Mauka Medical Corporation Patent holder, Mauka Medical Corporation
Alda Felicita Cossi MD (Presenter): Nothing to Disclose
Michael V. Krasnokutsky MD (Presenter): Nothing to Disclose
Mark LeRoy Lukens MD (Presenter): Nothing to Disclose
Kenneth S. Lee MD (Presenter): Research Consultant, SuperSonic Imagine Speakers Bureau, Medical Technology Management Institute
Manish Natvarlal Patel DO (Presenter): Nothing to Disclose
Hollins P. Clark MD, MS (Presenter): Nothing to Disclose
Mark Joseph Hogan MD (Presenter): Nothing to Disclose
Carmen Gallego MD (Presenter): Nothing to Disclose
Mabel Garcia-Hidalgo Alonso MD (Presenter): Nothing to Disclose
John David Lane MD (Presenter): Nothing to Disclose
Andrew Jered Rabe DO (Presenter): Nothing to Disclose
Humberto Gerardo Rosas MD (Presenter): Nothing to Disclose
Kristin Marie Dittmar MD (Presenter): Nothing to Disclose
Nicholas Andrew Zumberge MD (Presenter): Stockholder, Covidien AG Stockholder, Abbott Laboratories Stockholder, Abbvie Inc Stockholder, Mallinckrodt plc Stockholder, Dexcom, Inc Stockholder, Merck & Co, Inc Stockholder, Gilead Sciences, Inc Stockholder, Exact Sciences Corporation Stockholder, Cerner Corporation

LEARNING OBJECTIVES
1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography. 2) Discuss and perform basic skills involved in thermal tumor ablation in a live learning model. 3) Perform specific US-guided procedures to include core biopsy, abscess drainage, vascular access, cyst aspiration, soft tissue foreign body removal, and radiofrequency tumor ablation. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning opportunities.

RC153
Advances in Radiology Decision Support

Refresher/Informatics

IN IN
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: 5404AB
LEARNING OBJECTIVES

1) Define decision support systems and their role in radiology. 2) Describe widely used decision support technologies. 3) Explore how radiology decision support systems can improve patient care outcomes.

ABSTRACT

Decision support systems use knowledge -- ranging from books, to web sites, to real-time artificial intelligence systems -- to help physicians improve their decision making. This Refresher Course will review a number of systems that can help radiologists' decision making. We will describe tools for information retrieval and image retrieval, and systems that use rules or probabilities to help identify the most likely diagnosis. We will discuss how evolving technologies provide new ways to integrate advanced decision support into routine clinical practice, and how decision support systems can improve outcomes in patient care.

RC154

Getting It Right: Informatics Tools for Imaging 3.0

Refresher/Informatics

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

Sun, Nov 30 2:00 PM - 3:30 PM   Location: N229

Participants

Moderator

J. Raymond Geis MD : Nothing to Disclose

Sub-Events

RC154A

Right Order: Ordering Clinical Decision Support

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

LEARNING OBJECTIVES

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

URL's

https://dl.dropboxusercontent.com/u/140978/AlkasabRSNA2014RadCDS.pptx

RC154B

Right Interpretation: Radiologist Clinical Decision Support

Tarik K. Alkasab MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

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

URL's

https://dl.dropboxusercontent.com/u/140978/AlkasabRSNA2014RadCDS.pptx

RC154C

Right Information: Business Intelligence Tools

Woojin Kim MD (Presenter): Co-founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Board of Directors, Montage Healthcare Solutions, Inc Advisory Board, Zebra Diagnostics Ltd

LEARNING OBJECTIVES

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

ABSTRACT

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

Right Workflow: Workflow Engines and Lexicon
Bradley J. Erickson MD, PhD (Presenter): Stockholder, Evidentia Health, Inc

LEARNING OBJECTIVES

1) Become familiar with the RSNA Clinical Trials Processor Software, including how to configure it to accomplish the common tasks, including, deidentification for internal research or education, deidentification and forwarding to an external site for multi-site trials. 2) Learn how to optimize configurations and pipelines for variants of the above major categories of tasks.

ABSTRACT

CTP is a powerful software tool that is useful for supporting education and research. CTP has a pipeline approach to handling data. It can receive DICOM images using DICOM transports, but can also get DICOM images from a directory/filesystem. It can then modify the header elements according to rules defined by the user. It can replace Protected Health Information (PHI) in one of several ways, to help assure HIPAA compliance. PHI can be located in many parts of a DICOM object, and the many variants, and ways that CTP can address those will be described. CTP can also do basic processing on any other DICOM tag, if required. At the end of the pipeline, CTP can then send the images using DICOM, store them into a filesystem, or transmit them to another CTP instance using HTTP. Example configurations and the advantages of each will be described.

RCA12

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

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM  Location: S401AB

Participants
Holly Ann Burt MLIS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify freely available online image databases and data archives and know their contents and value. 2) Identify freely available online case studies and educational materials. 3) Become familiar with online drug, contrast agents, and other substance databases. 4) Understand basic searching skills across a variety of databases.

ABSTRACT

The National Library of Medicine (NLM) is only one of many agencies which support freely available online databases and data archives. In this hands-on workshop, explore the rich variety of online resources for radiographic images and data, imaging tools, drugs and contrast agents, and education (e.g. case studies). Databases covered include PubMed/MEDLINE, the National Cancer Institute’s Cancer Imaging Archive, MedlinePlus.gov and RadiologyInfo for patients and families, plus search engines and portals offering a radiology option. Learn which databases may be the best starting point for your research.

URL’s

http://nnlm.gov/training/resources/onlinedatabases.pdf

Handout:Holly Ann Burt

RCB12

Optimizing PowerPoint Slides (Hands-on)
Refresher/Informatics

IN ED IN ED

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: S401CD

Participants
William J. Weadock MD (Presenter): Owner, Weadock Software, LLC
Sarah C. Abate BS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Review the components of an optimal slide presentation. 2) Learn about common errors made in slide preparation and how they can be avoided. 3) Learn about how to improve the quality of a presentation by using optimal different slide backgrounds, font size and color, and image sizes. 4) Learn tips to ensure a smooth presentation.

ABSTRACT
Electronic presentations are very common in radiology practice. This hands-on demonstration and questions and answer session will show attendees how to optimize their presentations. The focus will be on the use of slide templates, color selection (font and background), font and image size, and animations. Additional review of image and video display and management will be covered. Demonstrations will include tips to decrease time creating and modifying presentations. Bring your questions!

RCC12
The Use of Business Analytics for Improving Radiology Operations, Quality, and Clinical Performance (In Association with the Society for Imaging Informatics in Medicine)

Refresher/Informatics

SQ LM IN SQ LM IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM Location: S501ABC

Participants
Moderator
Katherine P. Andriole PhD: Nothing to Disclose

LEARNING OBJECTIVES
1) Understand what is meant by business analytics in the context of a radiology practice. 2) Be able to describe the basic steps involved in implementing a business analytics tool. 3) Learn how business analytics tools can be used for quality assurance in radiology, for maintenance of certification (MOC), and for practice quality improvement. 4) Be introduced to the capabilities of current and potential future business analytics technologies.

ABSTRACT
This course will provide an overview of the use of business analytics (BA) in radiology. How a practice manages information is becoming a differentiator in the competitive radiology market. Leveraging informatics tools such as business analytics can help a practice transform its service delivery to improve performance, productivity and quality. An introduction to the basic steps involved in implementing business analytics will be given, followed by example uses of BA tools for quality assurance, maintenance of certification (MOC) and practice quality improvement. The power of current business analytics technologies will be described, along with a look at potential future capabilities of business analytics tools.

Sub-Events

RCC12A
Introduction to Business Analytics Demonstrating Use of an Open-Source Tool for Application to Radiology
Katherine P. Andriole PhD (Presenter): Nothing to Disclose

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 extract, transform, load (ETL) and key performance indicators (KPI). 3) See a demonstration implementation of an open-source business analytics tool using a radiology use case.

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 dynamically presenting key performance indicators (KPI) will be demonstrated. The extract, transform, load (ETL) steps will be shown using an example use case, and multiple database sources taken from a radiology practice.

RCC12B
Operational and Predictive Analytics in Radiology
LEARNING OBJECTIVES

1) Discuss the importance of informatics tools for ABR MOC PQI and ACGME SBP quality efforts. 2) Identify the role of informatics in capturing, extracting, analyzing, and communication quality projects. 3) Illustrate graphical dashboarding examples to support quality efforts.

Capabilities of Current and Future Business Analytics Technologies
Tessa S. Cook MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

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

VSPD12

Pediatric Series: Fetal/Neonatal

Series Courses

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Sun, Nov 30 2:00 PM - 3:30 PM  Location: S102AB

Participants

Moderator
Deborah Levine MD: Editor with royalties, UpToDate, Inc Editor with royalties, Amirsys, Inc Editor with royalties, Reed Elsevier

Moderator
Daniela Prayer MD: Nothing to Disclose

Sub-Events

VSPD12-01  Fetal Imaging at 3T
Teresa Victoria MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To compare and contrast fetal imaging at 1.5 and 3Tesla. 2) To discuss artifacts encountered while imaging the fetus at 3T. 3) To discuss safety concerns associated with scanning the fetus at higher magnetic strength.

ABSTRACT

Several attempts have been made in the past at imaging the fetus at 3T as part of the continuous search for increased image signal and better anatomic delineation of the developing fetus. Until now, imaging of the fetus at 3T has been disappointing, with numerous artifacts impeding image analysis. Improved technology now allows imaging of the fetus at greater magnetic strength, while still encountering some hurdles in the shape of imaging artifacts. In this course we present the preliminary experience of evaluating the developing fetus at 3T, discuss several artifacts encountered and techniques to decrease them, as well as safety concerns associated with scanning the fetus at higher magnetic strength.

VSPD12-02  Fetal Cardiac MRI and Left Ventricular Function Assessment Using a New Gating Strategy Based on Doppler Ultrasound: Preliminary Results
Fabian Kording (Presenter): Nothing to Disclose, Jin Yamamura MD: Nothing to Disclose, Chressen Catharina Remus MD: Nothing to Disclose, Manuela Tavares de Sousa: Nothing to Disclose, Friedrich Uberle: Nothing to Disclose, Gerhard B. Adam MD: Nothing to Disclose, Bjoern Schoennagel MD: Nothing to Disclose

PURPOSE

The commonly used method to evaluate the fetal heart is echocardiography (ECG). However, the detection of congenital heart diseases by ECG varies from 45% to 74% and an alternative imaging modality would be desirable. Fetal cardiac magnetic resonance imaging (MRI) has the potential to visualize anatomy and to assess functional parameters of the fetal heart but was up to now not feasible due to a missing gating strategy. The purpose of this study was to perform fetal cardiac MRI using a newly developed Doppler ultrasound sensor (DUS) for external fetal cardiac gating in a human fetus for the first time.

METHOD AND MATERIALS
One pregnant volunteer (gestation week 34) was examined at 1.5 T to evaluate the DUS gating method for fetal cine MRI. To obtain a gating signal from the fetal heart, an MRI compatible ultrasound transducer of a cardiotocogram was employed for cardiac triggering. DUS signals from the CTG were transferred to LabView with a data acquisition card. Trigger signals were processed based on a newly developed algorithm and transmitted to the physiologic unit of the MRI for cardiac gating. Retrospective cine imaging was then performed in four-chamber, long-axis and short-axis view. Left ventricular function parameters were assessed by cardiac cine MRI and compared to parameters obtained from consecutively performed standard ECG.

RESULTS
Cardiac gating signals from the fetus could be reliably detected. No artefacts and interferences were observed, resulting in very good image quality. The synchronous contraction of the ventricles was clearly visualized from the apex to the base with an average R-R interval of 464 ± 94 ms. End-systolic and end-diastolic volumes calculated from cine cardiac MRI and ECG were 0.58 ml / 0.62 ml and 3.17 ml / 3.22 ml, yielding stroke volumes of 2.60 ml / 2.59 ml with an ejection fraction of 80 % / 81 % and cardiac output of 334 ml/min / 335 ml/min.

CONCLUSION
For the first time, cine cardiac MRI could be performed in a human fetus using a newly developed DUS device and dedicated software for fetal cardiac triggering. Fetal cardiac functional parameters revealed high agreement in comparison with standard fetal echocardiography.

CLINICAL RELEVANCE/APPLICATION
Fetal cardiac MRI has the high potential to detect cardiovascular malformations and to evaluate fetal cardiac function and, hence, may be important to overcome the limitations of echocardiography.

VSPD12-03
In Utero Tractography of Ganglionic Eminence Pseudofibers

Christian Mitter MD (Presenter): Nothing to Disclose, Daniela Prayer MD: Nothing to Disclose, Peter Christian Brugger MD, PhD: Nothing to Disclose, Gregor Kasprian MD: Nothing to Disclose

PURPOSE
The ganglionic eminence (GE) is a transient structure of the developing fetal brain located adjacent to the lateral ventricle, and contains the proliferative zone for developing GABAergic basal ganglia projection neurons and cortical interneurons. Due to its highly anisotropic organisation the GE can be visualized and investigated by diffusion tensor imaging. We used in utero DTI-based tractography to identify the normal 3D imaging patterns of this structure in the developing fetal brain during the second trimester in vivo.

METHOD AND MATERIALS
Preselected non-motion degraded in utero DTI examinations of 13 unsedated fetuses (21 - 27 gestational weeks, GW) without gross cerebral malformations were included. Orthogonal axial diffusion tensor sequences (16 directions, reconstructed voxel size 0.94mmx0.94mmx3mm, b-values of 0s/mm2 and 700s/mm2) were performed using a 1.5T superconducting MR unit. Color coded FA maps were geometrically coregistered with multplanar T2-weighted MR sequences. The GE was anatomically defined using a multiple ROI approach and visualized using a FACT algorithm.

RESULTS
Three-dimensional visualization of anisotropic diffusion within the GE by in utero tractography resulted in multiple "pseudofiber" tracts with a C-shaped course along the wall of the lateral ventricle. Pseudofibers showed an anterior-posterior orientation along the body of the lateral ventricle and a superior-inferior orientation in front of the trigone. Coregistered T2w sequences confirmed the location to be within the strongly hypointense cell rich proliferative layers of the GE. Overall, in utero tractography of the GE was successful in 10/13 subjects in both hemispheres and in 3/13 subjects in only the right hemisphere.

CONCLUSION
This study demonstrates the potential of DTI-based in utero tractography to visualize the three-dimensional anisotropic organization of the GE in the developing fetal brain in vivo as early as 21 GW. Anisotropic diffusion within the GE may be related to tangential migration of developing neurons in this region. In utero tractography of GE pseudofibers may be useful for a more detailed assessment of this transient fetal structure in both normal development and fetal brain pathologies.

CLINICAL RELEVANCE/APPLICATION
Due to its important role in the production of GABAergic neurons, a more detailed assessment of the GE in utero may be useful in a range of neurodevelopmental disorders, including epilepsy.

VSPD12-04
DTI-based in Utero Tractography of Association Fiber Tracts in the Developing Fetal Brain

Christian Mitter MD (Presenter): Nothing to Disclose, Peter Christian Brugger MD, PhD: Nothing to Disclose, Daniela Prayer MD: Nothing to Disclose, Gregor Kasprian MD: Nothing to Disclose

PURPOSE
Association fibers connect different cortical areas in the same hemisphere and constitute an important anatomical substrate for a diverse range of higher cognitive functions. They already have been extensively investigated in vivo in adults and children as well as postmortem in human fetal brains. In the present study fetal MRI and DTI-based tractography was used to visualize major association fiber tracts (uncinate fasciculus - UF, inferior fronto-occipital fasciculus - IFOF, inferior longitudinal fasciculus - ILF and cingulum) and the fornix in the living fetal brain in utero.

METHOD AND MATERIALS

24 non-motion degraded DTI examinations of living unsedated fetuses (20-34 gestational weeks - GW) without gross cerebral abnormalities were included in the study. Orthogonal axial DTI sequences (16 directions, reconstructed voxel size 0.94/0.94/3mm, b values of 0 and 700 sec/mm²) were performed using a 1.5T MR unit. Association fiber tracts were anatomically defined using a multiple ROI approach and calculated using a deterministic linear tracking algorithm.

RESULTS

In utero tractography of UF and IFOF was possible as early as 20 GW. UF was found in 24/24 (100%) subjects and IFOF in 21/24 (87.5%) subjects. Visualization of the ILF was possible in only 6/24 (25.0%) subjects, most of them aged 30 GW or older. Tractography of cingulum and fornix was successful from 27 GW on in 9/24 (37.5%) and 8/24 (33.3%) of subjects respectively. Statistically significant differences in mean FA-value were found between left and right IFOF and between UF and IFOF of the right hemisphere.

CONCLUSION

Provided optimal imaging conditions DTI-based tractography can be used to visualize the morphological appearance of major association fiber tracts in the developing fetal brain in utero. Identifiable fiber tracts include the UF and the IFOF as early as 20 GW, and the ILF, the cingulum and the fornix in older fetuses. Quantitative analysis of diffusion parameters provides preliminary evidence for hemispheric asymmetry and structural differences between association fiber tracts.

CLINICAL RELEVANCE/APPLICATION

The possibility to non-invasively investigate association fiber tracts in utero with DTI-based tractography may be useful for a more precise evaluation of intrauterine white matter damage.

Magnetic Resonance Imaging Based Ratio of Fetal Lung Volume to Fetal Body Volume as a New Prognostic Marker for the Development of Chronic Lung Disease in Congenital Diaphragmatic Hernia

Magnetic Resonance Imaging Based Ratio of Fetal Lung Volume to Fetal Body Volume as a New Prognostic Marker for the Development of Chronic Lung Disease in Congenital Diaphragmatic Hernia

PURPOSE

Most prenatal prognostic parameters in congenital diaphragmatic hernia (CDH) refer to a healthy control group. The prenatally measured MR based ratio of fetal lung volume to fetal body volume (FLV/FBV) can be calculated individually. This study investigated the prognostic value of this ratio with regard to the development of chronic lung disease (CLD).

METHOD AND MATERIALS

MRI was performed in 132 fetuses with diagnosed CDH. Both FLV and FBV were measured and used to calculate the ratio of FLV/FBV. CLD was diagnosed if oxygen was required at postpartum day 28. Logistic regression analysis was used to model the dependence of CLD on the ratio. Prognostic accuracy was evaluated by applying the area under the curve (AUC) in receiver operating characteristics (ROC) analysis.

RESULTS

61 of 132 children (46%) developed CLD postnatally. Neonates who developed a CLD showed prenatally a significantly reduced ratio (FLV/FBV) of 0.011±0.005 in comparison to children without the diagnosis of CLD (0.014±0.005; p=0.0008). A higher ratio of FLV to FBV was associated with a reduced probability of CLD-development. In ROC-analysis, the AUC in this context was 0.743.

CONCLUSION

The MRI based ratio (FLV/FBV) is a prenatal predictor for the development of CLD in children with CLD. It is calculated individually and therefore independent of a control group.

CLINICAL RELEVANCE/APPLICATION

The individually calculated ratio of FLV to FBV is able to predict the probability of CLD-development prenatally. Its independency of a control group may be an advantage in particular in growth restricted children.
1) identify the various and different types of congenital lung malformations. 2) perceive their differentiating fetal imaging features and those of mimics. 3) understand the implications of differentiating lung malformations. 4) understand the strategies for management of CLMs in the fetus and neonate.

ABSTRACT

Congenital lung malformations are a heterogeneous group of non-malignant lesions that are not uncommonly seen on fetal ultrasound as echogenic or cystic masses in the chest. These are invariably referred to as 'CCAM’s (congenital cystadenomatoid malformation), but the pathology is much broader than just CCAM. Recent (Langston, 2003) pathologic review has proposed a unifying theory for the development of all of these lesions from early obstruction of the airway. We will discuss this pathologic approach to fetal lesions and show imaging correlates that can aid in differentiating types of lesions. We will discuss how differentiation prior to birth may be helpful; although these lesions are technically benign, certain lesions can cause in utero demise. We will discuss imaging strategies for both fetal and neonatal treatment planning of these lesions, and their differentiation from lesions that might mimic CLMs, including rare neoplasms. Neonatal correlation of fetal images will be included as appropriate.

Prenatal ADC Value Evaluation of the Fetal Brain in Monochorionic Twins with TTTS, and the Influence of Fetal Demise of One Fetus on the Surviving Sibling


PURPOSE

Twin-to-Twin Transfusion Syndrome (TTTS) is a chronic hemodynamic disequilibrium affecting 10-15% of all monochorionic pregnancies. Modern treatments have dramatically decreased the mortality rate from TTTS, and in the same time focused great attention to the still significant morbidity, primarily neurocognitive morbidity. TTTS pregnancies are extensively monitored with ultrasound and post-natal neurological exams; however, fetal magnetic resonance imaging (MRI) and Diffusion-weighted imaging (DWI) are not yet commonly used, despite evidence that MRI can detect changes that are not apparent on prenatal ultrasound. In this study we have set off to assess the ADC changes in the brains of fetuses in pregnancies complicated with TTTS.

METHOD AND MATERIALS

We have evaluated 53 DWI scans of fetuses afflicted by TTTS and 46 DWI scans of healthy singleton fetuses, in all of which ADC values from 8 regions of interest (ROIs) - frontal, parietal, temporal, occipital, basal ganglia, thalamus, pons and cerebellum, were plotted and compared using parametric and non-parametric tests.

RESULTS

We have found no significant differences in ADC values between the two groups, in any of the ROIs. Also, no significant differences were found in ADC values in any ROI between fetuses with or without co-twin demise. A non-parametric test comparing healthy controls to TTTS afflicted fetuses with and without pathological radiological findings have demonstrated significant difference between the three subgroups in the Basal ganglia (BG) ROI and Pons ROI. Comparison between the control group and the radiological pathology positive subgroup, using Mann-Whitney U Test, indicated a significant increase in ADC in the Pons ROI.

CONCLUSION

We observed that commonly used treatments for TTTS, do not evoke a significant changes in the diffusion of the fetal brain, even after a co-twin demise. Our data suggests the need for further investigation as to the meaning of pathological findings in fetal MRI scans and their correlations to neurocognitive injury in TTTS.

CLINICAL RELEVANCE/APPLICATION

This study is the first using fetal brain DWI to assess neurological changes caused by TTTS. We hope it will lead to improved pre-natal evaluation and treatment choices as well as post-natal care.
Additionally this modality is of value in problem solving in women with indeterminate anatomic imaging. In her presentation Dr Schilling will describe how MBI is integrated in her comprehensive breast center. Please visit http://www.register.inputinput.com/ to register for this Vendor Workshop.

Hologic: Essentials of 3D Mammography Self-Guided Training

Vendor Workshops
Sun, Nov 30 3:00 PM - 5:00 PM  Location: Booth 1465

LEARNING OBJECTIVES

Hologic is offering a series of ongoing sessions to allow radiologists to participate in an online Hologic 3D Mammography interactive virtual training. Each session takes approximately 2 hours to complete, therefore the last session will commence no later than 3:00 p.m. each day. Participants will be provided a workstation with headphones to enhance their learning experience. The sessions will include a lecture by a leading breast radiologist and an interactive case review module. The sessions are intended for radiologists interested in learning more about 3D mammography for screening and diagnosis. Please note the program will provide a certificate of completion that may be used towards the FDA mandated training for tomosynthesis. The course is not accredited for CME. Please visit <a href="http://www.hologic.com/RSNAtomo-courses" target='_blank'>www.hologic.com/RSNAtomo-courses</a> to register for this Vendor Workshop.

GE Healthcare: Breast Ultrasound Elastography

Vendor Workshops
Sun, Nov 30 3:30 PM - 4:00 PM  Location: Booth 4782

LEARNING OBJECTIVES

To secure your seat, please register at the link below. Ultrasound elastography is gaining an important role in routine breast imaging thanks to its ability to increase US specificity in breast examinations. The technique, usually interpreted using a color visual pattern scale, has been recently improved with quantitative and semi-quantitative measurements. Real time 2D Shear wave elastography measures tissue stiffness in kilopascals or the shear wave propagation in meters per second. Strain elastography can measurement the relative strain of tissue, the so-called strain-ratio evaluation (SR). The clinical gain in specificity of elastography has been reported in several articles of the literature; recent studies have shown both quantitative and semi-quantitative* techniques to be potentially helpful to reduce unnecessary breast biopsies.

*Semi-quantative elastography is not approved by the USA FDA and is not for sale in the USA.

Please visit http://www.register.inputinput.com/ to register for this Vendor Workshop.

Hologic: 3D Breast Biopsy using the Selenia® Dimensions®, Affirm™ and Eviva® systems.

Vendor Workshops
Sun, Nov 30 3:45 PM - 4:30 PM  Location: Booth 1465

LEARNING OBJECTIVES

Hologic is offering a series of 45 minute sessions that include demonstration of the Hologic 3D breast biopsy procedure using the Selenia® Dimensions®, Affirm™ and Eviva® systems. A brief lecture will provide an overview of the technology including comparison of 3D to stereotactic guided biopsy prior to the demonstration. The sessions are intended for radiologists and general surgeons interested in learning more about 3D for interventional breast procedures. The course is not accredited for CME. Please visit <a href="http://www.hologic.com/RSNAtomo-courses" target='_blank'>www.hologic.com/RSNAtomo-courses</a> to register for this Vendor Workshop.

PS12

Sunday Afternoon Plenary Session

Plenary Sessions

AMA PRA Category 1 Credits ™: 1.75
ARRT Category A+ Credits: 1.50
Sun, Nov 30 4:00 PM - 5:45 PM  Location: Arie Crown Theater

Participants

Presiding
N. Reed Dunnick  MD  Nothing to Disclose  President, Radiological Society of North America

Sub-Events

PS12A  Report of the RSNA Research and Education Foundation

James P. Borgstede  MD (Presenter):  Nothing to Disclose  Chairman, Board of Trustees, RSNA Research and Education Foundation

Abstract

The RandE Foundation - A Transformative Force in Radiology The theme of the 2014 RSNA Scientific Assembly and Annual Meeting is "A Century of Transforming Medicine." For 30 years of that century, the RandE
Foundation has played a significant role in advancing the RSNA mission to promote excellence in patient care and health care delivery through education, research and technologic innovation. In celebration of 100 years, the Foundation is launching Inspire-Innovate-Invest, The Campaign for Funding Radiology’s Future. This bold campaign seeks to raise $17.5 million to fund grants in radiologic research and education, bridging the gaps in funding for promising investigators and educators. The need is great and the time is now, if the Foundation reaches its campaign goal of $17.5 million, it will keep pace with the growing demand and help ensure that critical discoveries by radiologic investigators come to fruition. This year, the Foundation will fund 95 grants totaling $3.7 million. This means the RandE is funding 25% of our ever increasing number of excellent grant applications. While pleased with these achievements, imagine what the RandE Foundation could fund with additional support from all of us as radiology colleagues? And please recall that we are all the beneficiaries of this research. Of these individuals, who will start their academic research career with a RandE grant, and what will grow from this initial funding? What advances will emanate from their research? And, how can radiologists support these investigators and educators as they pursue their chosen career paths in an effort to make the specialty even stronger? During the meeting week, please take time to visit the RandE Foundation Booth, located on Level 3 of Lakeside Center to learn more about how you can be a part of the campaign and support the RandE Foundation and the future of our specialty.

Image Interpretation Session

PS12B


LEARNING OBJECTIVES

1) Identify key abnormal findings on radiologic studies that are critical to making a specific diagnosis. 2) Construct a logical list of differential diagnoses based on the radiologic findings, focusing on the most probable differential diagnoses. 3) Determine which, if any, additional radiologic studies or procedures are needed in order to make a specific final diagnosis. 4) Choose the most likely diagnosis based on the clinical and the radiologic information.

RCA13


Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 4:00 PM - 5:30 PM Location: S401AB

Participants
Holly Ann Burt MLIS (Presenter): Nothing to Disclose
Tony Nguyen MLIS (Presenter): Nothing to Disclose
Patricia Devine MLS (Presenter): Nothing to Disclose
Jamie T. Dwyer MLS (Presenter): Nothing to Disclose
Stephanie Frie MLIS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how PubMed constructs a query and how to develop and refine effective search strategies in radiology. 2) Use PubMed tools including Clinical Queries, Related Articles, Single Citation Matcher and Loansome Doc. 3) Build focused searches using the Medical Subject Headings (MeSH) vocabulary for radiology and limit searches to radiology-oriented journals. 4) Understand how to save and download citations.

ABSTRACT

This hands-on workshop covers key searching techniques, changes to PubMed, and how to develop effective search strategies for PubMed and MEDLINE. Topics covered include: why keywords don’t always give the results you expect, how to limit to specific journals, quick searches to find evidence-based citations, how to access full-text articles, and downloading citations to reference manager programs. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov). MEDLINE is a subset of PubMed which includes links to sites providing full text articles and to other related databases and resources.

URL’s
http://nnlm.gov/training/resources/pubmed8.pdf

Handout:Holly Ann Burt

RCC13

IHE Workflow Efficiency from Acquisition to the Report
Participants

Moderator
Bradley J. Erickson MD, PhD: Stockholder, Evidentia Health, Inc
Bradley J. Erickson MD, PhD (Presenter): Stockholder, Evidentia Health, Inc
Curtis P. Langlotz MD, PhD (Presenter): Shareholder, Montage Healthcare Solutions, Inc Advisory Board, Reed Elsevier
Advisory Board, Activate Networks, Inc Spouse, Consultant, Johnson & Johnson
Christopher Lindop (Presenter): Employee, General Electric Company
Harry Solomon (Presenter): Employee, General Electric Company

LEARNING OBJECTIVES

1) Understand how report templates can improve productivity. 2) Examine how IHE profiles facilitate system interoperability. 3) Learn about the features of the new IHE profile for management of radiology report templates. 4) Review proposed new features for radiology reporting systems.

ABSTRACT

The purpose of this session is to demonstrate how existing and planned IHE profiles can help improve the workflow in a medical imaging department, and help those responsible for its operation, monitor what is happening. Prior IHE profiles focused heavily on traditional RIS and PACS. Newer projects are focused on exchange of images and reports between medical facilities. We will also describe future possible profiles for utilizing RadLex to improve radiologist efficiency. We will also describe workflow terminology in RadLex and describe how that can help manage and improve departmental workflow.

GE Healthcare: ABUS Implementation and Workflow

Vendor Workshops

Sun, Nov 30 4:30 PM - 5:00 PM Location: Booth 4782

LEARNING OBJECTIVES

ABUS Implementation and Workflow

To secure your seat, please register at the link below.

Please visit http://www.register.inputinput.com/ to register for this Vendor Workshop.