

Monday

SPSH20

Hot Topic Session: PET/MR and Hyperpolarized MR for GU Imaging

Monday, Nov. 30 7:15AM - 8:15AM Location: E450B



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

Participants

Zhen J. Wang, MD, Hillsborough, CA, (jane.wang@ucsf.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with current PET-MR imaging strategies. 2) To learn the current and future applications of PET-MR in genitourinary oncology including gynecological cancers and prostate cancer. 3) To understand the principles of hyperpolarized carbon-13 MR metabolic imaging 4) To learn the clinical utility of hyperpolarized carbon-13 MR for measuring prostate cancer aggressiveness and response to therapy

ABSTRACT

URL

Sub-Events

SPSH20A PET/MRI of Gynecological Malignancies

Participants

Raj M. Paspulati, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) PET-MRI protocol and workflow for Gynecological cancer. 2) Role of PET-MRI in Gynecological cancer staging, treatment planning and follow up for treatment response. 3) PET-MR Imaging pit falls and limitations.

SPSH20B Imaging of Prostate Cancer: Potential of PET/MRI with Tracers beyond FDG

Participants

Matthias Roethke, MD, Heidelberg, Germany (*Presenter*) Speaker, Siemens AG

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSH20C Hyperpolarized 13C MR Clinical Trials of Prostate Cancer

Participants

John Kurhanewicz, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPDL20

RSNA Diagnosis Live™: 'Bo you don't know Didley' - Test Your Diagnostic Skills at the Crack of Dawn

Monday, Nov. 30 7:15AM - 8:15AM Location: E451B



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

Participants

Adam E. Flanders, MD, Penn Valley, PA (*Presenter*) Nothing to Disclose

Christopher G. Roth, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Sandeep P. Deshmukh, MD, Philadelphia, PA, (sandeep.deshmukh@jefferson.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

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

SPSC20

Controversy Session: Enteral Contrast for CT...High or Dry?

Monday, Nov. 30 7:15AM - 8:15AM Location: E451A



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

FDA Discussions may include off-label uses.

Participants

Kumaresan Sandrasegaran, MD, Carmel, IN (*Moderator*) Nothing to Disclose

Honored Educators

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

Kumaresan Sandrasegaran, MD - 2013 Honored Educator
Kumaresan Sandrasegaran, MD - 2014 Honored Educator

Sub-Events

SPSC20A Pro Enteral Contrast

Participants

Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Co-founder, VirtuoCTC, LLC; Stockholder, Collectar Biosciences, Inc; Research Consultant, Bracco Group; Research Consultant, KIT ; Research Grant, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Identify the advantages and disadvantages for the use of enteral contrast at CT. 2) Compare and contrast the various types of enteral contrast (positive, neutral, and negative). 3) Assess the appropriateness of the use of enteral contrast according to specific study indication.

ABSTRACT

N/A

URL

N/A

Honored Educators

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

Perry J. Pickhardt, MD - 2014 Honored Educator

SPSC20B Against Enteral Contrast for Most CT Indications

Participants

Benjamin M. Yeh, MD, San Francisco, CA, (ben.yeh@ucsf.edu) (*Presenter*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;

LEARNING OBJECTIVES

1) Review the evidence for the use and non-use of positive oral contrast material for CT will be reviewed. 2) Discuss artifacts and interpretive pitfalls arising from positive oral contrast use at CT. 3) Understand issues of patient tolerance and compliance with positive oral contrast use. 4) Explore specific scenarios where non-use of positive oral contrast outweighs the use of oral contrast will be explored, including in the emergency room setting, and when bowel pathology such as ischemia and inflammation is of concern.

ABSTRACT

As our multidetector CT technology improves and our understanding of imaging technique progresses, the use or non-use of positive oral contrast for CT imaging is evolving. Although positive oral contrast is used by the great majority of radiologists for routine CT imaging and has undisputed value, specific scenarios are emerging where positive oral contrast usage is harmful to accurate imaging diagnosis and patient care. This discussion will explore the economic, logistical, interpretive, and side effect issues of positive oral contrast usage in the modern CT practice. A re-examination of when it is appropriate not to use positive oral contrast will be discussed, and include rapid patient triage in the emergency setting, certain subsets of abdominopelvic imaging, and patient tolerance. The economic and radiation dose cost of positive oral contrast use will also be explored.

URL

Pediatric Series: MSK

Monday, Nov. 30 8:30AM - 12:00PM Location: N230



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

Participants

Andrea S. Doria, MD, Toronto, ON (*Moderator*) Consultant, Bayer AG; Consultant, Novo Nordisk AS; Consultant, Baxter International Inc
Tal Laor, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose
Siddharth P. Jadhav, MD, Houston, TX (*Moderator*) Nothing to Disclose
Sarah D. Bixby, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events**RC213-01 Magnetic Resonance Imaging of Children with Juvenile Idiopathic Arthritis**

Monday, Nov. 30 8:30AM - 8:50AM Location: N230

ParticipantsTal Laor, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose**LEARNING OBJECTIVES**

1) To review the nomenclature and criteria for the diagnosis of juvenile idiopathic arthritis (JIA) in children. 2) To recognize the sites in children commonly affected by JIA. 3) To illustrate the spectrum of abnormalities identified with magnetic resonance imaging in children with JIA.

ABSTRACT**RC213-02 Predictive Value of Magnetic Resonance Imaging in Clinically Inactive Juvenile Idiopathic Arthritis?**

Monday, Nov. 30 8:50AM - 9:00AM Location: N230

Participants

Charlotte M. Nusman, MSc, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Robert Hemke, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Cristina Lavini, DPhil, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Dieneke Schonenberg-Meinema, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marion Van Rossum, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Koert M. Dolman, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Merlijn van den Berg, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Taco Kuijpers, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mario Maas, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The value of subclinical synovitis on magnetic resonance imaging (MRI) in clinically inactive patients with juvenile idiopathic arthritis (JIA) is yet to be unraveled. This study was performed to determine whether (dynamic) contrast-enhanced MRI parameters of a previously affected target joint in patients with clinically inactive JIA can predict a flare of joint inflammation during 2-year follow-up.

METHOD AND MATERIALS

Thirty-two JIA patients with clinically inactive disease at the time of MRI of the knee were prospectively included. Dynamic contrast-enhanced (DCE) MRI provided both descriptive measures and time-intensity-curve shapes, representing functional properties of the synovium. Conventional MRI outcome measures included validated scores for synovial hypertrophy, bone marrow edema, cartilage lesions and bone erosions. During a 2-year period the patients were examined at regular time points and clinical flares were registered.

RESULTS

MRI analysis revealed synovial hypertrophy in 13 (39.4%) of the clinically inactive patients. Twelve patients (37.5%) had at least one flare during 2-year clinical follow-up. Median time-to-flare was 0.68 years (IQR 0.18-1.97) and 50% of the flaring patients did so within the first 6 months (Figure 1). Persistently inactive and flaring patients differed significantly in the maximum enhancement of the DCE-MRI ($p < 0.05$), whereas no difference was found between these two groups in any of the baseline scores of conventional MRI.

CONCLUSION

Our prospective clinical follow-up study indicates that the assessment of 'maximum enhancement' upon DCE-MRI may be able to predict a clinical flare within 2 years in inactive JIA patients. In the future, functional imaging biomarkers, such as DCE-MRI can be combined with serum markers or gene profiling data, leading to the construction of a predictive model to more precisely decide about treatment strategies in any individual patient.

CLINICAL RELEVANCE/APPLICATION

The presence of a relatively high maximum enhancement on dynamic contrast-enhanced MRI of the knee in clinically inactive patients with juvenile idiopathic arthritis indicates a risk of flaring.

RC213-03 Periosteal Entrapment in Salter-Harris Injuries: Too Much on the Plate

Monday, Nov. 30 9:00AM - 9:10AM Location: N230

Participants

Peter H. Van Geertruyden, MD, Fort Belvoir, VA (*Presenter*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc
Adam C. Zoga, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Timothy G. Sanders, MD, Keswick, VA (*Abstract Co-Author*) Nothing to Disclose
Jana M. Crain, MD, Atherton, CA (*Abstract Co-Author*) Nothing to Disclose
Brendan T. Doherty, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To present a series of Salter-Harris injuries with periosteal entrapment, to better understand incidence and distribution, appearance and potential complications with regard to healing.

METHOD AND MATERIALS

Two musculoskeletal radiologists retrospectively reviewed 142 MRI exams with Salter-Harris injuries from 2007 to present for the presence of periosteal entrapment. Evaluation included Salter-Harris grade, location, presence of periosteal entrapment, and degree of entrapment measured in distance extending within the physis. Available follow-up imaging findings and clinical evaluations were recorded.

RESULTS

Of 144 Salter-Harris injuries on MRI, 59 cases were type I injuries, 48 cases were type 2 injuries, 20 cases were type 3 injuries, 14 cases were type 3 injuries, and 3 cases were type 5 injuries. The most common location for type I injuries was the distal fibula. The most common location for type 2 injuries was the distal radius. Type 3 and 4 Salter-Harris injuries showed no particular location preference. Of the 144 cases, 96 cases were in boys and 48 in girls. Average age of boys was 13 years, 9 months. The average age for girls was 12 years, 4 months.

CONCLUSION

Periosteal entrapment is observed in 7% of Salter-Harris injuries by MRI; entrapment is an under-reported phenomenon in current literature. In our series periosteal entrapment occurred most commonly at the distal tibia and fibula. Continued follow-up will reveal whether premature physeal arrest/growth disturbance is associated with periosteal entrapment.

CLINICAL RELEVANCE/APPLICATION

To make aware the frequency and potential implications of periosteal entrapment in Salter Harris fractures.

RC213-04 Plastic Bowing Fractures of the Pediatric Forearm: Evaluation of a Novel Computer Aided Method for Detection

Monday, Nov. 30 9:10AM - 9:20AM Location: N230

Participants

Uygar Teomete, MD, Miami Beach, FL (*Presenter*) Nothing to Disclose
Yuwei Zhou, Coral Gables, FL (*Abstract Co-Author*) Nothing to Disclose
Ozgur Dandin, MD, Bursa, Turkey (*Abstract Co-Author*) Nothing to Disclose
Weizhao Zhao, Coral Gables, FL (*Abstract Co-Author*) Nothing to Disclose
Taner Dandinoglu, Bursa, Turkey (*Abstract Co-Author*) Nothing to Disclose
Onur Osman, PhD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, PhD, MSc, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

(1) To develop a computer aided diagnosis (CAD) system for detection of plastic bowing fractures of the pediatric forearm and (2) to compare its feasibility with respect to the radiologists' interpretation.

METHOD AND MATERIALS

Following IRB approval, we retrospectively analyzed the forearm radiographs of the patients presenting to the pediatric emergency room following trauma. We included a total of 55 pediatric patients from all age groups. We used morphological operations to extract the forearm diaphyseal features. In geometry, the radius of curvature, R , is a measure of the radius of the circular arc which best approximates the curve at that point. Along with the border of the bone, at every point, the more "bending" of the curve, the smaller of the radius of curvature; the "flatter" of the curve, the bigger of the radius of curvature. Average of R increases with increased bowing level. Curvature of the radial and ulnar diaphyses were calculated for the normal patients with normal interpretation and for the patients with plastic bowing fracture. Leave one out cross validation scheme was used for avoiding bias in our evaluations. Results were compared with the radiologist's interpretation. t-test was used to determine statistical significance level.

RESULTS

Curvature values were obtained from our CAD method in the training step. With a sensitivity of 80% in detecting plastic bowing fractures, we recorded 92% specificity. When compared to radiologists' conventional readings, we did not find significant differences between the proposed method and the radiologists' reading using t-test ($p > 0.05$).

CONCLUSION

The proposed automated computer aided detection method can be used as a second opinion to aid the radiologist's decision making by highlighting the suspicious regions for plastic bowing fracture. To best of our knowledge, this is the first attempt towards automatizing quantitative evaluation of pediatric buckle fractures from radiographs.

CLINICAL RELEVANCE/APPLICATION

Our CAD method is fast, effective and reliable. It can be used as a standalone application or as a plugin to the PACS viewer in a radiology workstation. Its use as a second opinion may obviate the need to obtain additional radiographs of the contralateral forearm for comparison, preventing unnecessary radiation exposure to the child.

RC213-05 Growth Recovery Lines are More Common in Infants at High- vs. Low-risk for Abuse

Monday, Nov. 30 9:20AM - 9:30AM Location: N230

Participants

Matthew A. Zapala, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Andy Tsai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul K. Kleinman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Growth recovery lines (GRLs), AKA growth arrest, Harris, and Parks lines are transverse radiodense metaphyseal bands believed to be due to a temporary arrest of enchondral ossification-caused by local or systemic insults such as intermittent illness and malnutrition. The purpose of this study was to determine if GRLs are more common in infants at high- vs. low-risk for abuse.

METHOD AND MATERIALS

The reports of initial high detail ACR compliant skeletal surveys done at a large pediatric hospital between 1999 and 2013 were reviewed, along with the relevant clinical records. Infants were considered at low-risk for abuse if they had a skull fracture without significant intracranial injury (ICI) on CT, a history of a fall and the determination of Child Protection Team (CPT)/social work assessment. High risk infants had significant ICI, retinal hemorrhages, skeletal injuries (other than skull fractures) and the determination of risk by CPT/social work assessment. There were 53 low-risk infants (age range, 0.4-12 months; mean, 4.7 months) and 21 high-risk infants (range, 0.8-9.1; mean, 4.2). Using a 4 point Likert scale, a pediatric radiology attending and fellow independently evaluated the frontal radiographs of the lower extremities from the skeletal surveys for the presence of at least one GRL involving the distal femurs/tibias. The data were pooled and differences between the two groups were calculated.

RESULTS

Intra- and inter-reader agreement was very good (Cohen's kappa inter-reader = 0.77 and intra-reader = 0.82 and 0.84). The relative prevalence of GRLs in the low-risk groups was 38% (SD 8%, reader 1 = 17/53, reader 2 = 23/53) vs. 71% (SD 7%, reader 1 = 16/21, reader 2 = 14/21) in the high-risk group ($p < 0.001$, odds ratio 4.1, 95% CI 1.8 to 9.8).

CONCLUSION

GRLs are encountered at a significantly higher rate in infants at high- vs. low-risk for abuse. This difference may reflect the response of enchondral ossification to intermittent stresses associated with abusive events. However, since healing classic metaphyseal lesions may appear as radiodense transverse metaphyseal bands, some of the apparent GRLs in the high-risk group may reflect the residua of inflicted metaphyseal injury.

CLINICAL RELEVANCE/APPLICATION

GRLs may carry special significance when encountered in infants with suspected abuse. The possibility that some apparent GRLs may in-fact reflect healing occult metaphyseal injuries deserves further study.

RC213-06 Definition of a Scoring System for Assessment of Skeletal Age Using MRI of Hand and Wrist in Healthy Males and Females Children: Gender Differences

Monday, Nov. 30 9:30AM - 9:40AM Location: N230

Participants

Milvia Martino, MS, Rome, Italy (*Presenter*) Nothing to Disclose
Rosa Maria Ammendola, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Ernesto Tomei, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Sofia Battisti, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Richard C. Semelka, MD, Chapel Hill, NC (*Abstract Co-Author*) Research support, Siemens AG; Consultant, Guerbet SA
Iacopo Carbone, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic Resonance Imaging (MRI) of hand and wrist is a radiation free tool used to create a gender specific scoring system method for the skeletal age (SA) estimation in the healthy pediatric population.

METHOD AND MATERIALS

96 healthy young male (chronological age (CA) 1y6mo to 19y) and 108 females (CA range 4y to 19y) were enrolled. 9 bones of the wrist and hand have been analyzed at different stages of the skeletal maturation detecting different pattern of growth among tubular and carpal bones based on several anatomic features of the cartilaginous and osseous component. Two operators first in consensus and after 6 months blinded from CA established a MRI scoring system. Correlation between CA and MRI bone age estimation was determined with Pearson coefficient (R^2). Spearman's correlation coefficient (r) was used to analyze each carpal and tubular bones stages development.

RESULTS

A significant linear correlation (R^2) between MRI bone age estimation and CA was demonstrated in males ($R^2 = 0.976$, A operators in consensus, $R^2 = 0.978$ B first operator in the double-blind, $R^2 = 0.977$ C second operator in double-blind) and females ($R^2 = 0.9694$, operators in consensus, $R^2 = 0.9751$ B first operator double-blind, $R^2 = 0.9710$ C second operator in double-blind). Radius and Ulna showed a stronger correlation with the skeletal age in both males and (Radius $r = 0.96$; Ulna $r = 0.963$, $p = < 0.0001$) females (Radius $r = 0.975$, Ulna $r = 0.963720$ $p < 0.05000$). A good linear correlation was observed (males $R^2 = 0.96$; females $R^2 = 0.9472$) between the sum of scoring system assigned for each subject and the CA in years. The growth curve resulting from the correlation

between CA and SA shows in males 2 peaks than 3 observed in females and related to the growth spurt in the pubertal age following by phases of deceleration.

CONCLUSION

The score system for MRI bone age estimation can be potentially used as a clinical tool to evaluate skeletal development. Males and females have patterns of maturation corresponding to a different clinical speed of growth. The MRI score system shows specific anatomical details characterizing the pubertal age when between the sexes there is a gap of about 2 years.

CLINICAL RELEVANCE/APPLICATION

Bone age estimation is performed in pediatric patients with growth failure and advanced or delayed puberty maturation mainly covering the clinical areas of endocrine, skeletal and metabolic diseases.

RC213-07 Pediatric Elbow MR

Monday, Nov. 30 9:40AM - 10:00AM Location: N230

Participants

John D. MacKenzie, MD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

1) Review developmental anatomy of the pediatric elbow as depicted by MRI. 2) Review technical imaging considerations when imaging the pediatric elbow with MRI. 3) Review unique lesions that occur at the pediatric elbow as depicted by MRI.

ABSTRACT

MRI presents an unique view into the detection and characterization of pediatric elbow pathology. Developmental changes at the pediatric elbow have a characteristic and predictable anatomy and it is important for the radiologist to understand the normal developmental appearance and separate this from pathology. Technical imaging considerations for high resolution MRI will be reviewed. Common pathologies unique to the pediatric elbow will be discussed and placed into context with their appearance on MRI.

RC213-08 Imaging of Slipped Capital Femoral Epiphysis: From Early Diagnosis to Late Sequelae

Monday, Nov. 30 10:20AM - 10:40AM Location: N230

Participants

Delma Y. Jarrett, MD, Boston, MA, (delma.jarrett@childrens.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize imaging findings of SCFE using radiographs, MR, CT, and US. 2) Understand surgical management and normal post-operative appearance of SCFE. 3) Recognize imaging findings of immediate and delayed post-operative complications of SCFE.

RC213-09 Absence of Rickets in Infants with Fatal Abusive Head Trauma and Classic Metaphyseal Lesions

Monday, Nov. 30 10:40AM - 10:50AM Location: N230

Participants

Jeannette M. Perez-Rossello, MD, Boston, MA (*Presenter*) Nothing to Disclose

Anna McDonald, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Andrew E. Rosenberg, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose

Andy Tsai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Paul K. Kleinman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if rickets is present in infant homicides with classic metaphyseal lesions (CMLs) and other skeletal injuries.

METHOD AND MATERIALS

This study was exempt from the institutional human subjects board review because the infants were all deceased. An archival review (1984-2012) was performed of the radiologic and histopathologic findings of 46 consecutive infant fatalities referred from the state Medical Examiner's Office for the evaluation of possible child abuse. Thirty infants with distal femoral histologic material were identified. Additional inclusion criteria were: 1) The medical examiner determined that the infant had sustained a head injury and that the manner of death was a homicide; 2) At least one CML was evident on skeletal survey; 3) CMLs were confirmed at autopsy; and 4) Non-CML fractures were also present. Nine infants (mean age 3.9 months, range: 1-9 months) were identified. Two pediatric radiologists independently reviewed the skeletal surveys for rachitic changes at the wrists and knees. A bone and soft tissue pathologist reviewed the distal femoral histologic sections for rickets.

RESULTS

There were no radiographic or pathologic features of rickets in the cohort.

CONCLUSION

Our findings provide no support for the view that the CML is due to rickets. Rather, they strengthen a robust literature that states that the CML is a traumatic injury commonly encountered in physically abused infants.

CLINICAL RELEVANCE/APPLICATION

This work confirms the traditional view that the classic metaphyseal lesion is a fracture encountered in abused infants rather than a manifestation of rickets. The classic metaphyseal lesion is a characteristic fracture in child abuse and should be reported as such.

RC213-10 Can Coronal STIR be Used as Screening for Acute Non-traumatic Hip Pain in Children?

Participants

Monica M. Forbes-Amrhein, MD, PhD, Zionsville, IN (*Presenter*) Nothing to Disclose

Matthew R. Wanner, MD, Zionsville, IN (*Abstract Co-Author*) Nothing to Disclose

Trenton D. Roth, MD, Indianapolis, IN (*Abstract Co-Author*) Institutional research support, Siemens AG; Institutional research support, Koninklijke Philips NV

Megan B. Marine, MD, Carmel, IN (*Abstract Co-Author*) Nothing to Disclose

Boaz Karmazyn, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate if coronal STIR can be used as a screening test for acute non-traumatic hip pain in children

METHOD AND MATERIALS

A 4 year (2008-2012) retrospective analysis was performed of pediatric (age < 18 years) pelvic MRI studies. Only patients with the following indications were accepted; acute hip pain, limping, or refusal to bear weight. Exclusion criteria included known trauma, known pelvic pathology, and follow-up studies. Each study was anonymized. The coronal STIR series and later the full MRI studies, including all series, were reviewed in a randomized order independently by a pediatric radiologist (rad1) and a musculoskeletal radiologist (rad2). The full MRI study was considered the gold standard. Analysis of the interobserver variability on the negative and positive studies of the STIR only series was reported using Kappa statistics, and overall percentage agreement.

RESULTS

A total of 127 studies were included. 103 (83%) studies were positive by both radiologists. The most common pathologies that were identified by rad1 and rad2 were: hip effusion (63% and 57%), osteomyelitis (58% and 59%) and myositis (37% and 38%). 46% and 54% patients had more than one pathology. Using the full MR as the gold standard, the STIR-only series yields a sensitivity and specificity of 94% and 83% (rad1) and 94% and 67% (rad2). In 42% and 54% of the 97 true positive STIR-only studies, inconsistencies were found on the full MR scans, the most common of which were missed osteomyelitis (20% and 21% by rad1 and rad2) and myositis (7% and 13% by rad1 and rad2). The readers agreed on 111 (87.4%) coronal STIRs (95 abnormal; 16 normal), Kappa statistic is moderate, 0.59.

CONCLUSION

Coronal STIR of the pelvis has high sensitivity (94%) with good interobserver agreement in detecting pathology in children with acute hip pain. However, the study should be supervised by a radiologist and, when positive, a full MR study should be performed as it may change findings in 42% to 54% of cases.

CLINICAL RELEVANCE/APPLICATION

Coronal STIR MR can be used as a screening for evaluation of acute non traumatic hip pain in children. However, when positive, a full MR study should be performed as it can alter the findings in about half of the cases.

RC213-11 Utility of Post Intervention Hip Spica MRI, Retrospective Evaluation of Experience at a Large Children's Hospital

Monday, Nov. 30 11:00AM - 11:10AM Location: N230

Participants

Siddharth P. Jadhav, MD, Houston, TX (*Presenter*) Nothing to Disclose

Farahnaz Golriz, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

Wei Zhang, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

Vinitha Shenava, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

J. H. Kan, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The objective of this study is to evaluate utility of post intervention hip spica MRI and to determine if there are pre-intervention predictors of failed reduction and need for reintervention. We also evaluate rates of reintervention after closed and open reduction.

METHOD AND MATERIALS

All patients who had hip spica MRI at our institution from 2008 to 2014 were retrospectively identified. This included 42 hips in 29 patients. Data was retrospectively reviewed including age at intervention, acetabular angle, degree of lateral and superoinferior displacement of the femoral head, intervention performed, MRI findings and need for reintervention. Wilcoxon scores were calculated and Wilcoxon two sample tests were performed to find correlation between age, acetabular angle, degree of lateral displacement and degree of superoinferior displacement and the need for re-intervention

RESULTS

Mean age at time of intervention was 20.1 months (range 4.7 to 63.8). Mean acetabular angle was 37.5 degrees (range 20-52). Mean lateral displacement was 11.2 mm (range 3-20mm) and mean superoinferior displacement was 5.7 mm (range 0-19mm). There was no correlation between age (P value=0.12), acetabular angle (P value=0.46), degree of lateral displacement (P value=0.82) and degree of superoinferior displacement (P value=0.54) and the need for re-intervention. Out of 19 hips that underwent closed reduction, 8 (42%) needed reintervention. Out of 23 hips that underwent open reduction, 1 (4%) needed reintervention but this could have been determined on the fluoroscopic images alone. Variables leading to a 42% rate of re-intervention in children who undergo closed reduction may be operator dependent or be related to extra-articular causes such as femoral version and biomechanical muscle imbalance.

CONCLUSION

Hip spica MRI is useful in determining need for reintervention after closed hip reduction. Value of MRI after open reduction is not clear since only 1 patient (4%) in our study needed reintervention after open reduction. This needs further evaluation. There is no correlation between age and pre-intervention imaging findings and the need for reintervention.

CLINICAL RELEVANCE/APPLICATION

Post intervention hip spica MRI is useful in determining need for reintervention after closed hip reduction but its role after open reduction is questionable.

RC213-12 Isolated Posteromedial Subtalar Coalitions: Incidence and Associated Morphologic Alterations of the Sustentaculum Tali

Monday, Nov. 30 11:10AM - 11:20AM Location: N230

Participants

Sarah D. Bixby, MD, Boston, MA (*Presenter*) Nothing to Disclose
Delma Y. Jarrett, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Patrick Johnston, MSc, Cambridge, MA (*Abstract Co-Author*) Employee, Ora, Inc
Susan Mahan, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul K. Kleinman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the prevalence and morphologic alterations of subtalar coalitions which lie entirely posterior to the middle facet (MF), AKA "posteromedial subtalar (PMST) coalition."

METHOD AND MATERIALS

After obtaining IRB approval, radiology records from 2004-2012 were reviewed to identify CT studies of patients with confirmed subtalar coalition. 97 subjects (48 male, 49 female, mean age 13.73 years) with subtalar coalition were identified. Electronic medical records were reviewed and symptoms of foot or ankle pain were confirmed in all subjects. In 41 (42%) subjects the coalition was bilateral. CT images of 138 subtalar coalitions were reviewed to determine site of coalition. In those patients with isolated PMST coalitions, multiplanar reformatted images along the long axis of the sustentaculum tali (ST) were generated, from which the antero-posterior dimensions of the ST and MF were measured. A posterior sustentaculum (PS) measurement was then calculated defining the posterior extension of the ST beyond the middle facet ($PS = ST - MF$). Ratios of the MF to the PS measurements were calculated. 33 patients undergoing CT for triplane ankle fracture (21 male, 12 female, mean age 13.70 years) served as controls. Measurement were performed independently by two readers, and intra- and inter-reader reliability was estimated via a component of variance model.

RESULTS

97 of the 138 coalitions (70.2%) affected the MF and 2 (1.4%) involved the posterior facet. There were 39 (28.2%) isolated PMST coalitions identified in 33 patients (18 male, 15 female, mean age 14.07 years). The mean AP measurement of the MF and PS in the patients with PMST coalition were 12.70 mm and 15.90 mm, respectively, compared to 16.50 mm and 6.36 mm in the control population ($p < 0.001$). The ratio of the MF to PS was 0.80 for PMST coalition patients versus 2.6 for controls ($p < 0.001$).

CONCLUSION

In our cohort, 1/4 of all subtalar coalitions were of the PMST variety associated with an intact, but significantly shorter MF, and longer ST. This observation may aid in accurate diagnosis and provide insights into the morphogenesis of this relatively common disorder

CLINICAL RELEVANCE/APPLICATION

The presence of a "normal" middle facet at imaging may lead to missed isolated PMST coalitions; the morphology of the ST and MF provide helpful imaging clues to the diagnosis.

RC213-13 A Retrospective Study to Evaluate the Effect Recent Changes to NICE Guidelines Will Have on Imaging of the Paediatric Cervical Spine in Blunt Trauma in the UK

Monday, Nov. 30 11:20AM - 11:30AM Location: N230

Participants

Joseph Davies, MBBS, MRCS, London, United Kingdom (*Presenter*) Nothing to Disclose
Sammy Anwuzia, BSc, MSc, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Jane Evanson, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Susan Cross, MBChB, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Paediatric cervical spine (c-spine) injury is a rare but devastating event. Imaging, particularly Computed Tomography (CT) is the investigation of choice to exclude injury. CT is however associated with increased thyroid radiation dose and risk of developing malignancy vs plain radiographs. Insufficient paediatric c-spine trauma data exists to produce robust imaging guidelines. There have been recent changes to NICE UK guidelines relating to evaluation of paediatric (<10 years) c-spine injury in trauma. We set out to investigate effects these changes have on the use of Computed Tomography (CT) in the investigation of c-spine injury

METHOD AND MATERIALS

5 year retrospective study of c-spine imaging in patients <10 years presenting to a level 1 trauma centre following blunt trauma. Data was collected relating to trauma mechanism, clinical presentation, radiologic evaluations and injury type. Patients with incomplete data were excluded. Criteria for c-spine CT in NICE head injury guideline 56 (CG 56) (GCS <8, inadequate plain radiographs, strong suspicion despite normal plain radiographs) and NICE head injury guideline 176 (CG176) (GCS <13, intubated, focal neurology, polytrauma, suspicion despite normal radiographs) were retrospectively applied to all cases with complete data to determine the proportion of patients requiring c-spine evaluation with CT.

RESULTS

278 patients underwent c-spine imaging and 217 had complete data. 80 patients met the criteria for a CT of the c-spine under CG 56, 4 of which had a significant c-spine injury. 1 patient with c-spine injury and a presenting GCS of 14 did not meet CG 56. 206 patients met the criteria for a CT under CG 176, 5 of which had a significant injury. Overall, there was one patient who presented

with significant c-spine injury who did not meet CG 56 guidelines, but falls under CG 176 criteria.

CONCLUSION

CG 176 is more inclusive and if followed will result in higher proportion of paediatric blunt trauma cases being eligible for a c-spine CT without an initial plain radiograph series. Increased paediatric thyroid radiation exposure will result.

CLINICAL RELEVANCE/APPLICATION

New guidelines are more sensitive for selecting c-spine injury, specificity is lower and results in potentially unnecessary thyroid irradiation. Further study is required to develop more robust paediatric trauma imaging guidelines.

RC213-14 Three-Point Dixon Technique for Fat Quantification and for Identifying Wasting Progression Rate of Pelvic and Thigh Muscles in Duchenne Muscular Dystrophy

Monday, Nov. 30 11:30AM - 11:40AM Location: N230

Participants

Jing Du, MD, Beijing, China (*Presenter*) Nothing to Disclose
Jiangxi Xiao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoying Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ying Zhu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Fei Y. Li, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Three-point Dixon technique was applied to quantify fat fraction (FF) and identify the annual rate of disease progression of leg muscles in Duchenne muscular dystrophy (DMD).

METHOD AND MATERIALS

This prospective study was approved by the Ethical Committee. Ninety boys with genetically and/or pathologically confirmed DMD were recruited. Imaging was performed with a 3-T unit by using a 32 channel phased-array coil. A quantitative water-fat separation method (IDEAL-Quant) was used. Imaging parameters were as follows: TR=6.3ms, TE=1ms, 6 echoes, bandwidth=111.11 kHz, FOV=32-40cm, slice thickness=7mm, matrix=160x160, flip angle= 3°, covering from the iliac crest to the knee, total imaging time=1min3sec. Images were processed on ADW4.6 workstation and FF of each muscle was calculated. The region of interest (ROI) was manually placed by tracing the outline of the individual muscle on the section level of the muscle belly. 18 muscles on each side were analyzed. Spearman correlation test was used to evaluate the correlation between age and FF. Linear correlation was used to show the relationship between age and FF.

RESULTS

90 DMD boys aged 2-13 (mean 5.8 years) were enrolled. The gluteus maximus was the most severely infiltrated (mean FF 28.82%±19.96%), followed by the adductor magnus (mean FF 23.13%±22.47%). The least affected muscle was the obturator externus (mean FF 3.67%±1.13%). Positive correlation was obtained between FF value and age for all the muscles with correlation coefficient varied from 0.28 to 0.76. Significant correlation was seen in the gluteus maximus muscle ($r=0.68$), adductor magnus ($r=0.74$), and the quadratus femoris ($r=0.74\sim0.76$). The muscle wasting progression can be calculated as $(A + B \cdot \text{age})$. A stands for a constant and B stands for annual progression rate varied from 0.3% to 6.1% for different muscles.

CONCLUSION

IDEAL-Quant method can be used to quantitatively assess leg muscle fatty infiltration and identify muscle wasting progression in DMD patients.

CLINICAL RELEVANCE/APPLICATION

IDEAL-Quant method can be used to quantitatively assess leg muscle fat infiltration in DMD. This method should be used to monitor disease severity and follow-up.

RC213-15 Sports Injuries of the Pediatric Knee

Monday, Nov. 30 11:40AM - 12:00PM Location: N230

Participants

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

Neuroradiology Series: Spine

Monday, Nov. 30 8:30AM - 12:00PM Location: N228



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

FDA Discussions may include off-label uses.

Participants

Michael N. Brant-Zawadzki, MD, Newport Beach, CA (*Moderator*) Nothing to Disclose
Gordon K. Sze, MD, New Haven, CT (*Moderator*) Investigator, Remedy Pharmaceuticals, Inc

Sub-Events**RC205-01 Rational Imaging of the Patient with Spine Pain**

Monday, Nov. 30 8:30AM - 9:00AM Location: N228

Participants

Timothy P. Maus, MD, Rochester, MN (*Presenter*) Institutional research contract, Sorrento Therapeutics, Inc

LEARNING OBJECTIVES

1) The learner will be able to identify the major specificity fault of spine imaging . 2) The learner will be able to describe the major sensitivity fault of spine imaging. 3) The learner will be able to describe the utility of spine imaging in the acute presentation of back or limb pain. 4) The learner will be able to describe appropriate utilization of spine imaging in the back / limb pain patient based on guidelines published by major specialty societies.

ABSTRACT

Abstract Spine imaging rightfully has a pivotal role in the evaluation of the patient with back or limb pain, primarily in the exclusion of systemic disease as a cause of symptoms. Unfortunately, imaging is frequently over utilized, providing no measurable benefit to the patient while incurring significant societal cost and potential patient harm. It is imperative to examine the literature to understand the appropriate interpretation, value to the patient, and evidence-based utilization of spine imaging. Systemic disease underlies only 5% of back or limb pain presentations; most imaging findings are categorized as "degenerative." This constitutes the primary specificity fault of spine imaging: the vast majority of reported "degenerative" changes involving the spinal articulations, the disc and facet joints, are asymptomatic and reflect only expected age-related change. They are not a degenerative disease; labeling them as such is misleading. Spine imaging also suffers a sensitivity fault: most advanced imaging is done in a recumbent position, without axial load and physiologic posture. This renders imaging insensitive to dynamic structural alterations present only in the upright patient. Reliance on anatomic structural changes alone must ultimately yield to imaging identification of the local inflammatory processes that are necessary for spine nociception. Utilization of spine imaging must occur as a risk / benefit calculation. The benefits of diagnosis of systemic disease, or guiding therapeutic intervention for truly symptomatic structural/inflammatory changes, must be weighed against the harms of inappropriately labeling the patient as suffering from a degenerative disease, radiation exposure, patient / societal cost, and the precipitation of interventions that are often poorly based on evidence. Evidence-based guidelines for imaging utilization, in combination with an evidence-based understanding of its interpretation, can help physicians employ this powerful tool more effectively and efficiently.

RC205-02 Ossification of the Posterior Longitudinal Ligament: Sex Difference and Prevalence on Computed Tomography (CT)

Monday, Nov. 30 9:00AM - 9:10AM Location: N228

Participants

Kamyar Sartip, MD, Washington, DC (*Presenter*) Nothing to Disclose
Sanmeet Singh, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Tuo Dong, BS, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Alexandra M. Millet, BS, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Motahar Basam, BA, Silver Spring, MD (*Abstract Co-Author*) Nothing to Disclose
Bonnie C. Davis, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Han Y. Kim, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Andre J. Duerinckx, MD, PhD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We report the prevalence of ossification of the posterior longitudinal ligament (OPLL) in the cervical spine on computed tomography (CT) in the North American population using the original and newer classification systems proposed by the Japanese Ministry of Public Health and Welfare (JMPHW).

METHOD AND MATERIALS

We retrospectively reviewed CT examinations of the cervical spine in adult patients performed from January 1st, 2009 through March 31st, 2010 at our institution. OPLL type, prevalence, and thickness were recorded. The OPLL types as described in the original JMPHW classification scheme were: continuous, segmental, mixed, and circumscribed. The CT classification comprised of two schemes: A or axial. Classification A described OPLL as bridging or nonbridging. In the axial classification, the location of the OPLL at the level of maximal stenosis on axial imaging was characterized as central or lateral.

RESULTS

We reviewed CT scans on 837 patients, 555 males (66%), with average age of 44.1 years (ranged from 18 to 100 yrs). We

detected 39 OPLL lesions in these 837 patients (4.7%). The OPLL types based on the original classification were 28 segmental, 8 circumscribed, 2 mixed, and 1 continuous. According to classification A, 31 were nonbridge (79%). According to the axial classification, 34 were central (87%). Of the 28 patients with segmental OPLL, 20 (71%) were male. Of the 8 circumscribed OPLL, only 5 (63%) were male. The two patients with mixed type were female.

CONCLUSION

We found the prevalence of OPLL to be 4.7% which is higher than previously reported. Additionally, although prevalence among males was higher than females, we discovered that in the cervical spine that this sex difference is not uniform and depends on type of OPLL.

CLINICAL RELEVANCE/APPLICATION

Ossification of the posterior longitudinal ligament is a well-known cause of spinal stenosis and neurologic dysfunction. The reported prevalence of OPLL based on radiography ranges between 0.1-1.7% in Europe and US, 0.4-3% in Asia excluding Japan, and 1.9-4.3% in Japan. However, we found the prevalence of OPLL to be much higher than previously reported. Given the wide spread use of CT in today's clinical practice, radiologists will identify incidental OPLL in asymptomatic patients. We believe recognition of OPLL and knowledge of its natural history will be important for guiding patient management.

RC205-03 CT Findings Predict Clinical Outcome after Dynamic Posterior Stabilization in Patients with Painful Segmental Instability of the Lower Spine

Monday, Nov. 30 9:10AM - 9:20AM Location: N228

Participants

Benedikt J. Schwaiger, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Alexandra S. Gersing, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Michael Behr, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Claus Zimmer, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose
Florian Ringel, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Jan S. Bauer, MD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Although clinical results after dynamic posterior stabilization in patients with painful degenerative segmental instability of the lower spine are promising, few is known about preoperative CT imaging parameters to select patients who will benefit from this procedure. Purpose therefore was to identify CT findings that predict post-surgical outcome.

METHOD AND MATERIALS

63 patients (age 66±11.7; 38 women) treated with dynamic stabilization for painful segmental instability with/without spinal stenosis were identified. Preoperative MDCT scans were assessed for quantitative and qualitative parameters defining degenerative changes of the thoracolumbar spine. BMD measurements were performed in asynchronously calibrated MDCT. For clinical follow-up at 24 months, visual analogue scale (VAS), Oswestry Disability Index (ODI), Short Form 36 physical (PCS) and mental (MCS) component summaries were assessed. For statistical analysis classification and regression trees, linear regression and non-parametrical tests were used.

RESULTS

At follow-up, all clinical scores showed significant improvement compared to preoperative values (delta VAS 4.1±2.9, delta ODI 32.1±17.2, delta PCS 4.9±2.3 and delta MCS 4.2±1.7; P<0.001, respectively). PCS improvement was significantly decreased in patients with higher grades of disc herniation (P<0.001) and spondylolisthesis (P=0.011) as well as with larger cross-sectional area (CSA) of the dural tube at disc level (P=0.043). PCS improvement was significantly higher in patients with high intervertebral disc height (P=0.006) and high grades of vertebral body sclerosis (P=0.002). Patients with high BMD and initially low AP diameter of intervertebral foramina showed a significantly higher improvement of ODI (P<0.05).

CONCLUSION

In patients treated with dynamic posterior stabilization, postoperative clinical improvement was predicted by the following CT parameters: high grades of vertebral body sclerosis, spondylolisthesis or disc herniation, high BMD and disc space height, larger CSA of the dural tube and AP diameter of intervertebral foramina. Preoperative evaluation of these CT parameters therefore may improve therapy selection for patients with degenerative disease of the lower spine.

CLINICAL RELEVANCE/APPLICATION

The identified CT parameters predict post-surgical outcome and therefore support appropriate therapy selection for patients with painful degenerative segmental instability of the lower spine.

RC205-04 Accuracy and Efficacy of Fluoroscopic guided Pars Interarticularis Injections on Immediate and Short-Term Pain Relief

Monday, Nov. 30 9:20AM - 9:30AM Location: N228

Participants

Lloyd M. Kershen, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Nicholas C. Nacey, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
James Patrie, MS, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Michael G. Fox, MD, Charlottesville, VA (*Presenter*) Stockholder, Pfizer Inc;

PURPOSE

To determine the accuracy and short-term efficacy of fluoroscopic guided steroid and anesthetic injections for symptomatic pars interarticularis (pars) defects.

METHOD AND MATERIALS

Following IRB approval. all fluoroscopically guided injections of symptomatic pars defects at a single institution from June 2010 to

October 2014 were retrospectively and independently reviewed by two MSK radiologists with 2 and 13 years of post-fellowship experience to determine if the injections from a single procedure were all intra-pars (n=48), all peri-pars (n=3), or partially intra-pars (n=6). The patient's pain score graded on a 0-10 numeric pain scale was recorded pre-injection, 5-10 minutes and 1 week post-injection. Age, gender, pre-pain level and fluoroscopic times were recorded. Univariate and multivariate statistical analysis were performed.

RESULTS

A total of 57 procedures (106 pars injections) were performed on 41 patients (mean age 37; 21M,20F). Exact agreement between the 2 readers was present in 86% (49/57) of the procedures with a consensus intra-pars location recorded in 91.5% (97/106) of injections. The mean pre-injection and 5-10 minute post-injection pain scores for the all intra-pars procedures was 5.9 and 2.9, respectively with a mean change in pain of -3.0 (95% CI -3.8, -2.2; p<0.001). For the all intra-pars procedures with a 1-week post-injection pain score recorded (n=18 pts; 34 pars), the mean 1-week post-injection change in pain was -0.8 (95% CI -1.8, 0.2; p=0.10). The mean pre-injection and 5-10 minute post-injection pain scores for the 9 peri-pars/partially-in procedures were 6.1 and 3.4, respectively with a mean change in pain of -2.7 (95% CI -4.5, -0.9; p<0.004). When accounting for radiologist performing the procedure, the mean fluoroscopic time per pars injected was 43 s (CI 37, 50) for the all intra-pars group versus 73 s (CI 52, 103) for the peri-pars injections (p=0.001).

CONCLUSION

Fluoroscopically guided intra-pars injections for symptomatic spondylolysis can be performed accurately in ~90% of cases with minimum fluoroscopic time. There is statistically significant pain reduction immediately following the procedure, with a trend in pain reduction at one week.

CLINICAL RELEVANCE/APPLICATION

Symptomatic pars interarticularis defects can be successfully injected with limited fluoroscopic time in ~90% of cases with significant immediate pain relief, obviating the need for CT to perform these injections

RC205-05 Acute Myelopathy Following Epidural and Spinal Anesthesia

Monday, Nov. 30 9:30AM - 9:40AM Location: N228

Participants

Ruth Eliahou, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Alexander Losus, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Eliel Ben-David, MD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
John M. Gomori, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, Medymatch Technology Ltd
Asaf Honig, MD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Spinal and epidural anesthesia (E-SA) are widely used and generally considered as safe procedures. However, rarely, myelopathy may develop acutely and may result in permanent neurological sequela. This study suggests three different mechanisms of post-procedure myelopathy including direct cord injury, toxic/allergic myeloradiculitis and cord ischemia.

METHOD AND MATERIALS

Over 300 medical files of an acute myelopathy were reviewed. Patients presenting acute myelopathies appearing within 24 hours after E-SA were included.

RESULTS

12 patients (mean age 44.7, range 25-74 years) presenting progressive spinal motor, sensory and autonomic dysfunction within 3-24 hours following E-SA met inclusion criteria. 4/12 women (ages 25-30 years) manifested acute myeloradiculitis. MRI showed cord and cauda equina nerve root enhancement and T2 hyperintense cord lesions, suggesting toxic/allergic reaction. 7/12 patients (32-71 years) presented Brown-Sequard-like symptoms with detrusor instability in conus medullaris injuries (6 patients) or tetraparesis in cervical cord injury (1 patient). Most cases showed unilateral cord injury. MRI showed focal blood products on SWI and cord edema at the site of injection. Follow up MRI showed decreased edema with syrinxomyelia as a late sequela in all cases, consistent with direct traumatic damage to the spinal cord. One 74 year old patient developed restricted diffusion on DWI-MRI and central grey matter T2 signal cord abnormality, suggesting local hypoperfusion and cord ischemia.

CONCLUSION

Acute myelopathy may develop following E-SA due to direct traumatic cord injury, toxic/allergic response or cord ischemia, with possibility of permanent neurological damage. Focal syrinxomyelia as a late sequela is typical. Characteristic MRI findings aid with the diagnosis and management.

CLINICAL RELEVANCE/APPLICATION

Acute myelopathy following spinal and epidural anesthesia is a rare but serious complication with potential for permanent neurological sequelae. SWI and DWI -MRI sequences aid the diagnosis and help characterize the mechanism of injury.

RC205-06 Epidural Steroid Injections for Spinal Stenosis: Helpful or Harmful?

Monday, Nov. 30 9:40AM - 10:10AM Location: N228

Participants

Jeffrey G. Jarvik, MD, MPH, Seattle, WA, (jarvikj@uw.edu) (*Presenter*) Stockholder, PhysioSonics, Inc; Consultant, HealthHelp, LLC; Co-editor, Springer Science+Business Media Deutschland GmbH; Royalties, Springer Science+Business Media Deutschland GmbH; Travel support, General Electric Company; ;

LEARNING OBJECTIVES

1) Review the rationale and design of the Lumbar Epidural Steroid injections for spinal Stenosis (LESS) study. 2) Examine the results of the LESS study. 3) Discuss the limitations of LESS study. 4) Discuss the policy implications of the LESS conclusion: in the

treatment of lumbar spinal stenosis symptoms, epidural steroid injections offered minimal to no benefit compared to epidural injections of lidocaine at six weeks.

ABSTRACT

The Lumbar Epidural Steroid injections for spinal Stenosis (LESS) study was double-blind study comparing epidural steroid injections (ESIs) with lidocaine to lidocaine injections alone. The study included 400 patients with back and leg pain from lumbar spinal stenosis who were randomized to receive either an epidural injection containing lidocaine or an epidural injection containing lidocaine plus a glucocorticoid. Sixteen U.S. centers participated in the study. Compared to injections with local anesthetic alone, injections with glucocorticoids provided these patients with minimal or no additional benefit. The primary outcomes were the Roland-Morris Disability Questionnaire and a leg pain numerical rating scale. Patients who received glucocorticoid reported greater satisfaction with treatment, with 67% of those patients reporting being very satisfied or somewhat satisfied compared to 54% of those who received lidocaine alone reporting the same level of satisfaction with the treatment. There were more adverse events in the patients who received the injections that included glucocorticoid. Furthermore, patients receiving the combination injections were more likely to have low morning serum cortisol levels at 3 weeks and 6 weeks after the injection, suggesting that the corticosteroid may have a broad systemic effect. In conclusion, for the treatment of lumbar spinal stenosis symptoms, ESIs offered minimal to no benefit compared to epidural injections of lidocaine at six weeks.; The small improvement with corticosteroid observed at 3 weeks was due solely to the interlaminar approach and not transforaminal approach injections. There is evidence of sustained systemic effects of the corticosteroid including cortisol suppression that should be considered, particularly in older adults.

RC205-07 Lumbar Disc Nomenclature 2.0: Recommendations of the Combined Task Force

Monday, Nov. 30 10:20AM - 10:50AM Location: N228

Participants

Gordon K. Sze, MD, New Haven, CT (*Presenter*) Investigator, Remedy Pharmaceuticals, Inc

LEARNING OBJECTIVES

1) To understand the scope and nature of the revisions of the lumbar disc nomenclature update, version 2.0. 2) To investigate the rationale for the revisions. 3) To comprehend the most important revisions.

ABSTRACT

'Lumbar disc nomenclature: version 2.0. Recommendations of the combined task forces of NASS, ASSR, and ASNR' is the updated and revised version of the original 'Nomenclature and classification of lumbar disc pathology' and is the product of a multidisciplinary effort over the course of nearly 10 years. The revised document resembles the original in format and language, but provides changes that are consistent with current concepts in radiologic and clinical care. The modifications center on: 1. updating and expanding the text, glossary, and references; 2. revision of the figures; 3. emphasizing the term annular fissure to replace annular tear; 4. refinement of the definitions of acute and chronic disc herniations; 5. revision of the differentiation between disc herniation and bulging disc. Several other minor amendments were also made, such as deleting the section on Reporting and Coding, which was outdated in the original and would become outdated in the current update as soon as it was published.

RC205-08 Assessment of Sensitivity and Radiologic Reporting of Oncologic Epidural Lesions on Body CT: A 12-year Retrospective Review

Monday, Nov. 30 10:50AM - 11:00AM Location: N228

Awards

Trainee Research Prize - Fellow

Participants

Lauren M. Kim, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

Evrin B. Turkbey, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

Ronald M. Summers, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Royalties, iCAD, Inc; Research funded, iCAD, Inc;

PURPOSE

Metastatic epidural spinal cord compression is a debilitating neurological complication which occurs in approximately 5-10% of patients with terminal cancer. Early detection of epidural lesions commonly actuates treatment which can prevent and even reverse this process, thereby substantially improving a patient's quality of life. Given the inherent difficulty of seeing epidural lesions on body CT due to their relatively small size and low contrast from surrounding tissues, we hypothesized that oncologic epidural lesions were being under-reported by radiologists interpreting body CT.

METHOD AND MATERIALS

A search of our institution's radiology information system identified patients who underwent a body CT within 30 days before or after undergoing a spine MRI. A board-certified radiologist then reviewed these CT and MRI examinations and the respective patients' medical records to determine etiology and location of the epidural mass, whether the epidural mass reported on MRI was plainly visible on CT, and whether an epidural mass plainly visible on body CT was reported by the interpreting radiologist.

RESULTS

From 09/01/2001 to 12/31/2013, there were 340 spine MRIs demonstrating at least one epidural mass of oncologic etiology with a body CT performed within 30 days. An epidural mass reported on MRI was plainly evident in 244 (71.7%) of the 340 body CTs. Of these 244 body CTs representing 129 unique patients, 61 CT reports (25.0%) did not mention the presence of an epidural mass, even in some cases wherein an MRI examination preceded and reported its presence (27 of 61 cases; 44.3%). There was no statistically significant correlation with respect to the omission of CT reporting and patient gender, age, primary diagnosis, epidural mass location, reporting radiologist, CT or MR scanner, or preceding MRI diagnosis of an epidural mass (univariate chi-squared analysis; $p < 0.05$).

CONCLUSION

In this retrospective analysis, body CT is 71.7% sensitive in detecting an epidural mass of oncologic etiology which is demonstrable on MRI. Additionally, oncologic epidural masses are commonly (25.0%) unreported on body CT, even in cases where there is preexisting imaging evidence to confirm their presence.

CLINICAL RELEVANCE/APPLICATION

Given the moderate sensitivity of body CT in demonstrating epidural masses, radiologists should incorporate the integrity of the spinal canal into their body CT search pattern for oncologic patients.

RC205-09 Lumbar MR Imaging: Does Epidemiologic Data in Radiology Reports Affect Patient Management and Outcomes in the Primary Care Setting?

Monday, Nov. 30 11:00AM - 11:10AM Location: N228

Participants

Jessica G. Fried, MD, Lebanon, NH (*Presenter*) Nothing to Disclose
Brook I. Martin, MPH, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose
David A. Pastel, MD, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A significant challenge to the appropriate diagnosis and management of low back pain is that lumbar MRI commonly reveals numerous findings that can be considered pathologic, even in asymptomatic individuals. Referring primary care providers may not understand the epidemiologic significance of the findings in the lumbar MRI reports they use to make patient-care decisions, potentially leading to unnecessary specialist referrals and overly aggressive treatment plans.

METHOD AND MATERIALS

A verified epidemiologic statement regarding prevalence rates of common findings in asymptomatic patients was included in all relevant lumbar MRI reports beginning July 01, 2013 at a single academic medical center. Patients referred for lumbar MRI by in-network primary care providers for uncomplicated low-back pain were followed prospectively for one year. Chart-review was utilized to capture health care utilization rates following MRI, including physical therapy referral, narcotic prescription, specialist referral, and spine surgery. A pre-statement-implementation cohort was compared to a post-statement-implementation cohort.

RESULTS

There were 323 patients who met inclusion criteria for the study, with 154 in the pre-statement cohort and 169 in the post-statement cohort. There was no significant difference in baseline demographic characteristics between the two cohorts. After one year of follow-up, there was a trend in decreased referral to spine specialists (53.6% v. 46.0%, $p=0.234$) and lumbar spine surgeries performed (10.9% v. 7.1%, $p=0.290$) when comparing the pre-statement cohort to the post-statement cohort. There were no apparent differences in referral for physical therapy or narcotic prescription rates in the study.

CONCLUSION

While the study is limited by small sample size, the trend in decreased referral to spine specialists by primary care physicians and fewer surgeries performed with the implementation of the statement motivates further investigation into the utility of enhancing imaging reports with epidemiologic information. This simple intervention may have meaningful impact on the management of these patients by referring primary care physicians.

CLINICAL RELEVANCE/APPLICATION

The addition of a simple, verified epidemiologic statement to lumbar MRI reports may impact the medical management of low-back pain in the primary care setting.

RC205-10 Open Surgical Biopsy of Degenerated Discs with Correlation of Associated MRI Modic Changes

Monday, Nov. 30 11:10AM - 11:20AM Location: N228

Participants

Mark Georgy, Escondido, CA (*Presenter*) Nothing to Disclose
Mark Stern, MD, Escondido, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recent publication had suggested evidence of chronic infection of degenerated disc spaces with *Propionibacterium Acnes* (PA) as a cause of chronic back pain that linked to type I Modic changes. Researches had advocated for antibiotic treatment of patients with chronic back pain. This had created extensive debate in the medical community. We are presenting our pilot data as a part of larger NIH prospective study of serial biopsies of degenerative disc spaces during open surgery.

METHOD AND MATERIALS

An IRB approval was obtained to conduct this retrospective study in a multicenter single neurosurgery practice over a 9-month period. Biopsies were obtained from the disc space during open surgery when possible for all patients who underwent surgery for degenerative disc disease. Biopsy materials were sent for gram stain and culture in all cases. Pre operative MRI images were evaluated for the presence of Modic changes.

RESULTS

Complete data were available from 21 lumbar disc surgeries, 10 of them (48%) had a positive culture. 5 levels were positive for PA, one level was positive for *S. Aureus*, one level was positive for *Actinomyces* and three levels were positive for *S. Epidermidis*. There were a total of 7 cases with Modic changes and none of them were positive for PA. Biopsies were collected from 26 cervical cases, and 9 of them (35%) showed a positive biopsy. There were 16 cases with Modic changes that included 6 (37.5%) of the positive cultures. Three of the positive cultures showed no Modic changes. 10 cases with Modic changes had a negative culture

CONCLUSION

Our results concur with the published date of high incidence of PA infection of the degenerated nucleus. However we did not show any constant relationship to Modic changes which could be due to the small sample size. The etiology of Modic changes may be related to factors other than infectious processes. Furthermore, the patho-physiology of the Modic changes in the cervical and lumbar spine could be different. Further evaluation of these results with a larger prospective controlled study is underway.

CLINICAL RELEVANCE/APPLICATION

There may be a high incidence of P Acne infection in the degenerated discs. However, there may not be a constant relationship to Modic changes.

RC205-11 Lumbar Plexus in Patients with Chronic Inflammatory Demyelinating Polyneuropathy: Evaluation with New MR Neurography (3D SHINKEI)

Monday, Nov. 30 11:20AM - 11:30AM Location: N228

Participants

Akio Hiwatashi, MD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Osamu Togao, MD, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Yamashita, MD, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazufumi Kikuchi, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Masami Yoneyama, Tokyo, Japan (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic resonance neurography is useful to evaluate nerves in patients with inflammations, tumors, and trauma. The purpose of this study was to evaluate feasibility of 3D nerve-sheath signal increased with inked rest-tissue rapid acquisition of relaxation enhancement Imaging (3D SHINKEI) in the ganglions and the nerves of lumbar plexus in patients with chronic inflammatory demyelinating polyneuropathy (CIDP).

METHOD AND MATERIALS

This study included 12 patients with CIDP (9 males and 3 females; age range 14-66 year-old; median 34 year) and 13 normal subjects (10 males and 3 females; age range 27-81 year-old; median 53 year). 3D SHINKEI is a turbo spine echo with a diffusion-weighted prepulse called improved motion-sensitized driven equilibrium. The imaging parameters were as follows; TR/TE = 2500/90 ms, FOV = 280 x 280 mm, voxel size = 0.98 x 0.98 x 2.0 mm³, b = 10 s/mm², acquisition time = 5 min 48 s. Regions of interests (ROIs) were placed at the ganglions and nerves from T12 to L5 bilaterally. Signal-to-noise ratio (SNR) and contrast-ratio (CR) were calculated. The size of the ganglions and the nerves was also measured. Statistical analyses were performed with Mann-Whitney U test. P-values less than 0.05 were considered significant.

RESULTS

The size of the ganglions and the nerves was larger in patients with CIDP (6.80 ± 1.90 mm and 5.81 ± 2.72 mm) than in normal subjects (5.22 ± 1.15 mm and 4.25 ± 1.08 mm, P < 0.0001, respectively). SNR of the ganglions and the nerves was larger in patients with CIDP (539.73 ± 789.57 and 519.31 ± 882.72) than in normal subjects (89.85 ± 91.29 and 44.03 ± 55.19, P < 0.0001, respectively). CR of the ganglions and the nerves was larger in patients with CIDP (0.74 ± 0.11 and 0.66 ± 0.16) than in normal subjects (0.72 ± 0.10 and 0.48 ± 0.16, P < 0.05 and P < 0.0001, respectively).

CONCLUSION

With 3D SHINKEI we could obtain high-resolution MR neurography. CIDP could be discriminated from normal subjects on 3D SHINKEI.

CLINICAL RELEVANCE/APPLICATION

With 3D SHINKEI we can evaluate the size and signal intensity of the lumbar plexus and can discriminate patients with CIDP from normal subjects.

RC205-12 Magnetic Resonance Neurography as an Adjunct for Back Pain and Extrapinial Sciatica

Monday, Nov. 30 11:30AM - 12:00PM Location: N228

Participants

John A. Carrino, MD, MPH, New York, NY (*Presenter*) Consultant, BioClinica, Inc; Consultant, Pfizer Inc; Advisory Board, General Electric Company; Advisory Board, Halyard Health, Inc; ;

LEARNING OBJECTIVES

- 1) Apply the critical technical elements for MR Neurography.
- 2) Comprehend the potential role for MR Neurography in spinal imaging.
- 3) Analyze pathologies identified with MR Neurography.

ABSTRACT

Neuromuscular imaging with MR neurography can be challenging technically because of requirements for high spatial resolution sometimes over an extended field of view such as an entire extremity unless the lesion or symptoms are well localized. Thus the concept of a "target zone" is useful to tailor protocols for high resolution portions. The trend is to use 3T MRI because of increased signal to noise ratio (SNR). The use of surface coils combinations may be needed to cover the entire region of interest or to evaluate distal muscles innervated. The availability of 3D isotropic pulse sequences avoids multiple 2D planar acquisitions and facilitates arbitrary reconstruction planes along and orthogonal to the structures of interest. The administration of intravenous contrast material is typically selectively used for mass lesions, post-operative situations or inflammatory conditions although dynamic contrast enhance MRI (DCE-MRI) has the potential to evaluate the vasa nervosum. Novel MRI techniques including diffusion-weighted imaging (DWI) and diffusion tensor imaging (DTI) may have a role in MR Neurography. Whole body MRI (WBMRI) has also been applied for MR Neurography. The general indication for MR Neurography is a suspected peripheral nerve dysfunction and is complementary to electrodiagnostic testing (e.g. electromyography). Broad categories of indications include confirming a diagnosis (e.g. brachial neuritis), elucidating pathoanatomy (e.g. thoracic outlet syndrome), establishing the location of a lesion for (e.g. nerve avulsion for pre-surgical planning), to evaluate unexplained neuromuscular symptoms (e.g. extra-spinal sciatica with a normal lumbar spine MRI) or to exclude a neoplasm (e.g. neurofibroma). MR Neurography can also be an adjunct to spine imaging. MRI findings may be related to nerve, muscle or compressive etiology (tumor, pathoanatomy or predisposing variant). Normal peripheral nerves will often although not invariably show a fascicular appearance on axial images. Contrast enhancement cannot always distinguish different pathoetiologies of neuropathy and is more likely to be abnormal with an inflammatory or neoplastic etiology. Endoneurial fluid increases when nerve is compressed, irritated or injured, leading to nerve image hyperintensity in an MR Neurography image. Acute axonal nerve lesions cause a hyperintense signal on T2-weighted images at and distal to the lesion site

corresponding to Wallerian degeneration. Denervation produces a non-specific muscle edema-like signal alteration. Muscle signal alteration occurs within a few days (as early as 72 hours) of denervation. Muscle atrophy is a late finding likely reflecting disuse. Fatty replacement (retained bulk and contour of muscle with fibers replaced by fat) is associated with neuromuscular etiologies (neurogenic or myogenic) or inflammatory myopathies. The MRI signal changes are reversible when the recovery of motor function occurs as a result of further muscle innervation. Tumor related neuropathy may be caused by a primary nerve neoplasm or a lesion compressing or infiltrating the nerve. Peripherical nerve sheath tumors (PNST) include neurilemmoma (schwannoma) and neurofibroma. The majority of PNST lesions are benign. Malignant PNST (MPNST) typically occurs in the setting of neurofibromatosis. It may be difficult for MRI to distinguish benign from malignant PNST and currently FDG PET has a role showing increased uptake in malignancies. Larger heterogeneous appearing lesions that have changed over time, either by clinical symptoms or imaging features suggests MPNST. Compressive lesions include non-neoplastic tumors (ganglions, hematoma), benign neoplasms (osteochondromas) or malignant neoplasm (sarcoma) that residing along the course of a nerve or within a fibro-osseous tunnel. Nerve infiltration and invasion may occur from lymphoma or metastatic neoplasm.

Honored Educators

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

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

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

RC218

Have RADS Gone Wild? Remaining Challenges of Standardized Reporting and Data Systems

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



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

Participants

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Evis Sala, MD, PhD - 2013 Honored Educator

Sub-Events

RC218A BI-RADS: Why Bother?

Participants

Carol H. Lee, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the rationale behind the development of BI-RADS. 2) Comprehend the application of BI-RADS in clinical practice. 3) Recognize the contribution of BI-RADS in improving patient outcomes.

RC218B LI-RADS: Pros, Cons and Solutions

Participants

Claude B. Sirlin, MD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;

LEARNING OBJECTIVES

1) To review the advantages, challenges, solutions, and future directions for standardized reporting of liver imaging examinations using LI-RADS.

RC218C PI-RADS: What Is the Supporting Evidence?

Participants

Hebert Alberto Vargas, MD, New York, NY, (vargasah@mskcc.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the rationale for PI-RADS. 2) Highlight the updates included in PIRADS v2. 3) Discuss the evidence basis for PI-RADS and present the literature highlighting its strengths and limitations.

ABSTRACT

The Prostate Imaging Reporting and Data System (PIRADS), published in 2012, was one of the first well-orchestrated efforts focused on "integration, reporting and communication of multi-parametric prostate MRI". The guideline was updated in 2015 (PIRADS v2) to address some of the limitations of the original version. This session will cover the highlights of PIRADS v2 and discuss the published evidence supporting or questioning the recommendations included in this guideline.

RC250

Interventional Stroke Treatment: Practical Techniques and Protocols (An Interactive Session)

Monday, Nov. 30 8:30AM - 10:00AM Location: S402AB



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

Participants

Joshua A. Hirsch, MD, Boston, MA (*Moderator*) Shareholder, Intratech Medical Ltd

LEARNING OBJECTIVES

1) Describe the diagnostic evaluation and decision making algorithms leading to urgent endovascular treatment of acute stroke. 2) Review endovascular techniques for the treatment of acute stroke from microcatheter set up to intraarterial thrombolysis to mechanical thrombectomy. 3) Discuss case examples of endovascular treatment including patient selection, technique, and pitfalls.

ABSTRACT

Rapid advances in the evaluation, selection, treatment and management of the acute stroke patient necessitates an ongoing educational event highlighting the newest information, techniques and strategies for obtaining the best outcomes for our patients. In this session, all of these topics will be covered in a practical 'how to' and case based approach which is designed to help the practitioner implement best practices. The course is useful for those performing imaging, treatment or both. Analysis of the latest ongoing trials, devices and techniques will be presented. Endovascular tips and tricks will be discussed, as well as pitfalls in the treatment of these patients.

Sub-Events

RC250A A Birdseye View to the Interventional Approach to Acute Stroke Therapy

Participants

Allan L. Brook, MD, Bronx, NY (*Presenter*) Advisor, Johnson & Johnson Advisor, Medtronic, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

RC250B Data, Data, and More Data: Endovascular Therapy Is the Proven Treatment for Large Vessel Occlusion

Participants

David J. Fiorella, MD, PhD, Stony Brook, NY (*Presenter*) Institutional research support, Siemens AG; Institutional research support, Sequent Medical, Inc; Research support, MicroVention Inc; Consultant, Medtronic, Inc ; Consultant, Cardinal Health, Inc; Consultant, Penumbra, Inc; Owner, Vascular Simulations LLC; Owner, TDC Technologies; Owner, CVSL; ;

LEARNING OBJECTIVES

View learning objectives under main course title.

RC250C Optimizing Patient Selection with Imaging

Participants

Ramon G. Gonzalez, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the essential ischemic stroke physiology parameters that are essential in selecting patients for endovascular treatment of a large vessel occlusion. 2) Be familiar with the imaging methods that can measure ischemic stroke physiology parameters and their relative accuracy. 3) Use the best available evidence, recognize the optimal imaging approach to select patients with acute ischemic stroke for endovascular treatment.

ABSTRACT

Properly selected patients with acute ischemic stroke caused by large vessel occlusion (LVO) may be effectively and safely treated endovascularly with modern thrombectomy devices. We have developed a high-precision imaging tool for selecting such patients. It is an experience and evidence-based clinical triage tool that uses advanced imaging to identify INDIVIDUAL patients most likely to benefit from endovascular stroke therapy. It was based on over a decade of using advanced imaging (CT, CTA, CT perfusion, DWI, MR perfusion) in acute stroke patients and a critical review of the literature and has been validated in clinical trials. The approach focuses on answering the following key questions using modern imaging: 1. Is there a hemorrhage? Noncontrast CT 2. Is there an occlusion of the distal ICA and/or proximal MCA? CTA 3. Is irreversible brain injury below a specific threshold (e.g. <70ml)? DWI Perfusion imaging is not employed unless patients cannot undergo MRI, or they do not meet the criteria for intervention. Investigations to understand the reasons for the unsuitability of perfusion CT to substitute for DWI have revealed theoretical and practical shortcomings of CTP. A major problem is the low signal-to-noise (SNR) ratio of CT perfusion that results in a poor contrast-to-noise (CNR) ratio in severely ischemic brain. In a comparison between DWI and CTP in over 50 consecutive patients with LVA, Schaefer, et al. showed that the mean CNR of DWI was >4 while it was <1 for CTP derived CBF. The poor CNR results in large measurement error: using Bland-Altman analyses it was found that the 95% confidence interval was ~+/- 50 ml for ischemic lesion volume measurements in individual patients. The Cleveland Clinic adopted a nearly identical algorithm and their results were published. They reported that after the new algorithm was adopted, there was a ~50% reduction in mortality and a ~3-fold increase in good outcomes, despite a ~50% decrease in the number of procedures. A recent prospective observational trial at the

MGH using stentriever and this imaging approach demonstrated >50% favorable outcomes (mRS 0-2) that is similar to recent randomized clinical trials. However, only 3 patients were evaluated for every patient that was treated, a screening to treatment ratio that is much lower than in recently published clinical trials.

1. Gonzalez RG, Copen WA, Schaefer PW, Lev MH, Pomerantz SR, Rapalino O, et al. The Massachusetts General Hospital acute stroke imaging algorithm: an experience and evidence based approach. *Journal of neurointerventional surgery*. 2013;5 Suppl 1:i7-12.
2. Wisco D, Uchino K, Saqqur M, Gebel JM, Aoki J, Alam S, et al. Addition of hyperacute MRI A/DAS in patient selection, decreasing the use of endovascular stroke therapy. *Stroke; a journal of cerebral circulation*. 2014;45(2):467-72.
3. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet*. 1986 Feb 8;1(8476):307-10.
4. Schaefer PW, Souza L, Kamalian S, Hirsch JA, Yoo AJ, Kamalian S, Gonzalez RG, Lev MH. Limited reliability of computed tomographic perfusion acute infarct volume measurements compared with diffusion-weighted imaging in anterior circulation stroke. *Stroke*. 2015 Feb;46(2):419-24.

Physics Series: Quantitative Imaging Mini-Course: Image Modality Specific Issues

Monday, Nov. 30 8:30AM - 12:00PM Location: S403B

BQ CT MR NM PHAMA PRA Category 1 Credits™: 3.25
ARRT Category A+ Credits: 3.75**FDA** Discussions may include off-label uses.**Participants**

Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Director*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ; ;
 Edward F. Jackson, PhD, Madison, WI, (efjackson@wisc.edu) (*Moderator*) Nothing to Disclose
 Paul L. Carson, PhD, Ann Arbor, MI (*Moderator*) Research collaboration, General Electric Company; Research collaboration, Light Age, Inc

Sub-Events**RC225-01 Quantitative Imaging for Computed Tomography: Applications and Future Directions**

Monday, Nov. 30 8:30AM - 9:00AM Location: S403B

ParticipantsSamuel G. Armato III, PhD, Chicago, IL, (s-armato@uchicago.edu) (*Presenter*) Nothing to Disclose**LEARNING OBJECTIVES**

1) Describe the role of computed-tomography-based quantitative imaging in the clinical and research settings.

ABSTRACT**RC225-02 Quantification of Vascular Response in Rodent Brown Adipose Tissue Using Spectral CT**

Monday, Nov. 30 9:00AM - 9:10AM Location: S403B

Participants

Xin-Gui Peng, MD, PhD, Nanjing, China (*Presenter*) Nothing to Disclose
 Zhen Zhao, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
 Di Chang, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
 Shenghong Ju, MD, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Brown adipose tissue (BAT) has abundant mitochondrion, uncoupling protein 1 and vascularization to provide sufficient energy compared to white adipose tissue (WAT). Our study is to assess the changes of iodine/water base material concentration in BAT after injecting norepinephrine (NE).

METHOD AND MATERIALS

The animal study was approved by the institutional Committee on Animal Research. Spectral CT scan (GE, Discovery CT750) was performed to measure the iodine/water concentration based on base material mapping in the BAT (interscapular) and WAT (visceral) of Wistar rat (n=6, 14 weeks, 304g±12g) at baseline condition. To induce the blood flow increase, animals were given NE (1µg/kg/min, 10min, total 1ml) or saline (1ml) from caudal vein. The enhanced CT imaging (6ml/kg, iopromide 300) was performed after the injection of the drug. The iodine/water concentration of BAT and WAT, the BAT/Aorta and WAT/Aorta ratio were calculated. Statistical analysis was performed with independent sample t test and paired sample t test.

RESULTS

There was no difference in mean base iodine (water) material concentration of BAT and WAT at the baseline condition between the NE and saline groups (P>0.05). After injecting NE, the base iodine material concentration of BAT increased significantly compared to controls (NE: -5.41±1.20mg/cm³ and 23.57±8.71mg/cm³; saline: -7.66±2.01mg/cm³ and 8.71±3.68mg/cm³, respectively; P<0.001) (Fig.A). However, there were no statistically significant changes observed in iodine and water material concentration of WAT between both groups. The BAT/Aorta ratio, WAT/Aorta ratio of iodine concentration and BAT/Aorta ratio of water concentration after injection NE increased significantly (iodine: BAT/Aorta ratio, 0.26±0.96 and 0.10±0.04, WAT/Aorta ratio, -0.12±0.04 and -0.16±0.03; water: BAT/Aorta ratio:1.06±0.02 and 0.93±0.04, respectively; P<0.001) (Fig.B). There was no difference of WAT/Aorta ratio in water concentration imaging between both groups (P>0.05) (Fig.C).

CONCLUSION

The iodine/water base material concentration detected the pharmacologic activation of BAT. Energy spectrum CT has potential to evaluate the change of BAT and WAT after treatment.

CLINICAL RELEVANCE/APPLICATION

Spectral CT provided a new noninvasive method to be translated to a clinical setting for evaluation the difference of adipose tissue and monitoring the responses to specific therapeutic strategies.

RC225-03 Determinants of the Accuracy of the Quantification of Glandularity and Iodine Uptake in Contrast-Enhanced Digital Mammography

Monday, Nov. 30 9:10AM - 9:20AM Location: S403B

Participants

Kristen C. Lau, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose

Moez K. Aziz, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

Young Joon Kwon, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

Andrew D. Maidment, PhD, Philadelphia, PA (*Abstract Co-Author*) Research support, Hologic, Inc; Research support, Barco nv; Spouse, Employee, Real-Time Radiography, Inc; Spouse, Stockholder, Real-Time Radiography, Inc

PURPOSE

To develop a method for determining breast tissue composition in dual-energy (DE) contrast-enhanced digital mammography (CE-DM). The motivation for this arises from our difficulty to resolve contrast uptake at the boundaries of the breast in DE subtraction.

METHOD AND MATERIALS

Phantoms were constructed using 1 cm thick uniform blocks of 100% glandular-equivalent and 100% adipose-equivalent materials (CIRS, Norfolk, VA). The thickness of the phantoms ranged from 3 to 8 cm, in 1 cm increments. For a given thickness, the glandular/adipose composition of the phantom was varied using different combinations of blocks. The phantoms were imaged using a prototype DE Hologic Selenia Dimensions DBT system. A 0.3 mm copper filter is used for the high-energy (HE) x-rays (49 kVp) and a 0.7 mm aluminum filter is used for the low-energy (LE) x-rays (32 kVp). X-ray energies were chosen so the k-edge of the contrast agent was in the range spanned by the LE and HE x-ray spectra. DE images were obtained by a weighted logarithmic subtraction of the HE and LE image pairs. The images were smoothed using a 2D convolution with a 4x4 matrix prior to quantitative analysis. LE and HE signal intensities were normalized by the mAs, and mean and standard deviation values were calculated for the normalized log HE and log LE images.

RESULTS

The mean LE and HE values varied with phantom thickness and glandularity. The log LE and log HE signals decrease linearly with increasing glandularity for a given thickness. The signals decrease with increasing phantom thickness; for a given glandularity, the x-ray signal decreases linearly with thickness. As the thickness increases, the attenuation difference per additional glandular block decreases, indicating beam hardening. Using these data, we have created a mapping between signal intensity and breast thickness. These data facilitate the subtraction of tissue in the periphery of the breast, and aid in discriminating between contrast agent uptake in glandular tissue and subtraction artifacts.

CONCLUSION

We have shown that breast thickness and composition can be predicted based on signal intensities in DE CE-DM. This has implications for the weighting factor used in DE subtraction.

CLINICAL RELEVANCE/APPLICATION

DE CE-DM can be improved by taking into account breast thickness and composition. Combining these techniques into a single procedure is a powerful tool for the detection and diagnosis of breast cancer.

RC225-04 Mapping of Medullar Adiposity of the Lumbar Spine in MRI

Monday, Nov. 30 9:20AM - 9:30AM Location: S403B

Participants

Nicolas Demany, Brest, France (*Abstract Co-Author*) Nothing to Disclose

Julien Ognard, MD, MSc, Brest, France (*Presenter*) Nothing to Disclose

Jawad Mesrar, Brest, France (*Abstract Co-Author*) Nothing to Disclose

Serge Ludwig Aho-Glele, Dijon, France (*Abstract Co-Author*) Nothing to Disclose

Alain Saraux, Brest, France (*Abstract Co-Author*) Nothing to Disclose

Douraid Ben Salem, MD, PhD, Brest, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The bone medullar adiposity is a marker of bone quality to the point that it should be better to know the factors which influence or not the density and distribution of this fat in the spine, especially at the lumbar level.

METHOD AND MATERIALS

A sagittal sequence IDEAL IQ (MRI GE 1.5T) was performed on the lumbar spine of 46 subjects without bone disease (21 women and 25 men, aged 18 to 77 years old). Medulla adiposity was determined directly from the measurement of the fat fraction of each vertebral body (T12 to S1) obtained on the fat cartography automatically generated by the IDEAL sequence.

RESULTS

Average vertebral fat fraction was 36.48% (DS 12.82 ; 14.69% - 72.8%], increasing with age, and it is higher among men. We observed a craniocaudal gradient of the fat fraction ($B = 1,37$; $p < 0,001$; DS 0,06) increasing with age in the lumbar spine from T12 to L5. Through a multivariate analysis, this gradient was independent of sex, weight and height of subjects.

CONCLUSION

This study shows the existence of a physiological craniocaudal gradient of vertebral medullar adiposity from T12 to L5. This gradient increases with age but it is independent of sex or BMI. The IDEAL sequence allows quick and reproducible measurement of the spine vertebral medullar adiposity.

CLINICAL RELEVANCE/APPLICATION

IDEAL IQ is a Rapid sequence, Allowing easy and reproducible measurements with ROIs. The need is to recruit a wider population to establish standards fat percentage by age strata and compare them with bone mineral density obtained by densitometry. For example, in an attempt to establish thresholds for a subject to be considered as osteopenic or osteoporotic. The IDEAL IQ sequence allows a fast and reproducible measure of the bone marrow fat of the spine, that could easily completing a lumbar MRI assessment

RC225-05 Automatic Quantification of Iodine and Calcium using Monoenergetic Virtual Images Generated by

Spectral Detector Dual-Layer CT: A Phantom Study

Monday, Nov. 30 9:30AM - 9:40AM Location: S403B

Participants

Isaac Leichter, PhD, Jerusalem, Israel (*Presenter*) Nothing to Disclose
Tzvi Lipschuetz, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Tzvi Vichter, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Zimam Romman, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jacob Sosna, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, ActiViews Ltd Research Grant, Koninklijke Philips NV

PURPOSE

To use Monoenergetic Virtual images generated by Spectral Detector Dual-Layer CT (SDCT) for automatic reliable identification and concentration calculation of calcium and iodine solutions.

METHOD AND MATERIALS

Tubes of 11.1 mm diameter filled with iodine and calcium solutions at concentrations of 10 to 60 mg/ml and 100 to 1000 mg/ml, respectively, were inserted in a water-equivalent anthropomorphic CT phantom (QRM, Moehrendorf, Germany). The phantom, of two sizes (25×35 cm and 30×40 cm), was scanned with a SDCT (Philips Healthcare, Cleveland, OH, USA) at 120kVp and 200 mAs. Software was developed to calculate the relationship between gray-level values of pixels containing iodine and calcium solutions in the monoenergetic virtual images generated by SDCT. The relationship obtained for the image of the small phantom was used to create spectral maps that uniquely characterize the material in the pixel, independently of its concentration. For any given image, the software searched and identified pixels which fitted into the spectral map equations of calcium and iodine and displayed them in different colors. In order to evaluate the effect of beam hardening, iodine and calcium was searched in images of both phantom sizes. The concentration of each solution identified by the software was evaluated.

RESULTS

In the small phantom (98.9±1.6)% of the pixels containing iodine or calcium were correctly identified and displayed in different colors. In the large phantom the identification accuracy was (92.7±10.4)%. The calculated solution concentrations in the small phantom were higher by (4.6±2.6)% from the actual concentrations, and lower by (5.7±4.6)% in the large phantom.

CONCLUSION

SDCT can differentiate between calcium and iodine solutions in a phantom model and calculate their concentrations with good accuracy on a pixel by pixel analysis. Beam hardening effects had only a small impact on the results which depended very slightly on the phantom size or the solution location within the phantom.

CLINICAL RELEVANCE/APPLICATION

By the use of Spectral Detector CT, contrast agents in blood and tumors may be reliably differentiated from adjacent skeletal components, and their concentration can be accurately assessed.

Honored Educators

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

Jacob Sosna, MD - 2012 Honored Educator

RC225-06 Quantitative Imaging for PET-CT: Applications and Future Directions

Monday, Nov. 30 9:40AM - 10:10AM Location: S403B

Participants

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

LEARNING OBJECTIVES

1) Describe the role of PET/CT-based quantitative imaging in the clinical and research settings.

RC225-07 Quantitative Imaging for DCE-MRI: Applications and Future Directions

Monday, Nov. 30 10:25AM - 10:55AM Location: S403B

Participants

Yue Cao, PhD, Ann Arbor, MI (*Presenter*) Research Grant, Siemens AG; Speaker, Siemens AG

LEARNING OBJECTIVES

1) Describe the role of quantitative DCE MR imaging in the clinical and research settings.

RC225-08 Measuring Blood Velocity with Doppler-CT (part 1): Theoretical Aspects and Simulations

Monday, Nov. 30 10:55AM - 11:05AM Location: S403B

Participants

Johannes G. Korporaal, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Rainer Raupach, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Thomas G. Flohr, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Bernhard Schmidt, PhD, Forchheim, Germany (*Presenter*) Employee, Siemens AG

PURPOSE

Measuring blood velocity with computed tomography (CT) has been subject of numerous studies, most of which used the time-of-flight technique. With that method, data acquisition should be performed with a stationary table (sequence mode) and the clinical applicability and measurement accuracy are limited by the detector size. The purpose of this study is to introduce Doppler-CT as a new method of measuring blood velocity by describing the theory, simulating its expected behavior and deriving clinical acquisition strategies.

METHOD AND MATERIALS

In general, the speed v [m/s] of a wave with wavelength λ [m] and frequency f [1/s] is given by $v = f \cdot \lambda$. When considering a straight vessel segment and assuming a linear increase in contrast enhancement after injecting an iodinated contrast agent, the blood velocity can be analogously calculated from the spatial [m/HU] and temporal [HU/s] contrast gradients within the vessel. In case the observer O (the scan plane of the CT scanner) and the source S (the human heart) are moving with respect to each other, i.e. during a spiral acquisition, the well-known Doppler-equations can be applied, e.g. $f_O = f_S(1 \pm v/c)$ [eq.1], with f_O being the measured temporal gradient [HU/s] of the spiral scan, f_S the temporal gradient [HU/s] produced by the heart, $\pm v$ the table speed and c the blood velocity. For table velocities of ± 70 cm/s and blood velocities of ± 100 cm/s, f_O was simulated as fraction of f_S , since the relative change in f_O is independent of f_S .

RESULTS

With a known direction of table movement, the direction of the blood flow can be qualitatively determined, since the relative gradient of f_O is centrally symmetric. With increasing table speed and decreasing blood speed, the deviation of f_O from f_S increases, indicating better quantitative measurement accuracy. For equal image noise, low tube voltages and high iodine delivery rates will further improve the measurement sensitivity.

CONCLUSION

High table speed and low blood velocity are favorable for quantifying blood velocity with Doppler-CT. Implementation in clinical routine can be simple, e.g. with two (or more) sweeps of a dynamic scan mode with alternating scan direction (part 2) or with a bolus tracking scan followed by a CT angiography (part 3).

CLINICAL RELEVANCE/APPLICATION

Measuring blood velocity is no longer reserved for wide-detector CT-systems in sequence mode, but can also be performed with CT-systems with smaller detectors in spiral scan mode.

RC225-09 Quantification of Hepatic Tumor Viability in Multi-phase MDCT Images

Monday, Nov. 30 11:05AM - 11:15AM Location: S403B

Participants

Wenli Cai, PhD, Boston, MA (*Presenter*) Nothing to Disclose

Anand K. Singh, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Yin Wu, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Gordon J. Harris, PhD, Boston, MA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc

PURPOSE

The purpose of this study was to develop a quantitative imaging biomarker, denoted as hepatic tumor viability (HTV), for quantification of viable and necrotic tumor volumes in addition to the size of liver and tumors in the assessment of tumor progression and treatment responses for patients with hepatocellular carcinoma (HCC) and metastasis.

METHOD AND MATERIALS

Based on the pattern analysis of time-intensity curve (TIC) in multi-phase MDCT images, we developed the automated HTV scheme for segmentation of liver and liver tumors, and classification of viable and necrotic tumor regions. To depict a TIC pattern, a group of TIC features was extracted including the peak CT value, the time to peak (TTP), the area under the curve (AUC), the AUC of wash-in/out, the max/average wash-in/out derivative, and a group of spatiotemporal textures: skewness, kurtosis, energy, and entropy. A K-mean cluster was applied to classify each voxels into four different types of materials: vessel, normal liver tissue, tumor tissue, and necrotic tissue. Liver, liver tumor and viable regions were segmented using the likelihood to each material. Forty (40) IV-contrast enhanced hepatic multi-phase MDCT cases with biopsy-confirmed HCC or metastases were used for evaluation of the proposed HTV biomarker. The MDCT imaging parameters settings were: 2.5-5 mm collimation, 1.25-2.5 mm reconstruction interval, 175 mA tube current, and 120 kVp tube voltage.

RESULTS

In reference to the liver and tumor segmentation by manual-contouring of two radiologists, the volumetric size of these 40 HCC or metastasis livers ranged from 1079.2 CC to 4652.3 CC, in which the tumor volume percentages ranged from 1.77% to 53.54%. The proposed HTV scheme achieved a liver volumetric difference of $3.27 \pm 2.58\%$ and tumor percentage difference of $1.33 \pm 1.44\%$. Viable tumor volume showed significant better performance than RECIST and total tumor volume in prediction of treatment response in the case of overall and progression-free survival.

CONCLUSION

Our HTV biomarker can achieve accurate and reliable quantification results in segmentation of liver and liver tumors, classification of viable and necrotic tumor regions, and thus provides a better prediction of treatment response.

CLINICAL RELEVANCE/APPLICATION

Our HTV biomarker can provide an accurate and reliable tumor quantification for assessment of tumor progression and treatment response for HCC and liver metastasis.

RC225-10 Fully Automated Quantitative Analysis of Myocardial Perfusion in First-pass MR Images

Monday, Nov. 30 11:15AM - 11:25AM Location: S403B

Participants

Luan Jiang, PhD, Shanghai, China (*Presenter*) Nothing to Disclose
Shan Ling, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jichao Yan, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Qiang Li, PhD, Shanghai, China (*Abstract Co-Author*) Patent agreement, General Electric Company Patent agreement, Hologic, Inc Patent agreement, Riverain Technologies, LLC Patent agreement, MEDIAN Technologies Patent agreement, Mitsubishi Corporation

PURPOSE

We are developing a fully automated scheme for quantitative analysis of myocardial perfusion in short-axis first-pass MR images.

METHOD AND MATERIALS

We obtained 8 short-axis myocardial perfusion MR scans from xxx Hospital in xxx with an xxx 1.5-T MR scanner. Each MR scan has 40 time frames with slice thickness 8 mm and in-plane resolution 1.37 mm × 1.37 mm. Our automated method consists of three steps, i.e., cardiac registration, myocardium segmentation, and empirical indexes quantification. Based on the region of interest (ROI) automatically identified from the image at the reference time phase with better contrast of left ventricle and myocardium, a multiscale affine transformation using Sobel gradient information and a non-rigid Demons registration using pseudo ground truth images were sequentially applied to correct the deformations caused by respiratory and cardiac motion. We then further used fuzzy c-means clustering method in the reference image and dynamic programming method in the maximum intensity projection image of all time phases to delineate, respectively, the endo- and epicardial boundaries of the myocardium. Finally, several empirical perfusion indexes (peak signal intensity, time to peak, and maximum upslope) were quantified from the time-intensity curves of segments of myocardium.

RESULTS

Dice index based on apical, midventricular, and basal slices was improved from 78.4% ± 12.5% to 85.9% ± 5.3% using cardiac registration, and Dice index of 82.2% ± 5.9% was achieved for myocardium segmentation. Subjective judgment showed that the empirical indexes were able to identify the ischemia in myocardium.

CONCLUSION

Our fully automated scheme for quantitative analysis of myocardial perfusion MR images would be useful for myocardium perfusion assessment and early diagnosis of myocardium with ischemia.

CLINICAL RELEVANCE/APPLICATION

Our CAD scheme could help the radiologists to quantitatively analyze myocardium perfusion and to improve the accuracy and efficiency for diagnosis of myocardium with ischemia.

RC225-11 Laws Textures: A Potential MRI Surrogate Marker of Hepatic Fibrosis in a Murine Model

Monday, Nov. 30 11:25AM - 11:35AM Location: S403B

Participants

Baojun Li, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Hei Shun Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hernan Jara, PhD, Belmont, MA (*Abstract Co-Author*) Patent holder, qMRI algorithms Research Grant, General Electric Company Royalties, World Scientific Publishing Co
Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the effect of disease progression on liver parenchymal Laws textures of ex vivo murine liver specimens imaged using 11.7 Tesla MRI. To compare Laws textures to other imaging-based surrogate markers (T2, PD, ADC, and degrees of inflammation).

METHOD AND MATERIALS

This animal study was IACUC approved. Seventeen male, C57BL/6 mice were divided into control (n=2) and experimental groups (n=15). The latter were fed a 3,5-dicarbethoxy-1, 4-dihydrocollidine (DDC) supplemented diet to induce hepatic fibrosis. Ex vivo liver specimens were imaged using an 11.7T MRI scanner, from which the parametric proton density (PD), T2, and ADC maps were generated from spin-echo pulsed field gradient and multi-echo spin-echo acquisitions. The PD maps were first preprocessed to eliminate the low-intensity histogram bias arisen from partial volume effect. The PD maps were further corrected by mean and standard deviation in order to minimize discrimination by overall graylevel variation, which is unrelated to liver parenchymal texture. Laws textures were extracted from the PD maps. Degrees of fibrosis and inflammation were assessed by an experienced pathologist (subjective scores) and digital image analysis (DIA, %Area Fibrosis). Scatterplot graphs comparing Laws texture, T2, PD, ADC, inflammation score to degrees of fibrosis were generated and correlation coefficients were calculated.

RESULTS

Hepatic fibrosis and Laws textures were strongly correlated with higher %Area Fibrosis associated with higher Laws textures (r=0.89, p<0.001). Strong correlation also existed between T2 and Laws textures (r=0.85, p<0.01). Moderate correlations were seen between %Area Fibrosis and PD (r=0.65), ADC (r=0.67), and Subjective Fibrosis Score (r=0.51). The Subjective Inflammation Score was poorly correlated with hepatic fibrosis (r=0.20). Without proposed corrections, there was only a moderate correlation between %Area Fibrosis and Laws textures (r=0.70).

CONCLUSION

Higher degree of hepatic fibrosis is associated with increased liver parenchymal Laws textures. Laws textures may be more accurate than PD, ADC, and subjective fibrosis and inflammation scores in assessing degrees of fibrosis. The proposed corrections are critical.

CLINICAL RELEVANCE/APPLICATION

Laws textures are potentially accurate surrogate marker for diagnosing and staging hepatic fibrosis.

Honored Educators

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

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

RC225-12 Grading of Diffuse Liver Diseases Using Phase-Contrast-Imaging

Monday, Nov. 30 11:35AM - 11:45AM Location: S403B

Participants

Marco Armbruster, Munich, Germany (*Presenter*) Co-Founder of medical software company.
Blaz Zupanc, MA, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Emmanuel Brun, Grenoble, France (*Abstract Co-Author*) Nothing to Disclose
Alberto Mittone, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Wieland H. Sommer, MD, Munich, Germany (*Abstract Co-Author*) Founder, QMedify GmbH
Wolfgang Thasler, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Paola Coan, Grenoble, France (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

X-ray PCI allows grading of diffuse liver diseases, is correlated to histopathology and might be a valuable technique for non-invasive diagnosis and grading of liver fibrosis and steatosis.

Background

Diffuse liver pathologies like steatosis, fibrosis or cirrhosis are an increasing cause of morbidity and mortality worldwide. Liver biopsy is currently the gold standard for the diagnosis and monitoring of disease progression and is essential both for treatment decisions and the prognosis of patients. However, liver biopsy has non-negligible risks, is prone to sampling errors and cannot be used as a screening method. Therefore, the purpose of this study was a proof-of-concept that high resolution X-ray phase contrast imaging (PCI) in computer tomography mode is able to directly visualize pathological changes of the microstructure and that grading of diffuse liver diseases is feasible using PCI-CT.

Evaluation

Synchrotron-based PCI-CT volumetric imaging was performed for human, ex-vivo liver samples from 20 patients (male: 12, female: 8, age: 62±12 yrs). Histopathological workup included hematoxylin-and-eosin-, elastica-van-Gieson-, and iron-staining. For PCI-CT, propagation based imaging technique was used with X-ray of 30 keV and a sample-to-detector distance of 11m. Images were acquired at a spatial resolution of 8 microns. All datasets were graded for the presence of fibrotic changes and the amount of fatty vacuoles. PCI-CT- and histopathological grading of fibrosis and steatosis was correlated using Pearson's correlation-coefficient. Both fatty vacuoles, portal, and septal fibrogenous deposits were identifiable in PCI-CT. Visual grading of fibrosis and steatosis correlated moderately but significantly to the histopathological assessment ($r=0.682$; $p<0.05$ for fibrosis; $r=0.764$; $p<0.05$ for steatosis).

Discussion

In this study we used X-ray PCI for a direct visualization of microstructural changes within the liver tissue of patients suffering from diffuse liver diseases. Detailed grading of fibrosis and steatosis was feasible. Due to the three-dimensionality of PCI datasets this technique has the potential to decrease interobserver variability and sampling errors in the grading of diffuse liver diseases.

RC225-13 Question and Answer

Monday, Nov. 30 11:45AM - 12:00PM Location: S403B

Participants

RCA21

Creating, Storing, and Sharing Teaching Files Using RSNA's MIRC® (Hands-on)

Monday, Nov. 30 8:30AM - 10:00AM Location: S401AB



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

Participants

Krishna Juluru, MD, New York, NY (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how easy it is to install the new and improved RSNA teaching file software with the one-click installer. 2) Learn how to create, organize, and share teaching files, create conference documents and save interesting cases for yourself, your group or your department.

RCB21

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

Monday, Nov. 30 8:30AM - 10:00AM Location: S401CD



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

Participants

C. Matthew Hawkins, MD, Decatur, GA, (matt.hawkins@emory.edu) (*Presenter*) Nothing to Disclose
Safwan Halabi, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Neil U. Lall, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Tirath Y. Patel, MD, Toledo, OH (*Presenter*) Nothing to Disclose
Amy L. Kotsenas, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Appreciate the professional relevance of social media for radiologists. 2) Understand the differences between Facebook pages and personal accounts. 3) Set up and use a Twitter account. 4) Understand the purpose of hashtags, lists, tweetchats, and DMs. 5) Get acquainted with other radiologists and radiology organizations on Twitter. 6) Understand the difference between and utility of professionally oriented social networking sites such as Doximity and LinkedIn. 7) Understand how to safely /securely communicate via social media while maintaining HIPAA requirements.

ABSTRACT

RC221

Medical Physics 2.0: Radiography

Monday, Nov. 30 8:30AM - 10:00AM Location: S404AB

PH

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

Participants

Ehsan Samei, PhD, Durham, NC (*Director*) Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Carestream Health, Inc
Douglas E. Pfeiffer, MS, Boulder, CO (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) To gain an appreciation for the broad developments in radiography technology and operation from film to digital, CR to DR, and the implications. 2) To understand the major challenges to optimized radiography that can be addressed by physics input and expertise.

ABSTRACT

Radiography continues to be the mainstay of medical imaging practice worldwide. The last 30 years have witnessed a number of major technological transitions in radiography, in particular from analogue to digital technologies, and from CR to DR. While these and newer advances have addressed a number of prior shortcomings, they have introduced new challenges. Image post-processing, for example, while praised as an asset of digital operation, has often been underutilized and suboptimal. This lecture aims to provide a historical perspective on these topics and to offer topics that worth the focus of the medical physics community.

Sub-Events

RC221A Radiography Perspective

Participants

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

LEARNING OBJECTIVES

View learning objectives under main course title.

RC221B Radiography 1.0

Participants

A. Kyle Jones, PhD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the testing philosophies, tests, and foci of current quality control programs in radiography. 2) Understand the motivation and basis for these current foci. 3) Investigate the limitations, shortcomings, and relevancy of these current foci in the modern radiography era.

RC221C Radiography 2.0

Participants

Eric L. Gingold, PhD, Philadelphia, PA, (eric.gingold@jefferson.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the likely changes in medical physics services for radiographic systems over the next 5-10 years. 2) Recognize the value of data logging capabilities of modern digital radiographic systems. 3) Understand how to utilize data to identify quality issues and recommend changes that can improve performance in digital radiography. 4) Understand how to employ modern image performance metrics to analyze image quality and assist facilities in optimizing the capabilities of radiographic systems. 5) Utilize modern process control methods to monitor stability.

ABSTRACT

RC214

Interventional Series: Venous Disease

Monday, Nov. 30 8:30AM - 12:00PM Location: S404CD



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



Discussions may include off-label uses.

Participants

Marcelo Guimaraes, Charleston, SC (*Moderator*) Consultant, Cook Group Incorporated ; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated
Wael E. Saad, MBBCh, Ann Arbor, MI (*Moderator*) Research Grant, Siemens AG ; Consultant, Siemens AG; Consultant, Boston Scientific Corporation; Consultant, Medtronic, Inc; Consultant, Getinge AB; Consultant, Merit Medical Systems, Inc;

LEARNING OBJECTIVES

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

ABSTRACT

Sub-Events

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

Monday, Nov. 30 8:30AM - 8:55AM Location: S404CD

Participants

Akhilesh K. Sista, MD, New York, NY, (aks9010@med.cornell.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC214-02 Additional Catheter-Directed Thrombolysis for Proximal Deep Vein Thrombosis: 5 Year Results of a Randomized Controlled Trial (The Cavent Study)

Monday, Nov. 30 8:55AM - 9:05AM Location: S404CD

Participants

Ylva Haig, MD, PhD, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
Ole Jorgen J. Grotta, MD, Oslo, Norway (*Presenter*) Nothing to Disclose
Tone R. Enden, MD, PhD, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
Per M. Sandset, MD, PhD, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
Carl-Erik Slagsvold, MD, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
Gunnar Sandbek, MD, PhD, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
Lars O. Holmen, MD, Krakeroy, Norway (*Abstract Co-Author*) Nothing to Disclose
Geir Hafsahl, MD, Billingstad, Norway (*Abstract Co-Author*) Nothing to Disclose
Nils-Einar Klow, MD, PhD, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To examine whether additional catheter-directed thrombolysis (CDT) had a persistent benefit in reducing post-thrombotic syndrome (PTS), and if CDT increased patency and reduced reflux 5 years following a high proximal deep vein thrombosis (DVT)

METHOD AND MATERIALS

Patients with a first-time objectively verified DVT affecting the upper femoral vein and/or iliac vein were randomized to receive conventional therapy alone or to additional CDT. PTS was assessed using the Villalta scale and the venous system was examined by duplex ultrasound and air plethysmography to define the presence of patency and/or reflux.

CONCLUSION

Follow-up after 5 years showed an additional benefit of CDT in reducing PTS, which supports "the open vein hypothesis" and underpins the importance of early clot removal to prevent PTS.

CLINICAL RELEVANCE/APPLICATION

The results of this first randomized controlled trial to evaluate the effect of additional CDT for deep vein thrombosis supports the use of CDT in selected patients.

RC214-03 When are Advanced Inferior Cava Filter Retrieval Techniques Necessary? An Analysis in 724 Procedures

Monday, Nov. 30 9:05AM - 9:15AM Location: S404CD

Participants

Kush R. Desai, MD, Chicago, IL (*Presenter*) Nothing to Disclose
James L. Laws, BS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Samdeep Mouli, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Jennifer Karp, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Robert K. Ryu, MD, Chicago, IL (*Abstract Co-Author*) Consultant, Cook Group Incorporated Stockholder, EndoVention Inc Consultant, IORAD
Robert J. Lewandowski, MD, Chicago, IL (*Abstract Co-Author*) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

PURPOSE

Retrievable inferior vena cava filters (rIVCF) with prolonged dwell time often cannot be removed with standard techniques. Advanced retrieval techniques, which are increasingly necessary with prolonged rIVCF dwell time, have positively impacted overall retrieval rates. We aim to derive a dwell time at which the use of advanced techniques becomes necessary to achieve retrieval success.

METHOD AND MATERIALS

All rIVCF retrieval procedures from 1/2009-2/2015 were identified from a prospectively acquired database. We assessed patient age/sex, filter dwell time, technical success, fluoroscopy time, adverse events, and advanced retrieval technique (loop wire, balloon disruption, directional sheath, endobronchial forceps, and Excimer laser sheath) use. The data were analyzed with binomial regression analysis to calculate a dwell time in months at which advanced techniques were necessary. Statistical significance was accepted at $p < 0.05$.

RESULTS

724 retrieval procedures were performed during the study period, with an overall technical success rate of 97%. Filters encountered in the study period include devices manufactured by Cook, Cordis, Bard, Argon, Volcano, and ALN. After 3.1 months (95% CI 2.8-3.4, $p < 0.01$), the likelihood of requiring advanced techniques to achieve retrieval success increased significantly.

CONCLUSION

At approximately 3 months rIVCF dwell time, the likelihood of requiring advanced techniques to maintain retrieval technical success increases significantly. In patients with rIVCFs in place beyond this time point, referral to centers with expertise in advanced filter retrieval techniques may facilitate their successful retrieval.

CLINICAL RELEVANCE/APPLICATION

Retrieval of prolonged dwell rIVCFs is not uniformly attempted and is often not successful due to lack of widespread expertise in advanced retrieval techniques. These devices with prolonged implantation time are prone to increased rates of complication. In accordance with a 2010 FDA safety communication, we strongly believe that rIVCFs that are no longer indicated should be removed. Identifying a time when advanced techniques will likely be necessary may improve overall retrieval of these devices.

RC214-04 Microbubble Augmented Ultrasound Thrombolysis of Deep Vein Thrombosis in an In-vitro Model

Monday, Nov. 30 9:15AM - 9:25AM Location: S404CD

Participants

Brahman Dharmarajah, MBBS, MRCS, London, United Kingdom (*Presenter*) Nothing to Disclose
Tom Mckinnon, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Christina Keravnou, Nicosia, Cyprus (*Abstract Co-Author*) Nothing to Disclose
Michalakis A. Averkiou, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Mike t. Laffan, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Edward Leen, MD, FRCR, London, United Kingdom (*Abstract Co-Author*) Equipment support, Koninklijke Philips NV Equipment support, General Electric Company Equipment support, SuperSonic Imagine Research Consultant, General Electric Company Speakers Bureau, Bracco Group Speakers Bureau, Koninklijke Philips NV Speakers Bureau, AngioDynamics, Inc Speakers Bureau, General Electric Company
Alun Davies, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Acute thrombus removal is recommended for extensive deep vein thrombosis (DVT) to prevent the long term sequelae of post thrombotic syndrome. However, catheter-directed thrombolysis confers a haemorrhage risk of up to 20%. Sonothrombolysis is the combination of high mechanical index ultrasound (US) and ultrasound contrast microbubbles (MBs) to achieve thrombus dissolution.

METHOD AND MATERIALS

Under venous shear stress, parallel plate flow chambers coated with tissue factor were used to create a DVT specific in-vitro clot model. Therapy groups included: control, US only and US and MBs (each $n=8$). US was applied via a Philips iU-22 platform with a C5-1 transducer using a custom bubble destruction sequence producing a triggered mechanical index pulse of 1.31 every 1500 milliseconds. SonoVue MBs were infused at 0.2% concentration. Fluoroscopically tagged fibrin captured via video microscopy provided validated blinded offline image quantification of clot surface area coverage with statistical analysis performed using a one-way ANOVA.

RESULTS

Mean surface area coverage of the clot \pm SD after treatment was $85.8 \pm 5.6\%$ in the control group, $52.7 \pm 7.6\%$ in the US only group and $10.7 \pm 12.37\%$ in the US and MBs group. A significant difference of US alone over control was identified ($P < 0.05$), however, a further significant effect was displayed by US and MBs ($P < 0.0001$). Qualitative video microscopy clot analysis revealed maintenance of the fibrin scaffold with areas of porosity with US only whilst complete dissolution of the fibrin structure with restoration of flow was observed with US and MBs.

CONCLUSION

This pilot study using commercially available MBs and US platform identifies sonothrombolysis as a feasible non-invasive, non-irradiating technique for the dissolution of DVT. Further translational research assessing both safety and efficacy of this novel technique is warranted before it can rival current thrombus removal strategies.

CLINICAL RELEVANCE/APPLICATION

Microbubble augmented ultrasound thrombolysis is feasible and may confer less risk of haemorrhage and irradiation than current thrombus removal strategies.

RC214-05 PE II: Treatment Options for the IR and the PE Response Team

Monday, Nov. 30 9:25AM - 9:50AM Location: S404CD

Participants

Robert A. Lookstein, MD, New York, NY (*Presenter*) Consultant, Johnson & Johnson; Consultant, Boston Scientific Corporation; Consultant, The Medicines Company

LEARNING OBJECTIVES

View learning objectives under main course title.

RC214-06 Unknown Case of the Session

Monday, Nov. 30 9:50AM - 10:15AM Location: S404CD

Participants

Wael E. Saad, MBBCh, Ann Arbor, MI (*Presenter*) Research Grant, Siemens AG ; Consultant, Siemens AG; Consultant, Boston Scientific Corporation; Consultant, Medtronic, Inc; Consultant, Getinge AB; Consultant, Merit Medical Systems, Inc;

LEARNING OBJECTIVES

View learning objectives under main course title.

RC214-07 Efficacy of TIPS/Embolization for Gastric Varices

Monday, Nov. 30 10:15AM - 10:25AM Location: S404CD

Participants

Janesh Lakhoo, BS, Chicago, IL (*Presenter*) Nothing to Disclose
Ron C. Gaba, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Gastric varices (GVs)-which occur in 5-35% of liver cirrhosis patients-may lead to severe bleeding and mortality rates ~25% at 2-years. Transjugular intrahepatic portosystemic shunt (TIPS) creation with/without variceal embolization serves to decompress and occlude varices in cases refractory to medical management. However, GV may be difficult to treat with TIPS/embolization due to distance from TIPS shunt ("proximity" theory), large size resulting in competitive outflow with TIPS ("throughput" theory), and canalization of new feeders after embolization ("recruitment" theory). This study evaluated the efficacy of TIPS with or without embolization in decompressing or occluding GV.

METHOD AND MATERIALS

In this single center, retrospective observational study, 79 patients with GV bleeding were selected from a cohort of 303 patients who underwent TIPS from 1999-2014. Individuals with bare metal stent TIPS and patients who lacked post-TIPS imaging/endoscopic follow-up were excluded. Chart and imaging review were used to assess variceal types, feeders, and post-procedure cross-sectional imaging or endoscopic patency. The primary study outcome measure was imaging and/or endoscopic GV patency rate as a surrogate for clinical efficacy of TIPS/embolization.

RESULTS

The final cohort consisted of 26 patients (M:F 16:10, median age 54 years, median MELD 16). GV included GEV1 (10), GEV2 (2), IGV1 (3), IGV2 (2), and unspecified (9). TIPS were hemodynamically successful in 24/26 (92%) patients with median final portosystemic pressure gradient of 7 mm Hg. Multiple GV feeders (left/posterior/short gastric veins) were present in 62% (16/26) cases. embolization was performed in 75% (18/24). 13, 3, and 10 patients had imaging, endoscopic, or both imaging/endoscopic follow-up. The incidence of GV patency on post-TIPS follow-up was 77% (20/26) (78%/75% with/without embolization) at 129 days median follow-up time. The post-TIPS rebleeding incidence was 27% (7/26), and the 90-day mortality rate was 15% (4/26).

CONCLUSION

In this study, most GV showed persistent patency despite TIPS decompression and variceal occlusion, and rebleeding incidence was high. The findings suggest suboptimal efficacy for GV therapy, and indicate need for study of alternative/adjunctive approaches to GV treatment, such as balloon-occluded antegrade or retrograde obliteration.

CLINICAL RELEVANCE/APPLICATION

TIPS/coil embolization may not optimally decompress or occlude gastric varices.

RC214-08 Comparison of Balloon-occluded Retrograde Transvenous Obliteration (BRTO) using Ethanolamine Olate Iopamidol (EOI), BRTO Using Sodium Tetradecyl Sulfate (STS) Foam and Modified BRTO (mBRTO)

Monday, Nov. 30 10:25AM - 10:35AM Location: S404CD

Participants

Young Hwan Kim, MD, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Hwan Kim, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Hee Hong, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byoung Je Kim, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hye Min Son, Daegu, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To compare the clinical outcomes of BRTO using EOI, BRTO using STS foam and mBRTO.

METHOD AND MATERIALS

From April 2004 to February 2015, Eighty-three patients underwent retrograde transvenous obliteration for gastric varices were analyzed retrospectively. BRTO with EOI was performed in 38 patients, BRTO with STS foam in 25 and mBRTO in 20. Among them, we obtained follow-up data in 66 patients. Recurrence of gastric varices was evaluated by follow-up endoscopy or CT. Medical records were reviewed for the clinical and technical efficacy. Statistical analyses were performed by Chi-square test, Fisher's exact test, Kruskal-Wallis test and Mann-Whitney U test.

RESULTS

Technical and clinical success was achieved in 79 patients (95.2%). As major complications, hemoglobinuria occurred in one patient with BRTO using EOI. Recurrence of gastric varices occurred more frequently in mBRTO group ($P < 0.05$). Recurrence of gastric varices occurred in 1 patient in BRTO using EOI group and 4 patients in mBRTO group with 3.3% and 22.2% of each expected one-year recurrence rates. There was no recurrence of gastric varices in all patients underwent BRTO using STS foam. Abdominal pain occurred more frequently in BRTO using EOI than BRTO using STS foam and mBRTO ($P < 0.05$). Procedure time of mBRTO was shorter than the other two conventional BRTO groups ($P < 0.05$).

CONCLUSION

Both BRTO using STS foam and mBRTO are better than BRTO using EOI for treatment of gastric varices in terms of complication and procedure time. However, mBRTO showed frequent recurrence of gastric varices during the long-term F/U rather than conventional BRTO.

CLINICAL RELEVANCE/APPLICATION

Modified BRTO is a time-saving procedure, but mBRTO has more recurrence rate. This article makes paying attention to perform mBRTO which has more recurrence rate of gastric varices.

RC214-09 Prediction for Improvement of Liver Function after B-RTO for Gastric Varices by Transient Elastography -To Manage Portosystemic Shunt Syndrome

Monday, Nov. 30 10:35AM - 10:45AM Location: S404CD

Participants

Akira Yamamoto, Osaka, Japan (*Presenter*) Nothing to Disclose
Norifumi Nishida, MD, PhD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyasu Morikawa, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Jogo, MD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Ken Kageyama, MD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Etsuji Sohgewa, MD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichi Hamamoto, MD, PhD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Tohru Takeshita, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukimasa Sakai, MD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukio Miki, MD, PhD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Norifumi Kawada, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the predictive factors including transient elastography (TE) using Fibroscan® for improvement in liver function after B-RTO for GV.

METHOD AND MATERIALS

We retrospectively analyzed 47 consecutive patients who were followed up for more than 3 months after B-RTO and who had undergone TE before B-RTO between January 2011 and December 2013. The correlation between change in liver function (total bilirubin, albumin, and prothrombin time) and baseline liver function values and the liver stiffness measurement (LSM) by TE using FibroScan® was evaluated by Pearson's correlation test. Receiver operating characteristic (ROC) curves were used to determine the cut-off values with the best sensitivity and specificity in discriminating between patients who experienced improved liver function and those who did not. To clarify the cut-off level, time interval from B-RTO to aggravation of esophageal varix (EV) was also analyzed.

RESULTS

Of the 47 enrolled patients, B-RTO was successfully performed in all patients (100%). The serum albumin was significantly improved at 3 months after B-RTO (3.60 vs. 3.80, $p = 0.001$). There was a significant negative correlation between the change in serum albumin and the baseline LSM ($r = -0.51$, $p < 0.0001$). The best cut-off point for LSM was ≤ 22.9 kilopascals (kPa) with a sensitivity and specificity of 76.5% and 69.2%, respectively, and an area under the curve of 0.79 for predicting which patients would experience improved albumin after B-RTO. In the patient with ≤ 22.9 kPa LSM, serum albumin levels improved significantly from before to 3 months after BRTO (3.60 ± 0.46 vs. 3.90 ± 0.45 g/dl, $p < 0.0001$). In the patient with > 22.9 kPa LSM, serum albumin did not improve significantly from before to 3 months after B-RTO (3.50 ± 0.36 vs. 3.50 ± 0.40 g/dl, $p = 0.75$). One year aggravation rate of EV after B-RTO was 9.5% in the patient with ≤ 22.9 kPa LSM, while 69.5% in the patient with > 22.9 kPa LSM.

CONCLUSION

The predictive factor for improvement in liver function after B-RTO was lower LSM (≤ 22.9 kPa) using TE. In the patients with ≤ 22.9 kPa LSM, aggravation rate of esophageal varices was very low.

CLINICAL RELEVANCE/APPLICATION

Predictor for improvement of liver function after B-RTO for gastric varices was identified by Transient Elastography.

RC214-10 BRTO-What Is It and When Should It Be Done

Monday, Nov. 30 10:45AM - 11:10AM Location: S404CD

Participants

Wael E. Saad, MBBCh, Ann Arbor, MI (*Presenter*) Research Grant, Siemens AG ; Consultant, Siemens AG; Consultant, Boston Scientific Corporation; Consultant, Medtronic, Inc; Consultant, Getinge AB; Consultant, Merit Medical Systems, Inc;

LEARNING OBJECTIVES

View learning objectives under main course title.

RC214-11 Chronic Venous Occlusions Treated with RFA

Monday, Nov. 30 11:10AM - 11:35AM Location: S404CD

Participants

Marcelo Guimaraes, Charleston, SC (*Presenter*) Consultant, Cook Group Incorporated ; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated

LEARNING OBJECTIVES

View learning objectives under main course title.

RC214-12 Wrap Up and Discussion

Monday, Nov. 30 11:35AM - 12:00PM Location: S404CD

Participants

MSMC21

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

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



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

Participants

Pamela K. Woodard, MD, Saint Louis, MO (*Director*) Research Consultant, Bristol-Myers Squibb Company; Research Grant, Astellas Group; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Bayer AG; Research agreement, Siemens AG; Research Grant, Actelion Ltd; Research Grant, Guerbet SA; ; ;
Pamela K. Woodard, MD, Saint Louis, MO (*Moderator*) Research Consultant, Bristol-Myers Squibb Company; Research Grant, Astellas Group; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Bayer AG; Research agreement, Siemens AG; Research Grant, Actelion Ltd; Research Grant, Guerbet SA; ; ;
Jill E. Jacobs, MD, New York, NY (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

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

Sub-Events

MSMC21A Normal Coronal Anatomy

Participants

Shawn D. Teague, MD, Indianapolis, IN (*Presenter*) Stockholder, Apple Inc

LEARNING OBJECTIVES

1) Recognize normal anatomy and common variants of the coronary arteries. 2) Understand the unique advantages and disadvantages of CT for coronary artery evaluation. 3) Describe the current State-of-the-Art capabilities for CT in coronary artery evaluation.

ABSTRACT

MSMC21B Anomalous Coronary Arteries

Participants

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

LEARNING OBJECTIVES

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

MSMI21

Molecular Imaging Symposium: Basics of Molecular Imaging

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

BQ **MI** **MR** **US**

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

FDA Discussions may include off-label uses.

Participants

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

Sub-Events

MSMI21A MI Using Radioactive Tracers

Participants

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

LEARNING OBJECTIVES

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

ABSTRACT

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

MSMI21B Molecular MRI and MRS

Participants

Zaver M. Bhujwala, PhD, Baltimore, MD, (zbhujwa1@jhmi.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

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

ABSTRACT

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

MSMI21C Nanoparticles

Participants

Heike E. Daldrup-Link, MD, Palo Alto, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand important safety aspects of USPIO. 2) To recognize the value of immediately clinically applicable iron oxide nanoparticles for tumor MR imaging applications. 3) To learn about clinically relevant new developments of theranostic USPIO.

ABSTRACT

Nanoparticles Nanoscale materials can be employed to develop novel platforms for understanding, diagnosing, and treating diseases. Integrating nanomedicine with novel multi-modality imaging technologies spurs the development of new personalized diagnostic tests and theranostic (combined diagnostic and therapeutic) procedures. This presentation will provide an overview over the safety, diagnostic applications and theranostic developments of clinically applicable ultrasmall superparamagnetic iron oxide nanoparticles (USPIO). USPIO which are currently used for clinical applications include ferumoxytol (Feraheme), an FDA-approved iron supplement, and ferumoxtran-10 (Combidex/Sinerem), which is currently undergoing renewed clinical trials in Europe. Safety considerations for these agents will be discussed. Both compounds provide long lasting blood pool enhancement, which can be used for MR angiographies and tissue perfusion studies. Subsequently, USPIO are slowly phagocytosed by macrophages in the reticuloendothelial system (RES), which can be used to improve MRI detection of tumors in liver, spleen, lymph nodes and bone

marrow. A slow phagocytosis by macrophages in inflammations and high grade tumors can be used to grade the severity of the disease process and monitor new immune-modulating therapies. Novel developments include synthesis of multi-functional nanoparticles, which can be detected with two or more imaging modalities, as well as clinically applicable approaches for in vivo tracking of stem cell therapies. Since USPIO are not associated with any risk of nephrogenic sclerosis, they can be used as alternative contrast agents to gadolinium chelates in patients with renal insufficiency or in patients in whom creatinine lab values are not available. Ongoing pre-clinical developments include the development of improved, targeted and activatable nanoparticle formulations, which can further improve sensitivity, specificity and theranostic imaging capabilities.

MSMI21D Contrast Ultrasound

Participants

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

LEARNING OBJECTIVES

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

MSMI21E Quantitative Imaging Biomarkers

Participants

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

ABSTRACT

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

Honored Educators

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

Richard L. Wahl, MD - 2013 Honored Educator

Musculoskeletal Series: Knee and Hip MR Imaging

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



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

Participants

Lynne S. Steinbach, MD, San Francisco, CA, (lynne.steinbach@ucsf.edu) (*Moderator*) Nothing to Disclose
Miriam A. Bredella, MD, Boston, MA, (mbredella@mgh.harvard.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC204-01 Pitfalls in Knee MRI Interpretation

Monday, Nov. 30 8:30AM - 8:55AM Location: E451B

Participants

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

LEARNING OBJECTIVES

1) Recognize common causes of false positives on MRI of the knee including misinterpretation of normal structures and normal variants, such as the dorsal defect of the patella. 2) Review causes of false negatives on MRI of the knee that may be undetected due to lack of recognition or that may look normal over time, such as a chronic cruciate ligament tear.

ABSTRACT

MRI is highly accurate for evaluation of the knee joint. This lecture will emphasize common pitfalls and pearls to get around them when evaluating the knee with MRI. Some anatomic structures and normal variants can simulate an abnormality of the menisci, ligaments, cartilage, bone and surrounding soft tissues of the knee on MRI. In addition there are some abnormalities that can be missed or misinterpreted.

RC204-02 The Anterolateral Ligament of the Knee: A Regular Ligament or Our Imagination? Correlation of MR Imaging with Anatomical Findings

Monday, Nov. 30 8:55AM - 9:05AM Location: E451B

Participants

Enver G. Tahir, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Christoph A. Berliner, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Sinef Yazar, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Georg Luers, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Murat Karul, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Jin Yamamura, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recently, evidence has been accumulating for the existence of a previously unknown structure at the anterolateral aspect of the human knee named anterolateral ligament (ALL). The aim of this study was to evaluate the visibility and to describe the anatomical features of the ALL using magnetic resonance imaging (MRI) and to correlate the results with gross anatomical findings.

METHOD AND MATERIALS

16 human knees were obtained from cadavers (4 male, 9 female) at a mean age of 84.3 ±5.2 years. All specimens were examined with plain film radiography to exclude advanced degenerative arthrosis, prior osseous injuries as well as joint replacement. Subsequently, MRI scans were performed with a 3 Tesla machine (Ingenia, Philips). Two musculoskeletal radiologists independently reviewed coronal and axial T1- and proton density-weighted images to assess the visibility of the ALL. In all 16 knees the lateral supporting structures were carefully dissected by an orthopedic surgeon and an anatomist to identify the course and anatomy of the ALL as well as its length and thickness.

RESULTS

On the basis of MR imaging a consistent structure correspondent to the ALL was identified in 11 knees (68%). On anatomical dissection the ALL was found in 13 knees (81%). It originated at the lateral femoral epicondyle and its proximal part was blended with the lateral collateral ligament (LCL) making it difficult to distinguish these two structures. The ALL was distally separate from the LCL and ran obliquely to insert on the lateral tibial plateau between Gerdy's tubercle and the fibular head. Measurements of a completely visible ALL on anatomic dissections revealed an average proximal length of 42.8 ±4.6 mm and a distal length of 34.3 ±10.8 mm, whereas its width was 6.46 ±2 mm.

CONCLUSION

MRI of the knee was accurate and sensitive in the identification of the intact ALL. It appeared as a thin black structure on T1 weighted sequences and was best visualized on coronal images. Information concerning this structure may be crucial with respect to the diagnosis and understanding of knee pathologies.

CLINICAL RELEVANCE/APPLICATION

The ALL is believed to be responsible for the Second fracture and its rupture has been associated with anterolateral rotational knee instability. MRI imaging may provide valuable information about the ALL.

RC204-03 Anterolateral Ligament Injury in Patient with Acute ACL Tears on MRI: Prevalence, Patterns and Relationships with Tibial Contusions

Monday, Nov. 30 9:05AM - 9:15AM Location: E451B

Participants

Angel J. Lopez-Garib, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Nogah Shabshin, MD, MBA, Haifa, Israel (*Abstract Co-Author*) Consultant, Active Implants Corporation

PURPOSE

The anterolateral ligament (ALL) of the knee is believed to be involved in maintaining rotatory stability of the knee, may be injured with the anterior cruciate ligament (ACL) tear during pivot shift injuries and may be accountable for failed ACL repairs. We sought to describe the incidence and patterns of ALL injury in patients with acute ACL tears, and investigate if there is a relationship with various bone contusions, meniscal tears and posterolateral injuries.

METHOD AND MATERIALS

Knee MR examinations of 81 patients with acute ACL tears were retrospectively reviewed by two musculoskeletal radiologists to assess the ALL: visualization, location of tibial insertion, sprain and presence of an anterolateral tibia insertional bone contusion. Additional bone contusions in the posteromedial, posterolateral and anteromedial tibia and lateral femoral condyle were noted, as well as meniscal tears and posterolateral injuries (popliteus tendon and fibular collateral ligament [FCL]). Statistical analysis for relationships of these findings with ALL injuries was obtained utilizing the Pearson correlation and Chi2 tests.

RESULTS

ALL injury, including sprain and/or an anterolateral tibia traction contusion, was seen in 49/81 (60%) (34/81 [42%] and 32/81 [40%], respectively), with an avulsion fracture in 3/32 (9%). Anteromedial and posterolateral tibial contusions were significantly more common in patients with ALL injury ($p=0.004$ and $p=0.006$, respectively). The anterolateral tibia traction contusion was characteristically subcortical, elongated (mean size (mm) 10.7CC x 12.7AP x 4.6TV), and involved the middle anteroposterior third of the tibia. There was correlation with posterolateral injury ($p=0.046$) and medial meniscal tears (32/81, $p=0.049$). There was no relationship between lateral meniscus tear, posterolateral tibial or lateral femur bone contusion and ALL injury.

CONCLUSION

ALL injury is present in more than 50% of ACL tears. It is specifically associated with anteromedial and posterolateral tibial contusions, and some demonstrate a characteristic anterolateral traction contusion.

CLINICAL RELEVANCE/APPLICATION

ALL injury is common on MRIs of acute ACL tears. Anteromedial and posterolateral tibia contusions are suspicious and anterolateral, elongated subcortical tibia contusion and ALL sprain should be assessed.

RC204-04 Distal MCL Tears of the Knee: MRI Features of Stener-like Lesions

Monday, Nov. 30 9:15AM - 9:25AM Location: E451B

Participants

Robert D. Boutin, MD, Sacramento, CA (*Presenter*) Nothing to Disclose
Russell C. Fritz, MD, Mill Valley, CA (*Abstract Co-Author*) Nothing to Disclose
Richard E. Walker, MD, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose
Mini N. Pathria, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Cassandra A. Lee, MD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Lawrence Yao, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze the MRI characteristics of distal MCL tears, without and with displacement superficial to the pes anserinus (Stener-like lesion [SLL]).

METHOD AND MATERIALS

In this IRB-approved study, MRI examinations of the knee at three institutions were selected which showed partial or complete tears of the (superficial) MCL centered distal to the joint line. MRI examinations were evaluated independently by two musculoskeletal radiologists for: a SLL of the distal MCL; coexistent tears of the meniscotibial and meniscofemoral ligaments; a wavy contour to the more proximal MCL; the vertical distance of the stump from the medial joint line; and the transverse distance of the stump from the medial tibial cortex. Additional co-existent knee injuries also were recorded.

RESULTS

The study included 32 patients (median age: 27 years; interquartile range 18 years). A SLL of the MCL was identified in 11 of 32 cases. The proximal stump margin was located significantly ($p<.01$, Mann Whitney U) more distal in cases with a SLL (mean=35 mm, $sd=11$ mm), as compared to without a SLL (mean=16 mm, $sd=15$ mm). The incidence of ACL tear, PCL tear, meniscotibial/meniscofemoral ligament tear, and lateral compartment osseous injury was high in cases with a SLL (91%, 36%, 73%, and 91%, respectively), but not significantly different ($p>0.10$, Fisher's exact test) from cases without a SLL (81%, 33%, 57%, and 91%, respectively). The MCL had a wavy appearance in 82% of cases with a SLL, and in 62% without a SLL.

CONCLUSION

A SLL of the MCL should be considered in the setting of a high-grade, distal MCL tear, particularly when there is a wavy appearance to the MCL. These lesions are accompanied very frequently by tears of the ACL and meniscotibial/meniscofemoral ligaments.

CLINICAL RELEVANCE/APPLICATION

A SLL of the distal MCL is important to recognize for appropriate treatment and operative decision making.

RC204-05 Postero-lateral Instability (PLI) of the Knee: Can the Right Diagnosis of Postern-lateral Corner (PLC) Structures Involvement, Using the WB-MRI, Evades a Future Anterior Cruciate Ligament (ACL) Reconstruction Failure?

Monday, Nov. 30 9:25AM - 9:35AM Location: E451B

Participants

Silvia Mariani, MD, L'Aquila, Italy (*Presenter*) Nothing to Disclose
Alice La Marra, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Arrigoni, Coppito, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonio Barile, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of our study was to evaluate the value of weight-bearing (WB)-MRI compared to standard-MRI in unmasking PLC structures involvement to determinate a PLI

METHOD AND MATERIALS

We prospectively analyzed 200 patients positive for an acute ACL injury, only 100 of them with suspicion of a PLI. All patients underwent a dedicated MRI in supine and WB position with knee flexion of 12°-15°. We evaluated knees for 3 direct signs of ACL injury (discontinuity, ACL altered morphology and deflection) and for 4 indirect signs (bone bruise, anterior tibial traslation, uncovered lateral meniscus and hyperbuckled posterior cruciate ligament (PCL). We evaluated the involvement of PLC capsuloligamentous structures. All patients underwent arthroscopy.

RESULTS

Among the direct signs we obtained that ACL deflection resulted the most statistical significant ($p < 0.004$) ; among the indirect signs the anterior tibial traslation was the most statistical significant ($p < 0.0001$) followed by the uncovered lateral meniscus ($p < 0.005$). Finally we evaluated the involvement of PCL capsulo-ligamentous structures (antero-lateral and postero-medial popliteo-meniscal ligaments) : both the ligaments were involved in 65/89 of the cases insteas only the inferior one was involved in 24/89 of the cases. Arthroscopy confirmed ACL tear with diagnosis of PLI in 89% of cases. The 100 patients with no clinical suspicion of PLI didn't show modifications of signs during the standard and WB-MRI.

CONCLUSION

The study discovers the value of WB-MRI in recognising the most sensitive direct and indirect signs of ACL injury and to diagnose a PLC involvement, leading patients to the right surgical treatment

CLINICAL RELEVANCE/APPLICATION

The diagnosis of the PLI is always clinical however there is no a pre-operative specific test to diagnose it. The added value of the weight-bearing MRI is to provide further information in unmasking direct/indirect signs of ACL injury negative at standard-MRI This may be very helpful for the orthopedic surgeon in the choice of possible treatment and to avoid an ACL graft failure

RC204-06 Posterolateral Corner Injuries

Monday, Nov. 30 9:35AM - 10:00AM Location: E451B

Participants

William B. Morrison, MD, Philadelphia, PA (*Presenter*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc

LEARNING OBJECTIVES

1) Understand the anatomy of the posterolateral corner of the knee. 2) Realize the importance of the posterolateral corner in injury of the knee. 3) Be able to recognize major and minor posterolateral corner injury on MRI.

RC204-07 Postoperative Meniscus

Monday, Nov. 30 10:10AM - 10:30AM Location: E451B

Participants

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

LEARNING OBJECTIVES

1) Differentiate between the 3 surgical techniques applied to the torn meniscus (the "three R's": Resection, Repair, and Replacement) -- each resulting in a different 'normal' MRI appearance of the postoperative meniscus. 2) Detect recurrent/residual tears in the post-operative meniscus on MRI.

ABSTRACT

After highlighting relevant anatomy, we review the current indications and techniques used for meniscus surgery, and focus on MRI interpretation of the postoperative meniscus, including recurrent tears and outcomes/complications.

RC204-08 Pitfalls in Hip MRI Interpretation

Monday, Nov. 30 10:30AM - 10:55AM Location: E451B

Participants

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

LEARNING OBJECTIVES

1) Develop a search pattern in the evaluation of the painful hip. 2) Identify common pitfalls in hip MRI interpretation. 3) Describe different features for conditions affecting the hip. 4) Differentiate between normal variants and pathology of the hip.

ABSTRACT

Relevant hip anatomy will be reviewed, followed by imaging features of intra-articular, internal and osseous pathology in the patient with the painful hip. Interpretive imaging pitfalls of these structures will be discussed.

RC204-09 Can MRI Predict a Future Bucket Handle Type Meniscus Tear in Patients with Recent Knee Trauma and ACL Injury?

Monday, Nov. 30 10:55AM - 11:05AM Location: E451B

Participants

Roula Bou Sader, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Michael G. Kendrick, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc
Adeel H. Azam, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Johannes B. Roedel, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Michael G. Ciccotti, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We anecdotally observed patients suffer bucket handle type meniscus tears (BHMT) after ACL reconstruction, requiring a 2nd surgery. We sought to assess if a knee MRI performed post initial injury can predict a potential future BHMT using a novel assessment algorithm for traumatic meniscal injury.

METHOD AND MATERIALS

A PACS and report database was searched for MRI knee examinations describing a medial BHMT from 2006 to 2013. These exams were then screened for the availability of a prior MRI performed after a trauma with no BHMT. The prior MRI was reviewed for presence of a meniscal tear or lesion borderline for a tear, tear configuration (oblique, horizontal, vertical, or complex), tear location (anterior horn, body, and/or posterior horn), tear zone (red, white, and/or pink), tear extension to articular surfaces of the meniscus (inferior, superior or both) and the presence of concomitant anterior cruciate ligament pathology (disruption or reconstruction). The time interval between the initial MRI and the BHMT MRI was recorded, as was patient age and gender.

RESULTS

931 MRIs with reported BHMT yielded 39 subjects with prior MRI. Of these, only 7/39 (17.9%) had no clear meniscus tear on the initial study and 6/7 had edema type signal at the posteromedial margin of the medial meniscus. Of the 32/39 (82.1%) with prior meniscal tears: 27/32 (84.4%) were vertical or complex with a vertical component, 4/32 (12.5%) were oblique, and 1/32 (3.1%) were horizontal. All of the prior meniscal tears involved the posterior horn while 10/32 (31.2%) also involved the meniscal body. The red zone was most often involved (28/32, 87.5%), while the white and pink zones were involved in 12/32 (37.5%) and 15/32 (46.8%) respectively. Concomitant ACL pathology was common on the initial exams, seen in 26/39 (66.6%). Of the 26 patients with ACL pathology, 16 had an active ACL tear and 10 had a prior ACL reconstruction. 28/32 (87.5%) of the initial meniscus tears including all vertical tears involved both articular surfaces.

CONCLUSION

In the setting of knee trauma and ACL injury, MR findings of a vertical medial meniscus tear involving the red zone and both articular meniscal surfaces should raise concern for the potential evolution of a BHMT.

CLINICAL RELEVANCE/APPLICATION

A non displaced peripheral vertical medial meniscal tear is an important observation on a posttraumatic knee MRI. Orthopedists should consider repair to prevent the evolution of a BHMT.

RC204-10 Hip MR Arthrography: Are We Underdiagnosing Laxity Pre-operatively?

Monday, Nov. 30 11:05AM - 11:15AM Location: E451B

Participants

Geoffrey M. Riley, MD, Half Moon Bay, CA (*Presenter*) Nothing to Disclose
Michael L. Richardson, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jonathan Packer, MD, Redwood City, CA (*Abstract Co-Author*) Nothing to Disclose
Marc Safran, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Robert D. Boutin, MD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Michelle Nguyen, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The preoperative clinical exam is known to be unreliable for the diagnosis of hip laxity and often an exam under anesthesia is necessary for diagnosis. The purpose of this study is to ascertain if MR arthrography findings are associated with laxity.

METHOD AND MATERIALS

After obtaining IRB approval, we identified 57 consecutive patients (36 women, 21 men) undergoing first hip MR arthrography and then arthroscopy by a single hip arthroscopist, within a maximum of 10 months (excluding patients with hip hardware, fractures, or tumors). The original MR report was reviewed for the preoperative diagnosis of laxity. An MSK radiologist and an MSK fellow blinded to surgical results then re-reviewed, by consensus, the MR arthrograms for 2 morphologic findings that have been associated with hip laxity: Widening of the anterior hip joint recess (>5 mm) and thinning of the adjacent joint capsule (< 3mm). Measurements were made on an axial T1-weighted image without fat saturation at the level of the anterior capsule insertion onto the greater

trochanter. An orthopaedic surgeon (blinded to MR findings) reviewed the arthroscopy reports for the documentation of clinical laxity determined by examination under anesthesia (reference standard).

RESULTS

None of the 57 MR reports described the findings related to laxity. Logistic regression was performed using clinical laxity as the dependent variable and gender, age, and MR findings of laxity scored as independent variables. Clinical laxity was much more common in women (26 women, one man). It was also more common in older patients. Statistically significant associations were noted between clinical laxity and gender (odds ratio for men = 0.009, $p = 0.0001$) and the presence of both MR findings of laxity (odds ratio = 11.1, $p = 0.039$).

CONCLUSION

Hip laxity is commonly underdiagnosed on pre-operative MR reports, compared with exam under anesthesia. We were able to confirm an association between clinical laxity and the MR findings of anterior recess widening and anterior capsular thinning.

CLINICAL RELEVANCE/APPLICATION

Atraumatic hip instability is increasingly recognized as a cause of hip pain that is potentially treatable, but difficult to diagnose preoperatively. MR may help identify patients with laxity, thus influencing surgical management.

Honored Educators

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

Michael L. Richardson, MD - 2013 Honored Educator

Michael L. Richardson, MD - 2015 Honored Educator

RC204-11 Supine Versus Standing Radiographs for Ischiofemoral Impingement Using a Propensity Score-Match

Monday, Nov. 30 11:15AM - 11:25AM Location: E451B

Participants

Kyu-Sung Kwack, MD, PhD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Sung Hoon Park, MD, Suwon-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Seulgi You, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose

Yoolim Baek, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aims of this study were to test useful parameters for ischiofemoral impingement (IFI) on both supine and standing anteroposterior hip radiographs, and to suggest optimal cut-off points for detection of IFI on radiograph.

METHOD AND MATERIALS

We performed a retrospective study for all patients who had a clinical history of hip pain. All hip joints with quadratus femoris muscle (QFM) edema characterized by increased signal intensity on axial FatSat T2-weighted MR images were selected as a IFI patient group, and an age- and sex-matched control group was created from the same cohort by propensity-score matching. Two readers independently measured the parameters, including ischiofemoral space (IFS), quadratus femoris space (QFS) and hamstring tendon area (HTA) on MR images. The ischiofemoral distance (IFD) and femur neck shaft angle (NSA) were also measured on radiographs. Differences in each parameters between the two study groups were assessed by using the Mann-Whitney U test. Interobserver agreement was quantified by using the intraclass correlation coefficient. The area under the ROC curve (AUC) was calculated as a measure of discriminative ability. Youden's J statistic was used to select the optimum cut-off points for each parameters on radiograph.

RESULTS

A total of 30 patients with QFM edema (44 hip joints, age: 54.8 ± 11 years) were included in the IFI patient group. A total of 88 patients without QFM edema (88 hip joints, age: 51.8 ± 13.4) were selected as control group from a cohort after propensity score matching. IFS, QFS, NSA and IFD showed statistically significant differences between two groups ($p < 0.05$). IFS, QFS and IFD showed almost perfect interobserver agreements ($r > 0.8$). IFDs showed good discrimination abilities (AUC > 0.80). Optimal cut-off points for IFD by reader 1 were 19.9 mm and 16.2 mm on supine radiograph and standing radiograph, respectively. Optimal cut-off points for IFD by reader 2 were 21.1 mm and 17.0 mm, respectively.

CONCLUSION

IFDs on both supine and standing hip radiographs showed good diagnostic performances for detection of IFI. It could be used as a good screening tool with optimal cut-off points.

CLINICAL RELEVANCE/APPLICATION

The measurements of ischiofemoral distances on both supine and standing hip radiographs are useful screening tool with good diagnostic performances for detection of ischiofemoral impingement.

RC204-12 Validation of 3D MRI for the Measurement of Skeletal Muscle Volumes

Monday, Nov. 30 11:25AM - 11:35AM Location: E451B

Participants

Elizabeth Robinson, London, United Kingdom (*Presenter*) Nothing to Disclose

Johann Henckel, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Marc Modat, PhD, Hertfordshire, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Christian Klemt, MSc, Hertfordshire, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Jorge Cardoso, PhD, Hertfordshire, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Keshthra Satchithananda, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sebastien Ourselin, PhD, Hertfordshire, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alistair Hart, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To validate the use of 3D MRI in volumetric computation of muscle wasting To demonstrate the role for 3D MRI in evaluating diseased muscles around hip replacements

METHOD AND MATERIALS

We have applied a novel automated segmentation propagation framework to the MR images of 18 patients with unilateral metal on metal hip replacements. The MR images were manually segmented into the following muscles: Gluteus maximus, Gluteus minimus, Iliopsoas and Tensor Fasciae Latae. MR images were bias-field corrected. The scans were divided in half to create two databases, healthy and diseased, which were processed separately. Each MR image in the database was affinely registered to all the other images using a block matching algorithm and aligned to a common space. We obtained an average matrix for the alignment of images in the database using least trimmed square regression. Consensus segmentation was achieved using similarity and truth estimation algorithm for propagated segmentations (STEPS). The proposed framework was assessed using a leave-one out validation approach. This was used to quantify a clinically relevant imaging biomarker.

RESULTS

The MR images of 18 patients (11 female, 7male) aged 64 ± 15 yrs underwent novel automated segment propagation. The leave-one out cross validation framework assessing the influence of non-rigid registration and label fusion parameters gave the average Dice score for healthy hip muscles is 0.864 (range 0.804-0.931). The average Dice score for pathological hip muscles is 0.827 (range 0.753-0.899).

CONCLUSION

The accuracy of the proposed automated framework was verified by leave one out cross validation. The values obtained for the average are promising given that only 17 MR images are in the database. We would expect these scores would rise with a larger database of images. Future work would involve the expansion of this database in order to define more variability and obtain more accurate automated segmentation.

CLINICAL RELEVANCE/APPLICATION

3D MRI, a technique applied successfully in brain imaging, offers a novel way to monitor the muscle disease formation and progression in patients with hip arthroplasties. This automated segmentation framework can be used to verify volume discrepancies in unilateral hip arthroplasty patients which is currently done manually. This technique will aid patient monitoring and surgical planning.

RC204-13 Extraarticular Hip MRI

Monday, Nov. 30 11:35AM - 12:00PM Location: E451B

Participants

Miriam A. Bredella, MD, Boston, MA, (mbredella@mgh.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with normal anatomy and common pathology of muscles, tendons, and bursae around the hip. 2) Demonstrate understanding of the pathomechanisms and imaging findings of extra-articular hip impingement syndromes.

ABSTRACT

Relevant extra-articular hip anatomy will be reviewed, followed by MRI findings of common pathology of tendons, muscles, and bursae around the hip. Pathomechanisms and imaging findings of extra-articular hip impingement syndromes will be discussed.

RC212

Transcatheter Aortic Valve Replacement (TAVR)

Monday, Nov. 30 8:30AM - 10:00AM Location: N226



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

Participants

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

Sub-Events

RC212A TAVR: The Surgeon's Perspective

Participants

Michael Fischbein, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the epidemiology, surgical and novel transcatheter treatment options for aortic stenosis. 2) Be able to analyze current evidence for the effectiveness of TAVR in different risk groups. 3) Comprehend the elements of a successful TAVR program implementation.

RC212B CTA for TAVR Planning: Current Evidence

Participants

Jonathon A. Leipsic, MD, Vancouver, BC (*Presenter*) Speakers Bureau, General Electric Company Speakers Bureau, Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc

LEARNING OBJECTIVES

1) Review the recent advancements in the field of TAVR. 2) Review the published literature defining the role of MDCT for device selection and annular sizing. 3) Discuss the other ancillary roles of MDCT in TAVR planning.

Honored Educators

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Jonathon A. Leipsic, MD - 2015 Honored Educator

RC212C Measurements, Workflow, Training and Q/A

Participants

Shannon Walters, Stanford, CA, (shannon.walters@stanford.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define elements of an effective TAVR image analysis workflow. 2) Discuss the variety and applicability of measurement/imaging tools. 3) Develop training plans to improve inter observer agreement. 4) Improve efficiency and reliability through quality assurance.

Genitourinary Series: Prostate MR 2015: Current Role in Staging and Surveillance and Intervention

Monday, Nov. 30 8:30AM - 12:00PM Location: N227

GU MR OI

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

FDA Discussions may include off-label uses.

Participants

Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Moderator*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To understand why prostate cancer is currently under- and over-diagnosed. 2) To understand the role of multiparametric prostate MRI in guiding biopsy of the prostate. 3) To understand the role in the diagnosis, surveillance and recurrence of cancer. 4) To review current progress in the focal treatment of prostate cancer.

ABSTRACT

The paradox of prostate cancer is that it is currently being overdiagnosed and underdiagnosed. PSA and blind biopsy has resulted in the overtreatment of men with low risk disease and the undertreatment of men with intermediate high risk tumors that evade blind biopsy. Multiparametric MRI is a major breakthrough in the diagnosis of prostate cancer. Moreover it can be used to monitor patients for active surveillance and guide treatment. New standards for reporting of prostate MRI have been recently development. This course will not only review these important developments but will provide new research results to participants.

Sub-Events

RC207-01 Intro to Prostate Cancer

Monday, Nov. 30 8:30AM - 8:55AM Location: N227

Participants

Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Presenter*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To understand the limitations of PSA screening and random prostate biopsy. 2) To introduce the concepts of novel screening tests and genomic analysis of prostate biopsies. 3) To review the importance of MRI in improving tumor localization, guiding biopsy, monitoring active surveillance and focally ablating prostate cancer.

ABSTRACT

See overview abstract

ABSTRACT

The diagnosis of prostate cancer is evolving quickly. There is increasing recognition that the combination of routine PSA screening and random prostate biopsy overdiagnoses low grade disease and underdiagnoses high grade disease. Autopsy studies show that the normal prostate harbors many low grade and microscopic cancers that never becomes clinically apparent. On the other hand, random biopsies undersample the anterior prostate gland. More accurate screening tests (e.g. PCA-3) are under development for determining which men warrant biopsy. Genomic testing of prostate biopsy samples is also becoming more common and it is thought to improve the prediction of tumor aggressiveness. The increased use of genomics to guide therapy clearly requires that the biopsy sample be representative of the tumor. MR guided biopsies, whether performed in gantry or using MR-US fusion, will improve the quality of the prostate biopsy specimen enabling more accurate genomic testing. Armed with more accurate and reliable tissue diagnosis, more rational decisions regarding active surveillance and/or focal therapy can be made. This course will review advances in MR guided diagnosis, biopsy and therapy of prostate cancer.

RC207-02 Detection and Characterization of Prostate Cancer with Multiparametric MRI (mpMRI): Do Learning and Experience Matter for Diagnostic Accuracy?

Monday, Nov. 30 8:55AM - 9:05AM Location: N227

Participants

Rajan T. Gupta, MD, Durham, NC (*Presenter*) Consultant, Bayer AG; Speakers Bureau, Bayer AG; Consultant, Invivo Corporation
Daniele Marin, MD, Cary, NC (*Abstract Co-Author*) Nothing to Disclose
Bhavik N. Patel, MD, MBA, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Kirema Garcia-Reyes, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Kingshuk Choudhury, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Lisa M. Ho, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Tracy A. Jaffe, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Polascik, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate effect of dedicated reader education on accuracy/Gleason score estimation of index and anterior prostate cancer (Pca) diagnosis with mpMRI in attending radiologists compared to abdominal imaging fellows.

METHOD AND MATERIALS

4 blinded attending abdominal imagers with 2-16 years of experience evaluated 31 prostate mpMRIs in this IRB-approved, HIPAA-compliant, retrospective study for index lesion and anterior PCa detection (including Gleason score estimation). Following dedicated education program, readers reinterpreted cases after a 2-4 month memory extinction period, blinded to initial reads. Reference standard was established combining whole mount histopathology with mpMRI findings by a board-certified radiologist with 5 years of prostate mpMRI experience. Multivariate analysis was performed to assess the effects of learning and reader experience. Results for attending radiologists were then compared with prior reader study results in radiology fellows (using the same set of cases).

RESULTS

Index cancer detection (attending vs. fellow): pre-education accuracy 64.5% vs. 74.2%; post-education accuracy 71.8% vs. 87.7% ($p=0.12$ vs. $p=0.003$). Gleason score estimation (index): pre-education accuracy 46.8% vs. 54.8%; post-education accuracy 57.3% vs. 73.5% ($p=0.04$ vs. $p=0.0005$). Anterior PCa detection: pre-education accuracy 46.4% vs. 54.3%; post-education accuracy 75% vs. 94.3% ($p=0.02$ vs. $p=0.001$). Gleason score estimation (anterior): pre-education accuracy 42.9% vs. 45.7%; post-education accuracy 67.9% vs. 80% ($p=0.03$ vs. $p=0.002$). These effects were all attributable to learning and not to reader experience based on multivariate analysis.

CONCLUSION

Accuracy of anterior PCa detection and Gleason score estimation for both index and anterior cancers significantly increased following dedicated reader education for both attendings and fellows. In addition, accuracy for index cancers was statistically significantly improved for fellows post-education. The degree of statistically significant improvement was higher for fellows vs. attendings overall.

CLINICAL RELEVANCE/APPLICATION

Performance in detection and characterization of PCa on mpMRI can be improved with dedicated reader education, however, it may be that the earlier the educational intervention is done, the more significant the improvement.

RC207-04 Abbreviated Prostate MRI (AP-MRI)

Monday, Nov. 30 9:15AM - 9:25AM Location: N227

Awards

RSNA Country Presents Travel Award

Participants

Robin Bruhn, Aachen, Germany (*Presenter*) Nothing to Disclose

Simone Schradung, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It has recently been shown that an Abbreviated MRI Protocol is suitable for breast cancer screening. Aim of this study was to investigate whether an Abbreviated Prostate MRI protocol (AP-MRI), consisting of 2 pulse sequences only (high resolution T2-TSE and DWI in a single plane), acquired without endorectal coil, is sufficient to diagnose prostate cancer (PCa) in men presenting with elevated PSA-levels.

METHOD AND MATERIALS

Ongoing prospective reader study on 222 men (mean age 53.6 years) with median PSA of 7.1 who underwent multiparametric 3.0T-MRI with multi-element surface coil. The AP-MRI took a table time of just under 10 min. The full diagnostic protocol (FDP) took 30 min and included the pulse sequences of the AP-MRI (0.4 mm in-plane axial T2-TSE and DWI with 4 b-values up to 1400 s/mm²), plus additional T2-TSE planes, coronal T1-TSE, and DCE. All MRI studies were read prospectively by two GU-radiologists in consensus according to PIRADS 2.0. Readers first read the AP-MR images and made their diagnoses. Then, they read the FDP. Results of MR-guided biopsy, TRUS/saturation biopsy, and/or final surgical pathology, or MRI and PSA follow up of at least 24 months served as SOR.

RESULTS

PCa was finally diagnosed in 85/222 men (38.3%), with median size 12 mm, classified as Gleason-6 in 25 patients, Gln-7 in 31, Gln \geq 8 in 29. Diagnostic indices of the AP-MRI vs. the FDP were: Sensitivity: 93% (79/85) vs. 94% (80/85); Specificity: 89% (122/137) vs. 87% (120/137); PPV: 84% (79/94) vs. 82% (80/97), NPV: 95% (122/128) vs. 96% (120/125). The single cancer that went undetected by AP-MRI was a Gln-6-cancer diagnosed by DCE. A total five additional cancers (Gln-6 in 3, and Gln-7 in 2 patients) went undetected by both, AP-MRI and FDP, and were detected by TRUS biopsy. NPV for biologically relevant prostate cancer (> Gln-6) was 98.8% (95%CI: 95.7%-99.9%) for both, AP-MRI and FDP.

CONCLUSION

Abbreviated prostate MRI allows diagnosis of biologically relevant PCa in under 10 minutes magnet time, without endorectal coil and without contrast agent, and offers a diagnostic accuracy that is equivalent to that of a full state-of-the-art multi-parametric prostate MRI protocol.

CLINICAL RELEVANCE/APPLICATION

Abbreviated prostate MRI, if confirmed by further studies, may open the door for systematic MRI screening for prostate cancer.

RC207-05 The Natural History of Low-grade Prostate Cancer: Lessons from an Active Surveillance Cohort

Monday, Nov. 30 9:25AM - 9:35AM Location: N227

Participants

Francesco Giganti, MD, Milan, Italy (*Presenter*) Nothing to Disclose

Neophytos Petrides, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Caroline M. Moore, London, United Kingdom (*Abstract Co-Author*) Speakers Bureau, Myriad Genetics, Inc; Research Grant,

GlaxoSmithKline plc; Consultant, STEBA Biotech NV
Mark Emberton, London, United Kingdom (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc; Consultant, sanofi-aventis Group;
Consultant, Glide Pharmaceutical Technologies Limited; Consultant, SonaCare Medical, LLC
Clare M. Allen, MBCh, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alex P. Kirkham, MBCh, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe the natural history of low-grade prostate cancer by mpMRI changes in patients under active surveillance (AS).

METHOD AND MATERIALS

This study had an authorization from our institutional ethics review board. From our database on patients with prostate cancer, a total of 86 were enrolled in an AS program and had their first mpMRI in 2012 or before. The two reading radiologists, in consensus, knew tumor location and PSA but were blinded to both patient demographics and date of scan. The scans were reported randomly (reducing any bias assuming an increase in size with time). For each visible lesion we measured volume on the sequence best showing the tumor (the same for all scans), as well as attributing a score based on the European Society of Uroradiology -ESUR-2012 guidelines.

RESULTS

1. 66/86 patients had Gleason 3+3 and 20/86 Gleason 3+4 tumor. Median maximum cancer core lengths were 1 and 3.5 mm, respectively. 2. 38/86 patients did not have a visible lesion on the initial MRI (< 3, ESUR criteria). Of these patients, none had developed at a median of 3.56 years of follow up. 3. 40/86 patients had a lesion scoring 3/5 or more (ESUR criteria) on more than 2 scans, enabling an estimation of annual growth rate. 25 had Gleason 3+3, and 15 Gleason 3+4. Median monthly increase in volume was 0.4% for Gleason 3+3 and 1.2% for 3+4 (p=0.049, Mann-Whitney test). No significant difference in the median monthly PSA increase between these groups (0.9 vs 0.6%, p=0.42) was observed. 4. In 38/40 patients having 2 scans separated by a median of 1.19 years, 9/38 showed a decrease in lesion size between 5 and 50 %.

CONCLUSION

In a group of men on AS, we never observed development of a convincing lesion in those negative on the first scan. Conversely, it was possible to measure a growth rate in visible tumors, and it was significantly different for Gleason 3+3 and 3+4. Finally, there is considerable inter-scan variability in volume: this must be taken into account when attributing a significant increase to a small lesion.

CLINICAL RELEVANCE/APPLICATION

The significant difference in rate of increase between small tumors of different grades under AS suggests that it is possible to monitor their size on MRI.

RC207-06 Multi-parametric MRI (including PIRADS)

Monday, Nov. 30 9:35AM - 10:00AM Location: N227

Participants

Clare M. Tempany-Afdhal, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The state of the art mpMR protocols/sequences for prostate cancer imaging. 2) How to acquire and interpret high quality images. 3) What ACR-Pi-Rads is and how it can be implemented in clinical practice. 4) Current and future role of Prostate MR and ACR- PiRads.

ABSTRACT

The current state of the art approaches to prostate cancer Multi-parametric MR(mpMR) Prostate imaging will be presented. MRI techniques at 1.5T and 3.0T and pulse sequence optimization for a state of the art mpMRI exam will be reviewed. The roles of each sequence will be illustrated with clinical case examples to outline technical aspects and interpretative approaches. As the examinations have become complex and the clinical demands are increasing there is a need for standardization of our techniques and interpretative reporting. Thus in keeping with Bi-Rads and Li-Rads, we are developing Pi-Rads. The current ACR-PiRads will be reviewed - goals, methods and clinical applications will be presented and future vision for the role of prostate MR and ACR-PiRADS will be presented

RC207-07 Active Surveillance with MRI

Monday, Nov. 30 10:05AM - 10:30AM Location: N227

Participants

Sadhna Verma, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) What is active surveillance and how it is done. 2) Who is a candidate for active surveillance. 3) The role of mpMRI in risk stratification for active surveillance. 4) The relevance of mpMRI in addition to clinical parameters in disease management.

ABSTRACT

ABSTRACT

Active Surveillance with MRI Active surveillance is increasingly acknowledged as a preferred strategy for most men with low-risk disease. This lecture will discuss low risk prostate cancer and how it is managed clinically. Role of mpMRI will be reviewed with clinical case examples to show selection, follow-up or possible removal of patients from active surveillance protocols.

Honored Educators

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educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/>

Sadhna Verma, MD - 2013 Honored Educator

RC207-08 Longitudinal Follow-up Study of Prebiopsy Multiparametric MRI with Cancer- Negative Findings in Patients with Suspicious Prostate Cancer: A Single Institution Experience

Monday, Nov. 30 10:30AM - 10:40AM Location: N227

Participants

Jun Gon Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chan Kyo Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Jae Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Few follow-up studies of prebiopsy prostate multiparametric MRI (mpMRI) with cancer-negative findings have been reported. The aim of this study was to investigate the chance and characteristics of missing cancers on prebiopsy mpMRI with cancer-negative findings based on Prostate Imaging Reporting and Data System (PI-RADS) in patients with suspicious prostate cancer (PCa).

METHOD AND MATERIALS

584 consecutive patients (mean, 62.7 years; range, 30-86 years) with suspicious PCa who performed initial (n= 391) or repeated prostate biopsies (n= 193) were enrolled in this retrospective study. All patients underwent prebiopsy 3-T mpMRI including T2-weighted, diffusion-weighted and dynamic contrast-enhanced imaging. Random systemic core biopsies and MR-targeted core biopsies in cases of cancer-positive MRI findings were performed, while cases with cancer-negative MRI findings underwent random systemic core biopsies during subsequent follow-up. Biopsy-based definition of clinically significant cancer (CSC) was Gleason $\geq 3 + 4$ or Gleason 6 with maximal cancer core length (MCL) ≥ 4 mm. The likelihood of PCa on mpMRI was evaluated based on PI-RADS version 2: score 4 or 5 was considered cancer positive.

RESULTS

Pathologically the cancers were found in 25% (146/584). The cancer-positive MRI findings were found in 17% (99/584) patients and of these, 85.9% (85/99) had pathologically cancer cores. Of 485 patients with cancer-negative MRI findings, a total of 61 (12.5%) had cancer cores [Gleason 6 (n= 42), 3 + 4 (n= 14), 4 + 3 (n= 2), 8 (n= 2), and 9 (n= 1)]: biopsy-naive patients (n= 38) and patients with negative previous biopsy (n= 23). The mean MCL was 3.4 mm (range, 1-12.6 mm). The CSCs were found in 47.5% (29/61). Accordingly cancer-negative MRI findings missed 6% (29/485) CSCs: 4.1% (20/485) in biopsy-naive patients and 1.9% (9/485) in patients with negative previous biopsy.

CONCLUSION

Prebiopsy 3-T mpMRI with cancer-negative findings misses approximately 12.5% PCa including 6% CSCs in a cohort of biopsy-naive patients and patients with negative previous biopsy.

CLINICAL RELEVANCE/APPLICATION

In a cohort of biopsy-naive patients or patients with negative previous biopsy, 3-T multiparametric MRI can improve the detection of clinically significant prostate cancers, which can help to select optimal treatment strategies.

RC207-09 Magnetic Resonance/Ultrasound (MR/US) Fusion Biopsy in Clinical Practice: Is Systematic Biopsy still Needed to Detect Clinically Significant Prostate Cancers?

Monday, Nov. 30 10:40AM - 10:50AM Location: N227

Participants

Andrei S. Purysko, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD, Rio De Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Antonio C. Westphalen, MD, Mill Valley, CA (*Abstract Co-Author*) Nothing to Disclose
Andrew J. Stephenson, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Erick M. Remer, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Brian R. Herts, MD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Siemens AG
Erika Schneider, PhD, Cleveland, OH (*Abstract Co-Author*) Stockholder, General Electric Company Stockholder, Pfizer Inc
Stockholder, NitroSci Pharmaceuticals, LLC
Jennifer Bullen, MSc, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Cristina Magi-Galluzzi, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Eric Klein, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the detection rates of clinically significant (CS) prostate cancer (PCa), herein defined as a tumor with Gleason score $\geq 3 + 4$, by MR/US fusion biopsy and systematic extended-sextant TRUS (S-TRUS) biopsy.

METHOD AND MATERIALS

IIRB-approved, HIPAA compliant retrospective study included 256 men (mean age: 62.3 yrs.) with either suspected PCa (n = 187) or enrolled on active surveillance (n = 69). All patients underwent multiparametric MRI (mpMRI) of the prostate on a 3.0 T magnet without endorectal coil as part of clinical care prior to biopsy, with T2, high B-value diffusion, and dynamic contrast enhancing imaging. Patients with potential tumor by mpMRI (n= 193) underwent MR/US fusion biopsy followed by 12-core systematic biopsy (SB) in the same procedure and performed by the same urologist who was aware of the location of the targets; those with negative mpMRI underwent SB only (n = 63). The results of both biopsy techniques alone and combined were evaluated.

RESULTS

The overall detection rate of PCa in this population was 51.2% (131/256), and CS PCa was detected in 26.6% (68/256) of the men. In those with positive mpMRI, there was no significant difference in the number of men with CS PCa detected by either biopsy technique (MR/US fusion biopsy: 46 men [23.8%]; SB: 48 men [24.9%]), and both techniques combined detected more men with CS PCa (66 men [34.2%]). CS PCa was detected exclusively by MR/US fusion biopsy in 18 men (9.3%), and by SB in 20 men (10.4%). In most men with CS PCa exclusively detected by SB, the sextants involved were the same (n = 14) or the immediately adjacent ipsilateral sextant (n = 3) where the MRI target was described; in only 3 men (1.5%) the targets were located in a distant sextant from the site involved by CS PCa. PCa was detected in 28.6% (18/63) of the men with negative mpMRI, but only 2 cases (3.2%) were CS PCa.

CONCLUSION

More CS PCa was detected when MR/US fusion biopsy was combined with SB, with greater contribution from biopsies of the same or immediately adjacent sextants of the MRI targets.

CLINICAL RELEVANCE/APPLICATION

In clinical practice, MR/US fusion biopsy should be performed in conjunction with systematic biopsy of the same and immediately adjacent sextants of MRI-targets to ensure the detection of CS PCa detected by mpMRI.

RC207-10 MR and MR-US Guided Biopsy

Monday, Nov. 30 10:50AM - 11:15AM Location: N227

Participants

Daniel J. Margolis, MD, Los Angeles, CA, (daniel.margolis@ucla.edu) (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) List the indications for in-bore MR-guided and MR/US fusion-guided prostate biopsy. 2) Optimize the protocol and image post-processing of prostate MRI for lesion detection, selection, and delineation. 3) Understand the differences between in-bore MR-guided and MR/US fusion-guided prostate biopsy. 4) Describe the advantages and disadvantages of the different kinds of MR/US fusion-guided prostate biopsy. 5) Communicate with referrers to ensure all information is processed correctly for the biopsy session.

ABSTRACT

Interest in, and growth of, prostate MRI has been largely driven by increasing use of this technology for lesion detection rather than treatment planning. This shift in focus is accompanied by changes in the MRI protocol, and how this information is used. A growing number of opportunities for targeted biopsy, both in-bore direct MRI-guided and MRI-ultrasound image fusion targeting, is accompanied by nearly as many different approaches. Each has advantages and disadvantages, some obvious, and some surprising. Awareness of these issues and how to master them is crucial for providing optimal patient care. These issues range from the hardware and software necessary to plan and perform the biopsy, to the intricacies of information and data communication, to referral and follow-up. A comprehensive, service-line approach ensures patients are followed appropriately at all stages of this process.

ABSTRACT

Multiparametric MRI has transformed from a tool primarily used for staging of known cancer into one for detection, localization, and sampling of suspected cancer. This has allowed for streamlining and simplifying the protocol use for imaging the prostate, which presents its own challenges, including managing decreased signal-to-noise ratios and interfacing with image-guided targeted biopsy software and hardware. The various platforms available for image-fusion targeted biopsy include in-bore MRI-directed, "cognitive-" or "mental-fusion" MRI-ultrasound targeted biopsy, software image fusion, articulated arm, and electromagnetic tracking. Attendees will learn how to incorporate image-guided targeted biopsy into their practice, how to interface with clinical collaborators and referrers, and how image-guided targeted biopsy improves confidence in managing men with suspected or known prostate cancer.

RC207-11 12 Months Follow-Up Results of MRI-Guided Transurethral Ultrasound Ablation for Treatment of Localized Prostate Cancer

Monday, Nov. 30 11:15AM - 11:25AM Location: N227

Participants

Maya B. Mueller-Wolf, MD, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Sascha Pahernik, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Boris Hadaschik, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Timur Kuru, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Ionel V. Popeneciu, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gencay Hatiboglu, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Joseph Chin, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Michele Billia, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
James D. Relle, MD, West Bloomfield, MI (*Abstract Co-Author*) Nothing to Disclose
Jason M. Hafron, MD, West Bloomfield, MI (*Abstract Co-Author*) Nothing to Disclose
Kiran R. Nandalur, MD, Northville, MI (*Abstract Co-Author*) Nothing to Disclose
Mathieu Burtnyk, DIPLPHYS, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter Schlemmer, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Roethke, MD, Heidelberg, Germany (*Abstract Co-Author*) Speaker, Siemens AG

PURPOSE

MRI-guided transurethral ultrasound ablation (MR-TULSA) is a novel minimally-invasive technology to treat organ-confined prostate cancer (PCa), aiming to provide local disease control with a low side-effect profile. Directional plane-wave high-intensity ultrasound generates a continuous volume of thermal coagulation to the prostate using real-time MR-thermometry control. A prospective, multi-institutional Phase I clinical study investigated safety, feasibility, and assessed efficacy of MR-TULSA treatment for PCa.

METHOD AND MATERIALS

30 patients with biopsy-proven, low-risk prostate cancer were enrolled: age \geq 65y, T1c/T2a, PSA \leq 10ng/ml, Gleason \leq 3+3 (3+4 in Canada only). Under general anaesthesia, the ultrasound device (TULSA-PRO, Profound Medical Inc., Canada) was positioned in the

prostatic urethra with guidance from a 3T MRI (Siemens, Germany). Treatment planning was performed under MRI visualization with therapeutic intent of whole-gland ablation. Treatment was delivered under continuous MRI thermometry feedback control.

RESULTS

MR-TULSA was well-tolerated by all patients without intraoperative complications. Median (5th-9th percentile) treatment time and prostate volume were 36 (24-54) min and 44 (30-89) ml, respectively. Maximum temperature measured during treatment depicted a continuous region of heating shaped accurately to the prostate to within 0.1 ± 1.3 mm. CE-MRI confirmed the resulting conformal non-perfused volume, and correlated well with the ablative temperatures on MR-thermometry. Successful treatment was further indicated by a median PSA decrease from 5.8 (2.8-8.9) ng/ml to 0.8 (0.1-3.2) ng/ml after one month remaining stable at 0.8 (0.1-3.7) ng/ml to 12 month. MRI and biopsy findings at 12 month show diminutive prostate volumes, averaging 51% fibrosis (n=29). Positive biopsies (55% of patients) demonstrate 61% reduction in total cancer length.

CONCLUSION

MRI-guidance enables accurate treatment planning, real-time dosimetry and control of the thermal ablation volume. Primary outcomes show that MR-TULSA is safe and precise for prostate ablation. Phase I data are sufficiently compelling to study MR-TULSA in a larger efficacy trial.

CLINICAL RELEVANCE/APPLICATION

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

RC207-12 A Pilot Study to Evaluate Outpatient, Transrectal, Magnetic Resonance-guided Laser Focal Therapy for Treatment of Localized Prostate Cancer

Monday, Nov. 30 11:25AM - 11:35AM Location: N227

Participants

Bernadette M. Greenwood, BS, RT, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose
John F. Feller, MD, Indian Wells, CA (*Presenter*) Consultant, Koninklijke Philips NV Consultant, Visualase, Inc
Stuart T. May Sr, MD, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose
Roger McNichols, PhD, Houston, TX (*Abstract Co-Author*) Employee, BioTex, Inc
Wes Jones, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose
Axel Winkel, DiplEng, Schwerin, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV

PURPOSE

In the United States alone, new prostate cancer cases for 2014 were estimated at 233,000 and deaths at 29,480. Focal therapies for low risk and intermediate risk localized prostate cancer are increasingly being explored. Our objective is to investigate the safety and feasibility of using outpatient MR- (magnetic resonance) guided laser focal therapy for MR-visible prostate cancer utilizing a transrectal approach for laser applicator placement and therapy delivery.

METHOD AND MATERIALS

All MR-guided therapy was delivered using a 1.5T Philips Achieva XR system (Philips Healthcare, Best, The Netherlands) for both image acquisition and real-time thermometry. Follow-up multiparametric MRI's (mpMRI) were performed on the same scanner as were all follow-up MR-guided prostate biopsies. DynaCAD and DynaLOC (Invivo, Orlando, FL, USA) software were used for image analysis and interventional planning. Laser therapy was delivered using a Visualase (BioTex, Houston, TX, USA) 15W 980 nm laser applicator introduced transrectally using the DynaTRIM (Invivo, Orlando, FL, USA)

RESULTS

34 men were treated. 45 cancer foci were treated. Total procedure time was between 1.5 and 4 hours. MRI volume of coagulation necrosis ranged from 1.2-5.0cc. No serious adverse events or morbidity were reported. 7 treatment regions were positive at 6 month biopsy, consistent with residual/recurrent cancer (23% of subjects, 15% of treated regions). 4 regions were retreated with laser focal therapy. We observed a 35% decrease in mean PSA 1 year post-therapy and no statistically significant change in IPSS and SHIM scores at 6 months post-treatment. 4 patients went on to whole gland therapy: 3 incidence cancer patients (2 Gleason Score 4+4=8, 1 Gleason Score 4+3=7 multi-focal) elected radical prostatectomy (RP). No additional technical difficulty with dissection was reported by the surgeon performing RP. 1 Gleason 3+3=6 elected proton beam therapy (PBT) before undergoing 6 month follow-up and biopsy. Incidence cancer rate was 10%.

CONCLUSION

Our data indicate that outpatient transrectally delivered MR-guided laser focal therapy for localized prostate cancer is both safe and feasible.

CLINICAL RELEVANCE/APPLICATION

In the current climate of cost-reduction and emphasis on minimally-invasive treatment of cancer, focal treatment of prostate cancer with a precisely delivered energy source under MRI-guidance may have favorable results for cost control and quality of life.

RC207-13 Focal Therapies

Monday, Nov. 30 11:35AM - 12:00PM Location: N227

Participants

Aytekun Oto, MD, Chicago, IL, (oto@uchicago.edu) (*Presenter*) Research Grant, Koninklijke Philips NV; ; ;

LEARNING OBJECTIVES

1) Emerging paradigm of focal therapy for early stage low risk prostate cancer. 2) Current status of different focal therapy methods including laser ablation, high intensity focused US, electroporation and cryotherapy. 3) Challenges in patient monitoring following focal therapy. 4) Future developments in focal therapy of prostate cancer and the importance of radiologist's involvement.

ABSTRACT

TITLE: Image guided focal therapy of prostate cancer Focal therapy of low risk early stage prostate cancer is increasingly important as a minimally invasive option for many patients. The rationale, patient selection criteria and challenges for image-guided focal prostate cancer therapy will be discussed. The essential technical details, advantages and disadvantages of clinically available focal therapy methods will be reviewed. Post-therapy patient monitoring options will be presented. Future developments in the area of focal therapy of prostate cancer and opportunities for involvement of radiologists in focal therapy will be explored.

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Aytekın Oto, MD - 2013 Honored Educator

RC251

Common Dilemmas in Lung Imaging

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



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

Participants

Sub-Events

RC251A An Algorithm for Lung Nodule Interpretation

Participants

Christian J. Herold, MD, Vienna, Austria (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand how different clinical scenarios influence the management of patients with pulmonary nodules. 2) To apply state-of-the-art features, methods and guidelines for the work-up of pulmonary nodules. 3) To develop an algorithm for the management of pulmonary nodules for various risk groups.

RC251B Current Concepts in Lung Cancer Staging: What the Clinician Wants to Know

Participants

Brett W. Carter, MD, Houston, TX, (bcarter2@mdanderson.org) (*Presenter*) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc; ;

LEARNING OBJECTIVES

1) Outline the staging system used for lung cancer. 2) Illustrate specific TNM descriptors through representative examples on imaging studies. 3) Synthesize TNM descriptors into stages and evaluate the impact on patient management. 4) Review limitations of the current system and assess the potential influence on image interpretation.

ABSTRACT

Lung cancer is the most common cause of cancer-related death in men and women in the United States. The seventh edition of the TNM staging system for lung cancer was published in 2009 by the International Union Against Cancer and the American Joint Committee on Cancer and was based on findings from the International Staging Project of the International Association for the Study of Lung Cancer (IASLC). In addition to the inclusion of small cell lung cancer and bronchopulmonary carcinoid, key revisions were made to the tumor (T) and metastasis (M) descriptors based on differential 5-year survival. As accurate staging of lung cancer is crucial to formulating treatment plans and optimizing survival, radiologists should be familiar with the current TNM staging system and understand the strengths of weaknesses of the various thoracic imaging techniques used to diagnose and stage the disease.

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Brett W. Carter, MD - 2015 Honored Educator

RC251C A Simple Approach to Interstitial Lung Disease

Participants

Michael D. Hope, MD, San Francisco, CA, (michael.hope@ucsf.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify key findings of lung fibrosis and small airways disease. 2) List 4 telltale findings of specific subtypes of interstitial lung disease. 3) Apply a simple methods for reliable characterization of the majority of cases of interstitial lung disease.

RC210

Abdominal Doppler (An Interactive Session)

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



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

Participants

Sub-Events

RC210A Imaging and Doppler of Portal Hypertension

Participants

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

LEARNING OBJECTIVES

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

RC210B Doppler Evaluation of Mesenteric Vessels

Participants

John S. Pellerito, MD, Manhasset, NY, (johnp@nshs.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify applications for Doppler evaluation of the mesenteric arteries and veins. 2) Develop techniques to detect and interpret mesenteric flow abnormalities. 3) Explain criteria for the interpretation of significant mesenteric arterial disease.

ABSTRACT

RC210C Renal Doppler: Vessels and Beyond

Participants

Deborah J. Rubens, MD, Rochester, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the technical parameters and diagnostic criteria of color and spectral Doppler interrogation of the renal arteries, veins and parenchyma. 2) Learn and apply new information regarding Doppler ultrasound applications including vascular disease, stone disease, renal masses and renal parenchymal disease. 3) Appreciate the value of renal Doppler and its role vs other vascular imaging with CT or MRI.

ABSTRACT

Renal Doppler: Vessels and Beyond This lecture will explore the use of Doppler ultrasound in the assessment of the kidney and its vascular supply. Doppler technique will be reviewed with particular attention to artifacts and pitfalls which may enhance or detract from diagnostic efficacy. The role of ultrasound imaging in assessment of acute as well as chronic renal dysfunction will be elucidated. The performance of Doppler ultrasound will be highlighted regarding vascular stenosis and occlusion, parenchymal perfusion, and diagnosis of renal masses and stones. Doppler techniques to avoid false negative and false positive studies will be emphasized. Controversial parameters will be stressed, in particular the use of absolute velocities versus ratios in the diagnosis of renal artery stenosis, especially in renal transplants. Surgical emergencies will be highlighted, and the role of correlative imaging with CT, MR and/or angiography will be addressed.

RC232

Hospital Contracting: The Radiologist's and The Attorney's Perspectives

Monday, Nov. 30 8:30AM - 10:00AM Location: E451A

LM

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

Participants

LEARNING OBJECTIVES

1) Identify the important elements of a hospital professional services agreement (radiology contract). 2) Describe the principles of negotiations that will benefit radiologists in their interactions with hospital administrators. 3) Discuss the roles of the radiologist and the attorney in hospital contract negotiations.

Sub-Events

RC232A The Attorney's Perspective

Participants

William K. Davis JR, JD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

B) Negotiating a Difficult Hospital Contract: The Attorney's PerspectiveW. Kenneth Davis, Jr, Chicago, IL ABSTRACTThis course is structured to explore the issues and opportunities involved in the process of negotiating a hospital radiology professional services agreement (hospital radiology contract). The principles of contract negotiations will be discussed, and the role of both the radiologist and the radiology-knowledgeable attorney will be covered. How the radiology leadership and the practice attorney interact will be explored. Potentially problematic clauses will be presented, and suggestions will be made to modify or eliminate these clauses. The importance of having the practice integrated into the medical, social, and political fabrics of the hospital and the community will be stressed. The faculty will introduce the concept of power in a negotiation, and they will define common negotiation terms. Issues of radiology group communication and unity during the process will be discussed. There will be sufficient time for questions from the attendees.

RC232B Hospital Contracting: The Radiologist's Perspective

Participants

Lawrence R. Muroff, MD, Tampa, FL, (LRMuroff@hotmail.com) (*Presenter*) CEO, Imaging Consultants, Inc; President, Imaging Consultants, Inc; ; ;

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

This course is structured to explore the issues and opportunities involved in the process of negotiating a hospital radiology professional services agreement (hospital radiology contract). The principles of contract negotiations will be discussed, and the role of both the radiologist and the radiology-knowledgeable attorney will be covered. How the radiology leadership and the practice attorney interact will be explored. Potentially problematic clauses will be presented, and suggestions will be made to modify or eliminate these clauses. The importance of having the practice integrated into the medical, social, and political fabrics of the hospital and the community will be stressed. The faculty will introduce the concept of power in a negotiation, and they will define common negotiation terms. Issues of radiology group communication and unity during the process will be discussed. There will be sufficient time for questions from the attendees.

Breast Series: Hot Topics in Breast Imaging

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



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

Participants

Wendie A. Berg, MD, PhD, Pittsburgh, PA, (wendieberg@gmail.com) (*Moderator*) Consultant, SuperSonic Imagine; Departmental Research Grant, General Electric Company ; Departmental Research Grant, Hologic, Inc; Equipment support, Gamma Medica, Inc; Equipment support, General Electric Company; Equipment support, Hologic Inc; ;
Sarah M. Friedewald, MD, Chicago, IL (*Moderator*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc
Elizabeth A. Morris, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

RC215-01 Tomosynthesis

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

Participants

Liane E. Philpotts, MD, New Haven, CT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Assess the increasing body of literature concerning digital breast tomosynthesis. 2) Describe its use in both the screening and diagnostic mammography environments. 3) Evaluate the benefits of tomosynthesis and understand how it is dramatically changing the whole practice of breast imaging.

ABSTRACT

Tomosynthesis is revolutionizing breast imaging. The evidence to date reveals consistent reductions in false positives and increases in invasive cancer detection in screening mammography. This should have a profound effect on shifting the balance of benefits and harms of screening mammography. In addition, tomosynthesis has a dramatic effect on diagnostic mammography, resulting in expedited imaging, fewer patients requiring follow up, and increases in the positive predictive value of biopsy recommendations. Interpretation time and learning curve are considerations in utilizing tomosynthesis. Correct utilization requires careful interpretation of images and careful correlation with multi-modality imaging, particularly ultrasound. Downstream effects of tomosynthesis lead to dramatic changes in workflow. Cost analyses point to cost savings with tomosynthesis.

RC215-02 Three Consecutive Years of Screening with Digital Breast Tomosynthesis: Are the Outcomes Sustainable?

Monday, Nov. 30 8:50AM - 9:00AM Location: Arie Crown Theater

Participants

Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Scientific Advisory Board, Hologic, Inc
Andrew Oustimov, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Siemens AG
Elizabeth McDonald, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Marie Synnestvedt, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Mitchell D. Schnall, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Studies have shown improved screening outcomes when digital breast tomosynthesis (DBT) is combined with digital mammography (DM) compared to screening with DM alone. However, questions exist regarding the sustainability of outcomes over consecutive years. Are the improved DBT outcomes due to prevalence rather than incidence screening? What impact is there on interval cancer rates? We investigate these issues by comparing outcomes from 3 years of consecutive DBT screening of our entire clinic population. Cancer registry data is used to determine interval cancer rates.

METHOD AND MATERIALS

We have screened over 33,000 patients with DBT after complete conversion in 9/2011. Recall rates, cancer detection rates, PPVs, biopsy rates and interval cancer rates within 1 year will be compared over the 3 year period with prior DM rates. A positive screen is defined as recall prompting a biopsy recommendation (cat. 4, 5). Patients assigned to short-term follow-up (cat. 3) are considered negative screens. Network cancer registry data through 12/2014 is used to determine interval cancer rate (defined as symptomatic cancers presenting at <1 year).

RESULTS

The reduction in recall from the baseline DM rate of 10.4% remained statistically significant over 3 DBT years ($p < 0.001$, < 0.001 and 0.003 , respectively) however, showed a non-significant trend upward from DBT yr 1 to 3 (8.8, 9.0 and 9.2%). Cancer detection rates/1000 screened continued to increase from baseline DM rate of 4.6 to 5.5, 5.8 and 6.1 for DBT yr 1 to 3, but the trend was non-significant ($p = 0.108$). The biopsy rate remained relatively stable, however, PPV1, 2 and 3 showed continued increases over time, with the trend in PPV1 statistically significant ($p = 0.025$). The interval cancer rate decreased from 0.9/1000 screened for DM to 0.5 for DBT yr 1 and 0.1 for DBT yr 2. There is not adequate follow-up to calculate interval cancer rate for DBT yr 3.

CONCLUSION

Our data shows that not only are DBT screening outcomes sustainable, there are continued trends of increased cancer detection

and PPVs over time. There was also a decrease in interval cancer rate with DBT within 1 year of screening suggesting that DBT detects more, clinically significant interval cancers.

CLINICAL RELEVANCE/APPLICATION

Consecutive years of screening with DBT demonstrate sustainable and even continually improving outcomes as measured by increased cancer detection and a trend of decreasing interval cancers.

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Mitchell D. Schnall, MD, PhD - 2013 Honored Educator

RC215-03 Screen-detected and Interval Cancers before, During, and after Implementation of Digital Breast Tomosynthesis in a Population-based Mammography Screening Program

Monday, Nov. 30 9:00AM - 9:10AM Location: Arie Crown Theater

Participants

Per Skaane, MD, PhD, Oslo, Norway (*Presenter*) Equipment support, Hologic, Inc; Consultant, Hologic, Inc; Support, Hologic, Inc
Sofie Sebuodegard, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
David Gur, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Randi Gullien, RT, Oslo, Norway (*Abstract Co-Author*) Support, Hologic Inc; Travel support, Hologic, Inc
Solveig S. Hofvind, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze cancer detection and interval cancer rates before, during, and after implementation of digital breast tomosynthesis (DBT) in organized breast cancer screening.

METHOD AND MATERIALS

The prospective screening trial including DBT was approved by the Ethical Committee. All participating women signed a written consent. The screening program includes women 50-69 years invited biannually to two-view full-field digital mammography (FFDM) screening. Image interpretation is carried out in batch reading mode with independent double reading using a 5-point rating scale for probability of cancer, with consensus/arbitration decision for all positive scores before final decision to recall. Incident screening exams (prior exams performed 2 years earlier) of the first years of four subsequent screening rounds in 2007 (FFDM), 2009 (FFDM), 2011 (FFDM plus DBT), and 2013 (FFDM only) were analyzed. Prevalent screen exams were excluded from analysis. Interval cancers of incident screened women in 2007, 2009, and 2011 were recorded based on a two-year follow-up period. Attendance as well as cancer detection rates (invasive cancers and DCIS), and interval cancer rates were compared using t-test with 95% confidence intervals (CI).

RESULTS

The number of women in the study population was 10,755, 11,069, 8,269, and 8,580 in 2007, 2009, 2011, and 2013, respectively. The numbers and rates (per 1,000 screen exams) of screen-detected cancers were 67 and 6.2 (95% CI 4.7-7.7), 52 and 4.7 (95% CI 3.4-6.0), 81 and 9.7 (95% CI 7.6-11.8), and 41 and 4.8 (95% CI 3.3-6.2) in 2007, 2009, 2011, and 2013. The numbers and rates (per 1,000 screen exams) of interval cancers were 22 and 2.1 (95% CI 1.2-2.9), 32 and 2.9 (95% CI 1.9-3.9), 17 and 2.1 (95% CI 1.1-3.0) for women screened in 2007, 2009, and 2011, respectively.

CONCLUSION

Implementation of digital breast tomosynthesis increases the cancer detection rate in mammographic screening. The interval cancer rate remained stable.

CLINICAL RELEVANCE/APPLICATION

Tomosynthesis increases cancer detection rate in organized mammographic screening. Further studies are needed for evaluating the interval cancer rates.

RC215-04 Missed Breast Cancer by Digital Mammography and Tomosynthesis

Monday, Nov. 30 9:10AM - 9:20AM Location: Arie Crown Theater

Participants

Miguel A. Pinochet, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Eleonora Horvath, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Monica P. Rochels, MD, Santiago, Chile (*Presenter*) Nothing to Disclose
Claudio S. Silva Fuente-Alba, MD, MSc, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Marcela Uchida, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Maria Paz Duran Caro, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Heriberto Wenzel, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Eduardo Soto, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Maria Cecilia P. Galleguillos, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Maria E. Droguett, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Full-field digital mammography (FFDM) plus digital breast tomosynthesis (DBT) have shown to improve the sensitivity of breast cancer detection in screening programs. The purpose of this study was to analyze the imaging and histopathological characteristics of the breast cancers missed by FFDM and DBT.

METHOD AND MATERIALS

IRB approved, retrospective review of 223 consecutive breast cancers evaluated by FFDM plus DBT and Ultrasound (US) examination between 2013 and 2014. Variables assessed were: age, breast density (ACR 1-4), tumor size, location in the parenchyma, presence of microcalcifications, detailed morphological features in different imaging methods, histopathological tumor type and molecular subtype. Qualitative variables were described by percentage distribution, median and range.

RESULTS

Detection-rate of FFDM and DBT were: 83.0% and 90.5% respectively, with a substantial interreader agreement ($k=0.67\pm 0.06$). In total we found 38 cancers (17%) undetectable in FFDM. Of these, 17 (7.5%) were recognized by DBT as a focal distortion or spiculated mass; 14 of them in dense breast (ACR 3-4). Finally 21 cancers (9.5%) among 20 women (median age: 53 years; range 41-64 years) were occult also in DBT, all identified by US. Breast density according to ACR 2, 3 and 4 was 10%, 65%, and 25% respectively. Median tumor size was 8.5 mm (range 4-35 mm). All cancers had an intraparenchymatous location, were microlobulated, without microcalcifications nor distortion. Two cases were DCIS and 19 infiltrating (14 ductal and 5 lobular). Thirteen were luminal A, 4 luminal B and 2 HER2 positive subtypes.

CONCLUSION

DBT improved the detection-rate of the FFDM, depicting more cancers that appeared as distortions or spiculated masses in dense breast tissue. However, the DBT also has limitations: it is not able to recognize 9.5 % of all breast cancers, mainly those small, infiltrating, non-calcified, non-spiculated, within dense parenchyma. Complementary breast US allows their earlier detection.

CLINICAL RELEVANCE/APPLICATION

We describe the imaging characteristics of those cancers that remain occult in FFDM and in DBT.

RC215-05 Performance Measures When Interpreting FFDM Examinations with Increasing Experience with DBT Based Screening in a Mixed FFDM/DBT Practice

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

Participants

David Gur, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Margarita L. Zuley, MD, Pittsburgh, PA (*Abstract Co-Author*) Research Grant, Hologic, Inc;

Jules H. Sumkin, DO, Pittsburgh, PA (*Abstract Co-Author*) Scientific Advisory Board, Hologic, Inc

PURPOSE

To assess radiologists' recall and cancer detection rates when interpreting full field digital mammography (FFDM) examinations as experience with digital breast tomosynthesis (DBT) increased in a mixed FFDM and DBT practice.

METHOD AND MATERIALS

Using MQSA and pathology reporting data, we reviewed FFDM recall and cancer detection rates for 12 radiologists in a mixed FFDM and DBT practice before they interpreted DBT and then after they each interpreted 500 DBT screening examinations, and for 5 radiologists after interpreting 1000 DBT examinations. All diagnostic recommendations were obtained from our radiology databases and outcome measures were verified by pathology. Individual and pooled data were assessed at a two sided significance level of $p<0.05$.

RESULTS

A total of 41,871 FFDM examinations were reviewed and analyzed pre DBT and 38,664 and 18,395 FFDM examinations were reviewed and analyzed post 500 and 1000 interpretations of DBT examinations, respectively. We observed no significant changes ($p>0.05$) in recall rates for FFDM as experience with DBT increased from virtually none to 500 DBT interpretations and later to over 1000 DBT interpretations. Average recall rates for FFDM were 11.4%, 11.6% and 11.3%, respectively, with no individual demonstrating a significant change or a relative rank order change on a relative scale ($p>0.05$). We observed no significant changes in cancer detection rates (CDRs) with increased experience with DBT from virtually none to 500 DBT interpretations and later to over 1000 DBT interpretations. Group CDRs were 4.7, 5.0, and 4.7 per 1000 FFDM screening examinations during the three periods, respectively ($p>0.05$). Pooled data group changes in recall rates had concordant trend changes in CDRs, albeit the trends were not statistically significant ($p>0.05$).

CONCLUSION

Despite expectations for improved performance, in particular in terms of recall rates, when interpreting FFDM examinations as experience with DBT increases in a mixed FFDM/DBT practice, radiologists reporting patterns and cancer detection rates did not change significantly.

CLINICAL RELEVANCE/APPLICATION

In a mixed FFDM/DBT practice, radiologists reporting patterns and cancer detection rates when interpreting FFDM examinations did not change significantly as experience with DBT increased.

RC215-06 Integrated Interpretation of Digital Breast Tomosynthesis and Ultrasound in Asymptomatic Women with Dense Breasts

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

Participants

Jung Min Chang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

Won Hwa Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Woo Kyung Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performances of combined digital mammography (DM) and digital breast tomosynthesis (DBT) versus combined DM and breast ultrasound (US) in asymptomatic women with dense breasts, and to evaluate the performance of an

integrated interpretation of DBT and US.

METHOD AND MATERIALS

This study was approved by our Institutional Review Board and all patients provided informed consent. 196 pairs of DBT and US images from asymptomatic women with dense breasts (median age, 51 years; range, 21-77), who underwent screening examinations comprised our study population. Two independent prospective reading sessions of DBT and US with information of DM were performed in parallel by 12 radiologists blinded to the other examinations, and the integration of the results from both examination was performed by 2 expert breast radiologists in consensus, downgrading BI-RADS 3 lesions on US to BI-RADS 2 if DBT showed benign findings (BI-RADS categories 1 to 3). Sensitivity, specificity, negative predictive value (NPV), and positive predictive value (PPV) for recall of DBT, US, and their integrated results were compared using McNemar test, and Fisher's exact test.

RESULTS

Among 196 women, 27 lesions were assessed as showing suspicious findings on DBT, and 60 on US. Five cancers (mean invasive tumor size, 1.9cm; range 0-2.8cm) were detected on both DBT and US. Sensitivities and NPVs were 100% for both DBT and US. Specificity and PPVs for recall were 96.9% and 18.5% for DBT and 90.6% and 8.3% for US. The specificity for DBT was significantly higher than that of US ($P=0.008$). Integrated results downgrading BI-RADS 3 lesions on US to BI-RADS 2 if DBT showed benign findings yielded a significant reduction in the recall rate (30.6% vs. 12.2%, $P=0.0004$) without sensitivity loss.

CONCLUSION

For asymptomatic women with dense breasts, DBT combined with DM showed higher specificity than US combined with DM, and the integration of DBT information to US, resulted in decreased recall rates without loss in sensitivity.

CLINICAL RELEVANCE/APPLICATION

DBT is a beneficial method in evaluating dense breasts on DM, and integrated reading of DBT and US may induce reduction of short-term follow-up without change in sensitivity.

RC215-07 Whole Breast Ultrasound

Monday, Nov. 30 9:40AM - 10:00AM Location: Arie Crown Theater

Participants

Regina J. Hooley, MD, New Haven, CT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the indications for whole breast ultrasound. 2) Be familiar with the advantages and disadvantages of automated and handheld whole breast ultrasound. 3) Review optimal technique and strategies to improve specificity of whole breast ultrasound.

ABSTRACT

Technological advances and improvements in scan resolution have led to increased utility of whole breast ultrasound. Whole breast ultrasound is more widely accepted as a supplemental screening tool in women with dense breasts and a negative mammogram, but may also be used to evaluate disease extent in women with a new diagnosis of breast cancer. Whole breast ultrasound may be performed using a traditional handheld technique or using an automated scanner, which is less operator dependent. Careful attention to scanning technique is essential to produce high quality images, as well as to improve overall sensitivity and specificity.

RC215-08 Update on Technologist-performed, Screening Breast Ultrasound in Women with Dense Tissue 5 Years after CT Public Act No. 09-41: How Are We Doing Now?

Monday, Nov. 30 10:00AM - 10:10AM Location: Arie Crown Theater

Participants

Liane E. Philpotts, MD, New Haven, CT (*Presenter*) Nothing to Disclose
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Laura J. Horvath, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
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Regina J. Hooley, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Much experience has been gained during 5 years of performing screening whole breast ultrasound (US) on women with dense tissue. The purpose of this study was to assess current outcomes of these exams and compare to results obtained in our first year.

METHOD AND MATERIALS

A HIPAA-compliant, retrospective review of the breast imaging database (PenRad, MN) was performed to identify all screening ultrasound exams performed at a satellite office of a tertiary academic cancer hospital, during a 5 month period (10/1/14-2/28/15). All screening US exams were performed by dedicated breast technologists using hand-held scanning and with on-site dedicated breast radiologists available. Only cases reported as normal and dense on recent screening mammogram were included. Patients undergoing diagnostic mammography or follow up ultrasounds were not included. The BIRADS final assessment, positive predictive value (PPV3) and cancer detection rate (CRD) was determined and compared to results obtained in our practice in the first year of performing screening ultrasound (10/1/09 - 9/30/10).

RESULTS

756 supplemental screening US were performed during the time period, of which 708 (94%) were reported as normal (BIRADS 1,2). 40 cases (5%) were reported as BIRADS 3. Only eight biopsies were recommended (BIRADS 4,5 1%) of which 2 were malignant (both invasive ductal carcinoma), PPV3=25%. This yield a cancer detection rate of 2.6 per 1000 (2/756). In comparison to our first year results, there has been significant changes with and increase in the rate of BIRADS 1,2 (75% vs 94%, $p<0.0001$), a decrease in the rate of BIRADS 3 (20% vs 5%, $p<0.0001$), fewer biopsies recommended BIRADS 4,5 (5% vs 1%, $p<0.0001$), and an

improvement in the PPV3(6.5% vs 25%, $p < 0.0001$) with maintained CDR (3.2 vs 2.6 per 1000).

CONCLUSION

There has been a large shift in the outcome of supplemental screening ultrasound performed during 5 years with significantly fewer false positives and a higher PPV with maintained CDR, resulting in greatly improved performance of this exam.

CLINICAL RELEVANCE/APPLICATION

With experience, the performance and outcome of supplemental screening ultrasound is greatly improved.

RC215-09 Radiologists' Specificity in Reading Automated Breast Ultrasound (ABUS) Can Be Improved by Computer Aided Arbitration

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

Participants

Jan Van Zelst, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Tao Tan, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, QView Medical, Inc
Andre R. Grivegnée, MD, Linkebeek, Belgium (*Abstract Co-Author*) Nothing to Disclose
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Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG

PURPOSE

Screening for breast cancer with supplemental Automated Breast Ultrasound (ABUS) increases the amount of unnecessary recalls for benign lesions that otherwise would not have been observed. We investigated the effect of using Computer Aided Detection (CADE) software as independent arbiter on radiologists' findings on the sensitivity and specificity of ABUS for breast screening.

METHOD AND MATERIALS

The IRB waived the need for informed consent for this study. Randomly selected views from ABUS scans (Siemens, ABUS) of 89 women were included. 19 women had malignancies, 30 had benign lesions and 40 women had no abnormalities. Three dedicated breast radiologists and a 4th year resident with experience in reading ABUS participated in this multi-reader-multi-case (MRMC) study. They read all 89 cases without aid from CADE and were instructed to mark and report their findings using a 0-100 likelihood-of-malignancy scale. The CADE program (Qview Medical Inc, Los Altos, Ca.) also analyzed the 89 cases independent from the radiologists, providing suspicious region candidates for each case. The locations of the findings of the radiologists were compared to the locations of the CADE software findings. Radiologist's findings were considered suspicious only when the marked lesions matched to the candidates of CADE. Radiologists' findings that were not marked by CADE were regarded as benign. MRMC ROC analysis was used to compare the area under the ROC curve (AUC) of the normal unaided readings to the AUC of the readings after computer aided arbitration.

RESULTS

The AUC improved significantly from 0.77 to 0.88 after arbitration, using the CADE software ($p = 0.01$). Furthermore, the partial AUC in the range of 90-100% specificity also improves significantly from 0.05 to 0.065 ($p = 0.04$). The radiologists' findings that were subsequently overruled by the CADE program were mostly true benign lesions or artefacts. None were malignant.

CONCLUSION

Using CADE software for computer aided arbitration has the potential to improve the specificity of breast radiologists screening with ABUS.

CLINICAL RELEVANCE/APPLICATION

CADE arbitration may help to identify unnecessary referrals for non-malignant lesions that can be reevaluated by second readers and potentially increase specificity without losing sensitivity.

RC215-10 Supplemental Automated Breast Ultrasound Screening in BRCA Gene Mutation Carriers; Is There Any Value?

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

Participants

Jan Van Zelst, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Gwendolyn Woldringh, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Roel D. Mus, MD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Intensive yearly breast cancer screening programs for BRCA carriers with MRI and mammography (XM) detect many cancers at an early stage. However, BRCA carriers still present with interval cancers. In this prospective study we investigated whether automated breast ultrasound (ABUS) leads to earlier or additional detection of breast cancer.

METHOD AND MATERIALS

This study was approved by a local IRB and is HIPAA compliant. 295 female BRCA gene mutation carriers signed informed consent for this study. They were offered 5 round of screening in two years. A team of 4 dedicated breast radiologists read all

examinations. We analyzed sensitivity, specificity and positive predictive value (PPV) of all three modalities. Furthermore, we retrospectively reevaluated prior ABUS scans of cancer patients and the ABUS scans of ultrasound negative cases in this cohort.

RESULTS

Out of 295 BRCA gene mutation carriers, 16 women were diagnosed with a screening-detected breast cancer. In six women, pure DCIS with no invasive component was found. None of the DCIS, not prospectively or in retrospect, was found on ABUS. In ten women, invasive breast cancer (IBC) was detected. Seven of these IBCs were found on ABUS. No additional cancers were found with ABUS. For six out of ten IBCs a prior ABUS scan was available. In retrospect, two IBCs (33,3%) were retrospectively visible on the ABUS scan six months earlier and one of these was detected but classified as BI-RADS 2. Also two interval IBCs (12.5%) occurred in between screening rounds and one of these cancer was also detected six months earlier but classified as BI-RADS 2. For XM, MRI, and ABUS sensitivity was 0.50, 0.88 and 0.44, specificity 0.97, 0.95 and 0.95 and PPV 0.32, 0.28 and 0.09, respectively

CONCLUSION

In our BRCA screening program, MRI and XM together detect most of the cancers. In this study, adding ABUS did not increase cancer detection. In retrospect, some cancers were seen earlier, but regarded benign due to a benign appearance, which is common in the BRCA population.

CLINICAL RELEVANCE/APPLICATION

High interval cancer rates in the BRCA carrier population justifies intensifying the yearly screening regimen of MRI and XM, however at this point adding ABUS does not seem to offer a solution.

RC215-11 Supplemental Screening US in Combination with Elastography and Color Doppler US: Interim Results of a Prospective Multicenter Study

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

Participants

Su Hyun Lee, MD,PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sung Ui Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
A Jung Chu, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Sun Bae, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Kyung Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To validate the added value of elastography and color Doppler ultrasonography (US) for supplemental screening US in a multicenter study.

METHOD AND MATERIALS

This study was conducted with institutional review board approval, and written informed consent was obtained. From November 2013 to December 2014, 1,241 women (mean age, 46 yrs) with breast masses (mean size, 1.0cm) detected on supplemental screening US and assessed as BI-RADS category 3 or higher were prospectively recruited from 10 tertiary care centers. After identifying the mass of interest on B-mode US, elastography (strain elastography in 4 sites; shear-wave elastography in 6 sites) and color Doppler US were performed. Investigators assessed the likelihood of malignancy as a percentage at the time of enrollment using the four data sets: B-mode US alone, B-mode US with elastography, B-mode US with color Doppler US, and B-mode US with elastography and color Doppler US. Reference standard of biopsy or at least 1 year of follow-up was completed in 1,050 women (84.6%) and included in the interim analysis.

RESULTS

71 of 1,050 breast masses (6.8%) were malignant. The areas under the receiver operating characteristics curve (AUC) of B-mode US increased from 0.878 to 0.922 (P=.039) and 0.911 (P=.157) when elastography or color Doppler US was added, respectively. When both elastography and color Doppler US were added to B-mode US, the highest AUC (0.957) was achieved (P<.001). The majority of breast masses in our cohort (91.5%, [961/1050]) was assessed as BI-RADS category 3 or 4A on B-mode US and included 25 malignancies (9 DCIS, 16 invasive carcinoma). None of invasive cancers but only one DCIS showed negative findings on both elastography and color Doppler US. If the BI-RADS category 3 or 4A masses with negative findings on both elastography and color Doppler US were managed with 1-year follow-up, a considerable number of benign biopsies (84.0%, [539/642]) and unnecessary short-term follow-up (85.7%, [252/294]) can be reduced yielding higher PPV (27%, [70/258]) compared to that of B-mode US alone (6.8%, [71/1050]).

CONCLUSION

Combined use of elastography and color Doppler US can increase the PPV of supplemental screening US for breast cancer detection.

CLINICAL RELEVANCE/APPLICATION

Combined use of elastography and color Doppler US can reduce a considerable number of unnecessary biopsies or short-term follow-up induced by supplemental screening breast US.

RC215-12 Breast MRI: Screening and Diagnostic Use

Monday, Nov. 30 10:50AM - 11:10AM Location: Arie Crown Theater

Participants

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

LEARNING OBJECTIVES

1) To list shortcomings of mammographic screening for breast cancer. 2) To define the term 'overdiagnosis' and distinguish it from 'false positive diagnoses'. 3) To list the current indications for screening with Breast MRI. 4) To describe pathophysiological

processes that determine diagnosis of breast cancer in MRI vs. in mammography. 5) To list the advantages and limitations of non-mammographic screening.

RC215-13 Prospective Abbreviated MRI (AB-MR) Exam in a Screening Cohort Compared with Conventional Breast MRI

Monday, Nov. 30 11:10AM - 11:20AM Location: Arie Crown Theater

Participants

Claudia R. Seuss, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yiming Gao, MD, New York, NY (*Presenter*) Nothing to Disclose
Amy N. Melsaether, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hildegard B. Toth, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate an AB-MR in women at intermediate and high-risk (HR) for breast cancer.

METHOD AND MATERIALS

An IRB approved study was performed on 86 asymptomatic women who underwent 114 breast MRI exams from 12/2011 - 12/2013. All women were at risk for breast cancer, had dense breasts, had surgery and/or follow up imaging. The breast MRI was performed on a 3T magnet with an acquisition time of 10 minutes. A single reader prospectively interpreted the AB-MR by reviewing the first post-contrast scan, T2 scan and prior studies. Comparison was made to the original diagnostic interpretation. Also, two additional readers retrospectively review the AB-MR exams. Final BIRADS assessment and confidence score was assessed for each lesion.

RESULTS

Of 86 women, 17 (19.8%) at HR, of which 11 (12.8%) were BRCA carriers, and 58 (67.4%) were at intermediate risk. Mean age was 46 years, range 29-76 years. Mean lesion size was 0.7cm (range 0.3 - 4cm). Sensitivity was 100%; 8 cancers (3 DCIS and five invasive cancer) were identified by the readers. All four cancers in BRCA carriers were identified by all readers. Using the abridged protocol, the specificity was 71% and an additional 14 findings were identified prospectively. The specificity for the retrospective review was 59 - 76%. Kappa score showed good interobserver agreement among the 3 readers. Mild to moderate BPE ($p=0.02$) small lesion size ($< 0.6\text{cm}$) ($p=0.03$) and absence of high signal T2 correlate ($p=0.01$) were significantly correlated with decreased confidence by all 3 readers. Of the 114 exams, 78 (68.4%) were originally assessed as BIRADS 1 or 2, 9 (7.9%) as BIRADS 3, 27 (23.7%) as BIRADS 4 or 5. Among the 3 readers, there was a statistically increase rate of BIRADS 3 assessments - 9.1 - 17.6% ($p=0.04$) but not for BIRADS 4 assessments 19.2 - 26.3% ($p=.76$).

CONCLUSION

An abridged breast MRI in a screening population had a high sensitivity but moderate specificity.

CLINICAL RELEVANCE/APPLICATION

An AB-MR screening exam can detected all the breast cancers but at the expense of a higher rate of follow up imaging.

RC215-14 Efficacy of Annual MRI for High-risk Breast Cancer Screening

Monday, Nov. 30 11:20AM - 11:30AM Location: Arie Crown Theater

Participants

Sarah Stampler, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Janice S. Sung, MD, New York, NY (*Presenter*) Nothing to Disclose
Jennifer B. Kaplan, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Tammy Huang, MD, Short Hills, NJ (*Abstract Co-Author*) Nothing to Disclose
Carol H. Lee, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
D. David Dershaw, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher E. Comstock, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the need for annual MRI in high-risk screening.

METHOD AND MATERIALS

IRB approved retrospective review was performed to identify breast cancers detected on screening breast MRI between January 2005-December 2010. Medical records were reviewed for risk factors (family history, personal history, BRCA status, prior high risk lesion) and tumor histopathology. The time intervals between the MRI on which the cancer was detected and the patient's baseline and most recent prior screening MRI were determined.

RESULTS

18,065 screening MRIs in 7,517 women were performed during the study period. 170 cancers were detected in 167 women (2.2%). 63/170 (37%) cancers were detected on baseline MRI. Of 107 (63%) cancers detected on a subsequent MRI, 81 (75%) were invasive, mean size= 0.7 cm, 9/107 (8%) node positive. 82/107 (77%) had a negative screening MRI within 1.3 years prior to the MRI on which the cancer was detected. Cancers were found at 1 year follow up (<1.5 years) in 17 (16%), at 2 years (1.5-2.5) in 25 (23%), and 65 (61%) on additional years of follow up. Results were independent of risk factors.

CONCLUSION

Annual MRI effectively detects node negative, subcentimeter invasive cancers in a high-risk population. These cancers were not seen on MRI 1 year earlier suggesting the need for annual screening in this population.

CLINICAL RELEVANCE/APPLICATION

Annual MRI is the most appropriate screening interval for high-risk women, detecting node negative subcentimeter invasive cancers.

RC215-15 Longitudinal Results of a Breast MRI Screening Program for Patients at High and Intermediate Risk: Does BRCA Status Matter?

Monday, Nov. 30 11:30AM - 11:40AM Location: Arie Crown Theater

Participants

Suzan Vreemann, MSc, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Albert Gubern-Merida, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Susanne Lardenoije, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
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Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG

PURPOSE

Breast cancer screening in women at elevated risk is performed with yearly MRI and mammography. This includes women with BRCA mutations and women at elevated risk for other causes (mainly family history). The purpose of this study was to assess differences between BRCA mutation carriers and non-BRCA patients in a longitudinal MRI screening program in terms of recall rate, positive predictive value, and detection.

METHOD AND MATERIALS

An IRB approved, retrospective review of patient files from women screened with breast MRI between 2003 and 2013 was performed at our academic center. We analysed 9,504 screening MR examinations in 2843 women (age: 45 ± 12.09 years), including 761 BRCA patients, and 2082 non-BRCA patients. Recall rate (RR), positive predictive value (PPV), and cancer detection rate (CDR) were evaluated for first round examinations and follow-up examinations separately. BRCA patients were compared with non-BRCA patients. Chi-square tests were used to determine statistical significance.

RESULTS

The RR for BRCA patients in the first round of screening was 86.07 per 1000 examinations and 52.58 per 1000 examinations in non-BRCA patients ($p < 0.001$). The PPV for BRCA patients in the first round of screening was found to be 0.44, compared to 0.50 in non-BRCA patients ($p = 0.013$). The CDR was 38.25 per 1000 examinations for BRCA patients and 26.53 per 1000 examinations for non-BRCA patients ($p < 0.001$). In follow up, the RR was found to be 24.92 per 1000 examinations for BRCA patients and 22.81 per 1000 examinations for non-BRCA patients ($p < 0.001$). The PPV was 0.46 for BRCA patients and 0.21 for non-BRCA patients ($p < 0.001$). CDR was 11.42 per 1000 examinations for BRCA patients and 4.86 per 1000 examinations for non-BRCA patients ($p < 0.001$).

CONCLUSION

RR and CDR are high for all patients in the first round. RR and CDR significantly decreased in follow-up rounds ($p < 0.001$). PPV remained at an acceptable level for both patient groups, and remains particularly high in BRCA carriers. RR, PPV, and CDR differed significantly between BRCA and non-BRCA patients in both first and follow up rounds.

CLINICAL RELEVANCE/APPLICATION

These results underline that MRI is an excellent tool for screening high risk patients. Cancer detection is very high in the first round in all patients, but remains high only in BRCA carriers in follow up rounds.

RC215-16 Ultrafast Dynamic Contrast Enhanced (DCE) MRI of the Whole Breasts: A Novel Imaging Technique for Breast Cancer Detection with Super High Temporal Resolution- Comparison of MIP Images between Ultrafast MRI and Regular DCE MRI

Monday, Nov. 30 11:40AM - 11:50AM Location: Arie Crown Theater

Participants

Hiroyuki Abe, MD, Chicago, IL (*Presenter*) Consultant, Seno Medical Instruments, Inc
Naoko Mori, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiko Tsuchiya, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
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Federico Pineda, BS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Gregory S. Karczmar, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Milica Medved, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether DCE ultrafast MRI (UFMRI) is equal or superior to regular DCE MRI in terms of cancer detection using maximum intensity projection (MIP) images.

METHOD AND MATERIALS

The acquisition protocol of UFMRI consisted of 5 pre and 8 post-contrast bilateral, fat-suppressed ultrafast acquisitions of whole breasts, with temporal resolution of 7 sec for 3T (spatial resolution: $1.5 \times 1.5 \times 3$ mm), or 9 sec for 1.5T (spatial resolution: $1.5 \times 1.5 \times 3.75$ mm); followed by four high spatial resolution acquisitions (spatial resolution: $0.8 \times 0.8 \times 0.8$ mm) with temporal resolution of 75 sec for 3T or followed by five acquisitions (spatial resolution: $1.0 \times 1.0 \times 1.0$ mm) with temporal resolution of 65 sec for 1.5T. Two radiologists compared MIP images of regular MRI (first phase) and UFMRI (first to eighth phase) of 16 patients with breast cancer, to see if tumors are detectable with MIP images of each acquisition method. In total 30 known cancers were evaluated.

RESULTS

All 30 masses (100%) were detected on MIP images of the UFMRI, while 22 masses (73%) were detected on the MIP image of the regular MRI. Among the 22 masses detected on both, 3 masses were subtle on the regular MIP, but clearly seen on the UFMRI MIP.

Eight masses were not visible on regular MRI due to strong parenchymal enhancement (6 masses), misregistration artifacts (1 mass), and overlap with large vessels (1 mass).

CONCLUSION

UFMRI could represent a better method than regular MRI for the detection of breast cancer with MIP images.

CLINICAL RELEVANCE/APPLICATION

Enhancing lesions are clearly visualized with UFMRI due to the lack of interference from background parenchymal enhancement. MIP images of UFMRI may be useful as a new screening MRI protocol which would shorten the performance and interpretation time without lowering the sensitivity and therefore decrease costs.

RC215-17 Abbreviated MRI (AB-MR) of the Breast - Do We Need a Second Post-Contrast Scan?

Monday, Nov. 30 11:50AM - 12:00PM Location: Arie Crown Theater

Participants

Amy N. Melsaether, MD, New York, NY (*Presenter*) Nothing to Disclose
Yiming Gao, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Claudia R. Seuss, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Laura Heacock, MS, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

AB-MR exam has a high sensitivity for the detection of breast cancers. However, for AB-MR to be an effective screening tool, it should maintain a high sensitivity and specificity. The purpose of this study was to assess the diagnostic accuracy of an AB-MR using one and two post-contrast scans in a screening cohort.

METHOD AND MATERIALS

An IRB approved retrospective review of 145 women with 205 findings who underwent a breast MRI at 3T was performed by two readers. Women with dense breasts who were at risk for breast cancer were included. 61 (42%) women were newly diagnosed with breast cancer and 84 (58%) were asymptomatic high-risk women. The scan time for the 3 T1-scans was 4 minutes; the scan time for the T2-sequence was 4 minutes. Prior to this study, each reader interpreted 400 AB-MR exams. Final BIRADS assessment and confidence score was assessed for each lesion. Comparison was made to the original diagnostic interpretation.

RESULTS

73 (97%) of 76 invasive cancers and all 61 known cancers, especially those presenting as masses were detected on the first post-contrast scan. However, the second post-contrast scans allowed improved characterization of foci and NME but not for masses ($p < 0.03$). Of interest, about 10 (50%) of 20 DCIS were better seen on the second post contrast scan. Seven of 10 lesions were low or intermediate grade DCIS. With a single post contrast data set, 15 (10.3%) incidental NME not reported on the full breast MRI protocol was noted and recommended for additional imaging, follow-up or biopsy. The second post-contrast scan was as such able to downgrade a BIRADS 3 assessment in 9 (60%) lesions to a BIRADS 2 diagnosis assessment, none of which were malignant at follow-up. One interval cancer, low grade DCIS, was missed by both readers on the abbreviated two post-contrast data set protocol.

CONCLUSION

In an intermediate risk population with dense breasts, a second post-contrast scan both increased cancer detection and improved characterization of benign lesions, which led to a decrease in BI-RADS 3 assessments.

CLINICAL RELEVANCE/APPLICATION

Two post-contrast scans may be sufficient for an AB-MR exam to have a high sensitivity and specificity.

RC209

Gastrointestinal Series: Imaging Pancreatic Diseases

Monday, Nov. 30 8:30AM - 12:00PM Location: E351

GI

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

FDA

Discussions may include off-label uses.

Participants

Eric P. Tamm, MD, Houston, TX (*Moderator*) Nothing to Disclose
Onofrio A. Catalano, MD, Napoli, Italy (*Moderator*) Nothing to Disclose
Mahmoud M. Al-Hawary, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Honored Educators

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Kumaresan Sandrasegaran, MD - 2013 Honored Educator
Kumaresan Sandrasegaran, MD - 2014 Honored Educator

Sub-Events

RC209-01 Cutting-Edge Imaging on the Pancreas

Monday, Nov. 30 8:30AM - 8:55AM Location: E351

Participants

Riccardo Manfredi, MD, Verona, Italy (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To illustrate the role of contrast enhanced sonography and then Ultrasound elastography in pancreatic imaging The role and utility of dual energy CT examination in pancreatic CT and the clinical utility of low voltage CT examination in detecting pancreatic focal lesions. 2) To illustrate the role of diffusion weighted imaging in detecting small pancreatic neuroendocrine neoplasms, especially in functioning neuroendocrine neoplasms. 3) To show the pancreatic response to secretin stimulation; the pancreatic duct changes following secretin stimulation. 4) To illustrate how to diagnose pancreatic outflow obstruction due to Sphincter of Oddi dysfunction.

ABSTRACT

New pancreatic diagnostic imaging techniques are represented by contrast enhanced ultrasound (US), US Elastography, dual energy computed tomography (CT), perfusion CT, diffusion weighted Magnetic Resonance (MR) imaging, and secretin enhanced magnetic resonance cholangiopancreatography (S-MRCP). The role of contrast enhanced ultrasound (CEUS) in pancreatic sonography will be illustrated and its role in staging pancreatic adenocarcinoma. Ultrasound elastography is an emerging technique that is able to assess the stiffness of pancreatic parenchyma and might be helpful in diagnosis and staging chronic pancreatitis and in the differential diagnosis of focal pancreatic lesions. Dual energy CT might be useful in increasing the contrast resolution of pancreatic adenocarcinoma, and namely in diagnosing isovascular and/or small pancreatic adenocarcinomas, eventually responsible of main pancreatic duct stenosis. Diffusion weighted MR imaging is helpful in diagnosing focal pancreatic neoplasms and autoimmune pancreatitis. Its role in the abovementioned clinical settings will be discussed. MRCP is able to non-invasively assess pancreatic duct system. However in the assessment of pancreatic duct system MRCP has limitation due to the small size of the ducts. Secretin is able to improve the pancreatic duct system visualization at MRCP and at the same time is able to give functional information, since is able to physiologically stimulate the exocrine pancreas. The indication to S-MRCP and the S-MRCP signs in different pancreatic diseases will be illustrated.

RC209-02 Pancreatic Mass Evaluation with Portal Venous Phase Single Energy (SE) and Dual-Energy CT (DECT)

Monday, Nov. 30 8:55AM - 9:05AM Location: E351

Participants

Andrea Prochowski Iamurri, MD, Boston, MA (*Presenter*) Nothing to Disclose
Manuel Patino, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Diana Murcia, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yasir Andrabi, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Canellas, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Farhad Mehrkhani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Avinash R. Kambadakone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Consultant, Allena Pharmaceuticals, Inc

PURPOSE

Pancreatic mass evaluation with CT often dictates multi-phase acquisition and focused CM injection protocols for optimal detection and staging. Our objective was to investigate if the gain in the CNR from material density iodine images from ssDECT in portal venous phase is sufficient for pancreatic mass evaluation.

METHOD AND MATERIALS

In the IRB approved analysis, 143 patients with pancreatic masses and 10 controls (CC) were included; 100 with pancreatic ductal adenocarcinoma (PDAC), 16 with neuroendocrine tumors (pNET), 7 malignant cystic lesions (mCL), 5 metastasis (MTx), 5 focal pancreatitis (AP) and 10 splenules (SPL). Portal-phase ssDECT (GE) of the abdomen was performed. 140 kV single energy (SE) and material decomposition iodine images (MD-I) images were reviewed by two blinded readers for lesion detection, size, diagnosis, stage using a 5-point confidence scale. ROIs were placed in the aorta and lesions for estimating mean iodine concentration (MIC) and normalized iodine concentrations (NIC). Surgical findings in 128 cases and EUS/FNA and or FU in 15 cases served as a reference standard.

RESULTS

All 153 portal-phase DECT exams were rated of diagnostic quality and sufficient for rendering interpretation in 151/153 (98.7%) with high overall confidence (R1 4.4 and R2 4.5). The SECT images were considered adequate in 138/153 (90.1%) exams with low overall diagnostic score and confidence (R1 3.8 and R2 3.5) ($p < 0.001$, $p < 0.001$). 4 pNET, 6 PDAC and 2 solid masses in mCL were not reliably recognized on SECT but detected on DECT ($p < 0.05$). 14/143 (9.8%) lesions measured < 2 cm in diameter and 11/14 (78.6%) were confidently detected on the MD-I in comparison to 6/14 (42.9%) detected on SECT ($p > 0.005$). In PDAC group, 6 patients were incorrectly down staged on SECT. Agreement between readers resulted almost perfect ($\kappa = 0.81-1$). The mean NIC were for PDAC 0.35 ± 0.1 , pNET 0.71 ± 0.1 , mCL 0.32 ± 0.01 , MTx 0.37 ± 0.2 , AP 0.55 ± 0.3 , SPL 0.66 ± 0.1 and CC 0.50 ± 0.1 .

CONCLUSION

ssDECT enables more confident evaluation of pancreatic masses including small lesions and staging over SECT in a single portal phase acquisition. Quantitative analysis showed differences of iodine distribution in each type of lesion.

CLINICAL RELEVANCE/APPLICATION

These results lend opportunity to simplify pancreas CT protocol for easier workflow and lower radiation dose without negatively impacting the diagnostic performance.

Honored Educators

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Dushyant V. Sahani, MD - 2012 Honored Educator

Dushyant V. Sahani, MD - 2015 Honored Educator

RC209-03 Detection of Small Neuroendocrine Tumors by Pancreatic 3T MRI in Patients with Endogenous Hyperinsulinemic Hypoglycemia: A Prospective Study in Comparison to Glucagon-like Peptide-1 Receptor Imaging

Monday, Nov. 30 9:05AM - 9:15AM Location: E351

Participants

Kwadwo Antwi, Basel, Switzerland (*Presenter*) Nothing to Disclose

Daniel Boll, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Christoph J. Zech, MD, Basel, Switzerland (*Abstract Co-Author*) Research Grant, Bayer AG Speaker, Bayer AG Travel support, Bayer AG Advisory Board, Bayer AG Speaker, Bracco Group Travel support, Bracco Group

Elmar M. Merkle, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Damian Wild, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Tobias Heye, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Emanuel Christ, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Melpomeni Fani, PhD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Guillaume Nicolas, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate pancreatic 3T MRI in the detection of small neuroendocrine tumors in comparison to Glucagon-like Peptide-1 receptor (GLP1-R) imaging by ^{68}Ga -DOTA Exendin-4 Positron emission computed tomography (PET/CT) and/or surgery.

METHOD AND MATERIALS

This is an IRB approved, HIPAA compliant prospective study. In this interim analysis (32 patients planned) 18 consecutive patients with endogenous hyperinsulinemic hypoglycemia highly suspicious for an insulinoma and 2 healthy controls (13 female; 7 male; mean 56 yrs; range 18-80 yrs.) were included. Patients first underwent pancreatic MR imaging using a 3T MRI scanner (Magnetom Prisma, Siemens Healthcare) including T1w, T2w, diffusion weighted imaging (DWI) and dynamic contrast enhanced (DCE) sequences. PET/CT (Discovery STE, GE Healthcare) 2.5h after intravenous administration of ^{68}Ga -DOTA Exendin-4 (all patients) and surgery in 14 patients served as reference standard. Three expert readers with >10 years of experience in abdominal radiology analyzed MRI in a blinded fashion. Presence and size of lesions were determined by 2 different readers in consensus using MRI and PET/CT results.

RESULTS

A total of 23 lesions were identified (mean size 12mm; range 3-25mm) by PET/CT. The overall MRI sensitivity and specificity was 82.1% and 44.4%, respectively (reader A: 69.6%; 60.0%; reader B: 81.8%, 33.3%; reader C: 95.5%; 42.9%). Signal characteristics of detected lesions were as follows: GRE 3D T1w FS 100% hypointense; TSE T2w 85.7% hyperintense; 14.3% hypointense; high b-value DWI hyperintense 90.9%; 9.1% hypointense; DCE: 67.4% early hyperenhancing, 30.4% late hyperenhancing, 2.2% hypoenhancing. Consensus reading in correlation with PET/CT data showed all 23 lesions are discernible on MRI.

CONCLUSION

Focused pancreatic MRI is able to visualize small lesions in patients with suspected insulinomas with a sufficient detection rate. Although most lesions revealed typical reported signal characteristics few showed a different pattern which may explain failed detection. While MRI is not specific in lesion characterization it offers precise lesion localization when combined with a specific

method such as Glucagon-like Peptide-1 receptor imaging.

CLINICAL RELEVANCE/APPLICATION

The combination of 3T MRI and GLP1-R PET/CT changed clinical management in 14 of 18 patients in which previous diagnostic procedures were not able to localize any lesion.

RC209-04 Pancreas Cancer

Monday, Nov. 30 9:15AM - 9:40AM Location: E351

Participants

Eric P. Tamm, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the current status of staging pancreatic cancer, the impact of cross-sectional imaging on staging, and understand the category of 'borderline resectable pancreatic cancer.' 2) Appreciate the impact of advances in vascular reconstruction surgery on staging and surgical planning. 3) Have a basic understanding of neoadjuvant therapy, and its impact on staging.

ABSTRACT

Because of recent advances in surgical technique and preoperative therapy, it has become useful for clinicians to group pancreatic cancer into categories useful for clinical trials and treatment management. Besides the clearly resectable, and clearly unresectable tumors, there has emerged the category of 'borderline' resectable pancreatic cancer. Classifying patients into these three categories is dependent on precise descriptions of the extent of tumor, particularly vascular involvement, as seen on cross sectional imaging. These descriptions also depend on the use of commonly understood terminology. Understanding and appreciating new surgical techniques, advances in preoperative therapy and how this has impacted margin positivity, and therefore why it is important to describe accurately and clearly tumor involvement and how best to do that will be the focus of this lecture.

RC209-05 Diffusion-weighted MRI of the Pancreas: Optimizing b-Value for Visualization of Pancreatic Adenocarcinoma

Monday, Nov. 30 9:40AM - 9:50AM Location: E351

Participants

Yoshihiko Fukukura, MD, PhD, Kagoshima, Japan (*Presenter*) Nothing to Disclose
Toshikazu Shindo, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroto Hakamada, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Takumi, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuichi Kumagae, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Aya Umanodan, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Junichi Ideue, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanori Nakajo, MD, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyohisa Kamimura, MD, PhD, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Yoshiura, MD, PhD, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the optimal b-value of DWI for visualizing pancreatic adenocarcinomas.

METHOD AND MATERIALS

Fifty-five patients with histologically confirmed pancreatic adenocarcinoma underwent DWI with different b-values (b=500, 1000, 1500, and 2000 s/mm²). We evaluated DWI findings of tumors using 3-point visual scoring (type 1, clearly demarcated hyperintensity; type 2, hyperintensity with an unclear distal border; and type 3, isointensity), and measured signal intensity (SI) of the tumor and proximal or distal pancreatic parenchyma. Visual scores and SI ratios of the tumor to pancreatic parenchyma were compared between b-values of 500, 1000, 1500, and 2000 s/mm². In types 2 and 3 tumors on DWI with b-value of 1000 s/mm², serum amylase levels were compared between type 1 and types 2-3 tumors on DWI with b-value of 1500 s/mm².

RESULTS

Type 1 tumors were seen in 17 (30.9%), 28 (50.9%), 42 (76.4%), and 44 patients (80.0%) on DWI with b-values of 500, 1000, 1500, and 2000 s/mm², respectively. There was a higher incidence of type 1 tumors on DWI with b-value of 1500 s/mm² than on that with b-value of 1000 s/mm² (P<.001), and on DWI with b-value of 1000 s/mm² than on that with b-value of 500 s/mm² (P<.001). There was no significant difference in the tumor to proximal pancreas SI ratio among the four b-values (P<.467). The tumor to distal pancreas SI ratio was higher with b-value of 1500 s/mm² than with b-value of 1000 s/mm² (P<.001), and with b-value of 1000 s/mm² than with b-value of 500 s/mm² (P<.001). Between b-values of 1500 and 2000 s/mm², there was no significant difference in the incidence of type 1 tumors (P=.083) or the tumor to distal pancreas SI ratio (P=.870). In types 2-3 tumors on DWI with b-value of 1000 s/mm², a lower frequency of abnormal serum amylase elevation was observed in patients whose SI types were changed to type 1 at b-value of 1500 s/mm² than in those whose SI types were not changed (P<.018).

CLINICAL RELEVANCE/APPLICATION

The use of b-values ≥1500 s/mm² can improve the delineation of pancreatic adenocarcinomas without tumor-associated acute pancreatitis on DWI.

RC209-06 CT after Neoadjuvant FOLFIRINOX Chemotherapy for Borderline and Locally Advanced Pancreatic Adenocarcinoma

Monday, Nov. 30 9:50AM - 10:00AM Location: E351

Participants

Mathilde Wagner, MD, PhD, Paris, France (*Presenter*) Nothing to Disclose
Celia Margarida S. Antunes, Coimbra, Portugal (*Abstract Co-Author*) Nothing to Disclose
Daniel Pietrasz, Cretell, France (*Abstract Co-Author*) Nothing to Disclose

Christophe Cassinotto, MD, Pessac, France (*Abstract Co-Author*) Nothing to Disclose
Magaly Zappa, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Antonio Sa Cunha, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Baptiste Bachet, Paris, France (*Abstract Co-Author*) Consultant, Amgen Inc Consultant, F. Hoffmann-La Roche Ltd Consultant, sanofi-aventis Group Consultant, Celgene Corporation
Olivier Lucidarme, MD, Paris, France (*Abstract Co-Author*) Consultant, Bracco Group Consultant, F. Hoffmann-La Roche Ltd Consultant, Boehringer Ingelheim GmbH

PURPOSE

FOLFIRINOX is a chemotherapy regimen, which demonstrated positive impact in pancreatic adenocarcinoma. The aim of this study was to assess Computed Tomography (CT) modifications after neoadjuvant FOLFIRINOX chemotherapy for borderline (BR) and locally advanced (LA) pancreatic adenocarcinoma.

METHOD AND MATERIALS

Thirty-six patients (M/F = 26/10, mean age 60 ± 10) with BR and LA pancreatic adenocarcinoma who had received neoadjuvant FOLFIRINOX chemotherapy and had undergone surgery were retrospectively included. Baseline CT and pre-surgical CT were reviewed by two radiologists in consensus. All lesions were classified according to NCCN classification by the radiologists and a pancreatic surgeon. Largest diameter, product of the 3 diameters (P3D), arterial (superior mesenteric/coeliac/hepatic arteries) and venous (superior mesenteric/portal veins) involvement (score = 0-5) were studied on both CT and compared to pathological data (TNM/type of resection R0-R1).

RESULTS

There were significant decreases of the largest diameter and of P3D ($p < 0.0001$) and a partial response (PR) according to RECIST was found in 17/36 patients (47%). A significantly smaller pre-surgical largest diameter and P3D were found in patients with complete R0 resection ($p = 0.019/p = 0.021$). The largest diameter and P3D variations were significantly higher in patients with pathological response (T0-1N0) ($p = 0.004/p = 0.033$). A decrease of the arterial or venous involvement was respectively found in 9 (25%) and 8 patients (22%). In the opposite progression of the vascular involvement was seen in 2 (5%) patients associated with a shorter Disease Free Survival after the surgery ($p < 0.05$). 31 patients had R0 resection and among them only 4 (13%) exhibited a downstaging according to NCCN classification, while 27 (87%) did not.

CONCLUSION

In BR and LA pancreatic adenocarcinoma, effects of FOLFIRINOX regimen are identified on CT. However, downstaging identification is rare even in case of resectable lesion.

CLINICAL RELEVANCE/APPLICATION

Despite a lack of NCCN downstaging during chemotherapy, most of BR and LA patients were R0 at surgery, suggesting that additional imaging patterns must be found to predict resectability post-chemotherapy.

RC209-07 Cystic Pancreatic Tumors

Monday, Nov. 30 10:10AM - 10:35AM Location: E351

Participants

Celso Matos, MD, Brussels, Belgium, (cmatos@ulb.ac.be) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Classify cystic pancreatic tumors. 2) Describe the common and uncommon imaging patterns that allow differentiation of cystic pancreatic tumors. 3) Debate the role of imaging modalities in determining options for patient management.

RC209-08 Diagnostic Performance and Image Features for Prediction of Malignant Potential of Intraductal Papillary Mucinous Neoplasm of the Pancreas: A Comparison of EUS, Contrast-enhanced CT and MRI

Monday, Nov. 30 10:35AM - 10:45AM Location: E351

Participants

Seo-Youn Choi, MD, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Hoon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Mi Hye Yu, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyo Won Eun, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hae-Kyung Lee, MD, Kyungki-Do, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Hee Lee, MD, Bucheon-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance and image features for prediction of malignant potential in intraductal papillary mucinous neoplasm of the pancreas between EUS, CT and MRI.

METHOD AND MATERIALS

76 patients with pancreatic IPMN (benign = 37, malignant = 39) underwent EUS, contrast-enhanced CT, and MRI. EUS finding was analyzed based on the formal reports and CT and MR imaging were retrospectively analyzed by two radiologists, according to the high-risk stigmata and worrisome feature proposed by the international consensus guideline 2012. Diagnostic performance of each image modalities and image features in the evaluation of the malignant potential of IPMNs were analyzed by using receiver operating curve analysis and univariate and multivariate analyses.

RESULTS

The diagnostic performance for prediction of malignant potential was comparable among contrast-enhanced CT ($A(z)=0.7918$ in R1, $A(z)=0.8302$ in R2), MRI ($A(z)=0.7422$ in R1, $A(z)=0.7755$ in R2), and EUS ($A(z)=0.7328$) without significant difference ($p>0.05$). In

multivariable analysis, enhanced solid component in CT and MRI and mural nodule in EUS (OR= 1.8 in CT, OR= 1.36 in MRI, and OR= 1.47 in EUS, $p < 0.05$), MPD diameter $\geq 10\text{mm}$ (OR= 1.3 in CT, OR= 1.4 in MRI, and OR= 1.66 in EUS, $p < 0.05$), MPD diameter of 5-9mm (OR= 1.23 in CT, OR= 1.31 in MRI, $p < 0.05$), and thickened septae or wall (OR= 1.3 in CT and MRI, $p < 0.05$) were significant variables. With CT and MRI, interobserver agreement of thickened cyst wall or septum ($k=0.6893-0.7884$) and abrupt caliber change of MPD ($k=0.5790-0.6174$) was lower than that of other variables ($k>0.80$).

CONCLUSION

The diagnostic performance for prediction of malignant potential of pancreatic IPMN was comparable among contrast-enhanced CT, MRI, and EUS without significant difference ($p>0.05$). Enhanced solid component in CT and MRI and mural nodule in EUS, MPD diameter 5mm, and thickened septae or wall were significant variables.

CLINICAL RELEVANCE/APPLICATION

Contrast-enhanced CT, MRI, and EUS are useful for prediction of malignant potential in pancreatic IPMN using specific image features.

RC209-09 Tumor Cellularity is a Negative Predictor of Survival in Pancreatic Cancer

Monday, Nov. 30 10:45AM - 10:55AM Location: E351

Participants

Rickmer Braren, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Irina Heid, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Katja Steiger, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Marija Trajkovic-Arsic, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Markus Settles, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Steingotter, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Markus Schwaiger, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Jorg Kleef, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Irene Esposito, MD, Neuherberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Jens Siveke, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Molecular and morphological heterogeneity are key factors for prognosis, therapy response and resistance in pancreatic ductal adenocarcinoma (PDAC). By defining subtypes of PDAC based on tumor cellularity, we applied multiparametric MRI in complex mouse models of endogenous PDAC for non-invasive detection of subtypes.

METHOD AND MATERIALS

Murine (mPDAC; N=141) and human (hPDAC; N=94) PDAC were histologically analyzed and subtyped based on tumor cellularity. Diffusion weighted- and dynamic contrast enhanced-MRI (DW-MRI, DCE-MRI) was evaluated for non-invasive characterization of mPDAC subtypes.

RESULTS

Tumor cellularity showed excellent correlation with the DW-MRI derived ADC parameter in murine PDAC ($r=-0.86$, $CI=-0.92 - -0.78$). Applied in patients with corresponding PDAC subtypes (hPDAC_{low}, N=55; hPDAC_{med}, N=27) revealed a significantly better prognosis of patients exhibiting low tumor cellularity (19.8 versus 13.0 months, Log rank, $p<0.002$). In analogy to the murine model, the ADC parameter identified hPDAC subtypes pre-operatively.

CONCLUSION

This study identifies tumor cellularity as a negative predictor in PDAC and the ADC parameter as a promising biomarker for non-invasive classification that may be used for evaluation of subtype-directed approaches.

CLINICAL RELEVANCE/APPLICATION

The presented work supports the clinical relevance of subtyping of PDAC based on tumor cellularity and identifies high sensitivity and specificity of the ADC parameter for non-invasive detection of the different PDAC subtypes. Reliable, non-invasive assessment of tumor cellularity of a particular tumor by means of ADC calculation may facilitate stratification of PDAC subtypes for outcome analysis and personalized therapeutic intervention trials.

RC209-10 Acute Pancreatitis

Monday, Nov. 30 10:55AM - 11:20AM Location: E351

Participants

Kumaresan Sandrasegaran, MD, Carmel, IN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the working party classification of acute pancreatitis. 2) Appreciate the difference between peripancreatic and pancreatic necrosis. 3) Have an understanding of how imaging findings affect endoscopic and surgical management of severe acute pancreatitis.

Honored Educators

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Kumaresan Sandrasegaran, MD - 2013 Honored Educator

RC209-11 Extrapancreatic Inflammation on Abdominal Computed Tomography for Evaluating Early Organ Dysfunction in Acute Pancreatitis Based on Revised Atlanta Classification

Monday, Nov. 30 11:20AM - 11:30AM Location: E351

Participants

Chenyang Chen SR, MD, Chengdu, China (*Presenter*) Nothing to Disclose
Zixing Huang, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Bin Song, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study was conducted to assess Extrapancreatic inflammation on CT (EPIC) in predicting early organ dysfunction of patients with acute pancreatitis based on the revised Atlanta classification.

METHOD AND MATERIALS

109 patients diagnosed as acute pancreatitis from December 2013 to February 2014 were analyzed retrospectively. Outcome parameters included the length of hospital stay and the occurrences of organ dysfunction during the first week. The Balthazar score, the EPIC score, the Beside Index of Severity in Acute Pancreatitis (BISAP) and the Systemic Inflammatory Response Syndrome (SIRS) were evaluated by calculating receiver operator characteristic (ROC) curves and the area under the ROC curve.

RESULTS

In our study population of 109 patients (68 men, 41 women; median age, 44 years; age range, 16-85 years), 44 patients developed organ dysfunction, 20 patients developed persistent organ failure, 3 patients developed infection, and nobody died. The area under the ROC curve of EPIC to predict early organ dysfunction was 0.770 (95% confidence interval, 0.679-0.845), which was higher than the Balthazar score (0.641, 95% confidence interval, 0.551-0.738), similar to BISAP (0.789, 95% confidence interval, 0.701-0.862) and SIRS (0.742, 95% confidence interval, 0.650-0.821). An EPIC score of 5 or more had a 68.18% sensitivity and 80.00% specificity for predicting early organ dysfunction. The EPIC score was significantly superior to the Balthazar score to predict outcome.

CONCLUSION

In patients with acute pancreatitis, EPIC allows accurate estimation of early organ dysfunction.

CLINICAL RELEVANCE/APPLICATION

EPIC can early predict severity of acute pancreatitis, help clinicians to determine treatments and improve patients' outcomes.

RC209-12 Quantitative Magnetic Resonance Elastography for Differentiating Solid Pancreatic Masses and Predicting Postoperative Pancreatic Fistula (POPF)

Monday, Nov. 30 11:30AM - 11:40AM Location: E351

Participants

Shi Yu, MS, Shenyang, China (*Presenter*) Nothing to Disclose
He An, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Qiuju Li, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Jiahui Li, MD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Qiyong Guo, MD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MR elastography (MRE) is an accurate and non-invasive technique for measuring tissue stiffness. A soft texture of the pancreatic remnant is one of the most important risk factors for postoperative pancreatic fistula (POPF). Thus, we aimed at both evaluating the usefulness of MRE in differentiating solid pancreatic masses, and preoperatively assessing the texture of pancreatic remnant as an indicator for POPF.

METHOD AND MATERIALS

Twenty healthy volunteers and 46 patients were recruited consecutively in this prospective study. MRE was performed on a 3.0T MR scanner with a 32-slice echo-planar imaging (EPI) pulse sequence at 40Hz. The stiffness of the mass (for patients) and the non-mass bearing parenchyma (for all subjects) were analyzed. The stiffness ratio was calculated as the ratio of the mass to parenchymal remnant. The diagnostic accuracy was calculated using receiver operating curve analysis with an area under the curve (AUC).

RESULTS

The final diagnosis, confirmed by histopathologic examinations after surgical resection (n=28) or US-guided biopsy (n=18), includes 35 malignant lesions (pancreatic adenocarcinoma, 27; malignant neuroendocrine tumor, 5; metastasis, 3), and 11 benign masses (mass-forming pancreatitis, 8; solid pseudopapillary neoplasm, 2; pancreatic lipoma: 1]. The mean stiffness of the malignant masses was significantly higher than benign lesions and normal pancreas, and were (3.31±1.40)kPa, (2.02±0.58)kPa and (1.21±0.12)kPa, respectively. The stiffness ratio had better performance for detecting malignancies than the stiffness (AUC: 0.922 versus 0.766, P<0.05). The stiffness of parenchymal remnant between patients with POPF (1.19±0.19)kPa was significantly lower than that without POPF (1.57±0.41)kPa (P<0.05). Univariate logistic regression analysis showed that patients with pancreatic stiffness less than 1.21 kPa was a risk factor increasing POPF rate with an odds ratio of 9.000 (95% CI, 1.36 to 59.78; P = 0.030).

CONCLUSION

MRE is a promising tool for both differential diagnosis of solid pancreatic masses indicating their mechanical properties, and prediction of POPF relating to the soft texture of pancreatic remnant, without invasion, radiological exposure and excessive time consumption.

CLINICAL RELEVANCE/APPLICATION

It is suggested to incorporate MRE into a standard MRI study, which offers one-stop services and a comprehensive preoperative evaluation for individual patients with solid pancreatic masses.

RC209-13 Autoimmune Pancreatitis

Monday, Nov. 30 11:40AM - 12:00PM Location: E351

Participants

Joel G. Fletcher, MD, Rochester, MN, (fletcher.joel@mayo.edu) (*Presenter*) Grant, Siemens AG; ;

LEARNING OBJECTIVES

1) To review the diagnostic criteria for autoimmune pancreatitis. 2) To discuss the differences between Type 1 and Type 2 autoimmune pancreatitis. 3) To understand the temporal changes and morphologic patterns of contrast enhancement in autoimmune pancreatitis. 4) To describe imaging features relating to the pancreatic and intrahepatic ducts, and periductal parenchyma, in autoimmune pancreatitis that may distinguish it from cancer, chronic pancreatitis, or PSC. 5) To describe non-diagnostic but other frequently seen imaging findings of autoimmune pancreatitis. 6) To illustrate imaging findings demonstrating response to treatment in autoimmune pancreatitis, as well as recurrence after initial remission.

Understanding and Using the STARD (Standards for Reporting Diagnostic Accuracy Studies) and PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Guidelines

Monday, Nov. 30 8:30AM - 10:00AM Location: E352



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

Participants

Herbert Y. Kressel, MD, Boston, MA (*Moderator*) Royalties, Bayer AG

Herbert Y. Kressel, MD, Boston, MA (*Presenter*) Royalties, Bayer AG

Deborah Levine, MD, Boston, MA, (dlevine@rsna.org) (*Presenter*) Editor with royalties, UpToDate, Inc; Editor with royalties, Reed Elsevier;

Patrick M. Bossuyt, PhD, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose

Matthew D. McInnes, MD, FRCPC, Ottawa, ON, (mmcinn@toh.on.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To familiarize attendees with reasons for why quality improvement initiatives are important for the dissemination of published research. 2) To discuss the components of the STARD criteria and why these are important for studies of diagnostic accuracy. 3) To describe the PRISMA statement and why these make up key components of high quality systematic reviews. 4) To enable authors to improve completeness of reporting in their submitted manuscripts, to demonstrate study quality and thus enhance the likelihood that their manuscripts will be favorably reviewed when submitted to journals for publication.

ABSTRACT

The purpose of this session is to describe STARD and PRISMA, two documents that aim to improve scientific study quality by improving reporting. The Editor of Radiology, Dr. Herbert Kressel, Professor Radiology at Harvard Medical School, will introduce the importance of quality metrics in scientific research. Dr. Patrick Bossuyt, Professor of Clinical Epidemiology at University of Amsterdam, and one of the original authors of the STARD manuscript who is currently working to revise STARD, will discuss the components of the STARD criteria and why these are important for studies of diagnostic accuracy. Dr. Matthew McInnes, Associate Professor of Radiology at University of Ottawa, and our 2014 Eyer Editorial fellow will describe the PRISMA statement and the important key components of high quality systematic reviews. Dr. Deborah Levine, Professor of Radiology at Harvard Medical School and the Senior Deputy Editor of Radiology will describe how to put all of this information together into your final study plan and written manuscript. Our goal is to enable authors to improve completeness of reporting in their submitted manuscripts, to demonstrate study quality and thus enhance the likelihood that their manuscripts will be favorably reviewed when submitted for publication. Please see our publication information for authors at : <http://pubs.rsna.org/page/radiology/pia>.

RC253

Leveraging Your Data: Informatics Approaches and Solutions to Improve Imaging Care Delivery

Monday, Nov. 30 8:30AM - 10:00AM Location: E353A



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

Participants

Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify unmet needs of current and future practices with regards to emerging and existing informatics tools. 2) Apply existing and emerging informatics applications to improve report generation. 3) Demonstrate an understanding of how best to achieve consistency of radiologists' recommendations.

ABSTRACT

Existing and emerging informatics applications have the potential to markedly improve the quality of imaging care delivery. Much of the inefficiency and inconsistency of report generation could be potentially solved with the appropriate informatics application. In this session, the learner will gain an appreciation of the unmet needs of current and future practices and discover how novel applications developed at various institutions across the country are seeking to plug these voids and improve imaging care delivery.

Sub-Events

RC253A The Unmet Needs of Current and Future Practices

Participants

Michael E. Zalis, MD, Boston, MA (*Presenter*) Co-founder, QPID Health Inc; Chief Medical Officer, QPID Health Inc; Stockholder, QPID Health Inc

LEARNING OBJECTIVES

1) Describe some of the external mandates and requirements facing practicing radiologists. 2) Describe gaps in function that exist between these requirements and the functionality provided by EHR and PACS systems. 3) Provide example approaches and example solutions to bridge these gaps.

ABSTRACT

RC253B Augmenting Image Interpretation through the Use of Advanced Health Record Technology

Participants

Arun Krishnaraj, MD, MPH, Charlottesville, VA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Appreciate the current state of Electronic Health Record (EHR) technology and adoption in the United States. 2) Identify areas where EHR integration into the daily workflow of Radiologists is lacking. 3) Demonstrate an understanding of the importance of incorporating data contained in the EHR to generate high quality reports. 4) Understand the consequences of under utilizing data contained in the EHR.

ABSTRACT

Advanced health information technologies, specifically EHR systems, are undergoing rapid dissemination and widespread adoption spurred by initiatives in the American Recovery and Reinvestment Act of 2009. When properly integrated into clinical workflow, an EHR can improve both the quality and efficiency of care delivery. Radiology has long been at the forefront with respect to information technology (IT), however the integration of EHR data into radiologists' workflow is lacking which affects the efficiency, safety, and costs of Imaging. Emerging advanced health record technologies which incorporate natural language processing and semantic search allow the radiologists to retrieve and incorporate relevant clinical data when generating reports thereby improving both efficiency and quality. In this session, the learner will explore how one such health intelligence platform, known as QPID (Queriable Patient Inference Dossier), allows for the creation of search queries tailored to the workflow of an abdominal radiologist.

RC253C Bone Age and Skeletal Atlas Decision Support Tools with Patient Context Integrated into Clinical Workflow

Participants

Cree M. Gaskin, MD, Keswick, VA, (cree@virginia.edu) (*Presenter*) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc; ;

LEARNING OBJECTIVES

1) Review concepts for contemporary decision support tools for diagnostic radiologists. 2) Discuss bone age and skeletal atlas decision support tools integrated into clinical diagnostic workflow via context sharing.

ABSTRACT

There are numerous references available to radiologists to aid image interpretation or provide guidance on management of imaging findings. Given the vast amounts of information we are expected to know and the speed with which we are expected to perform our

clinical work, it is helpful to have quick and easy access to relevant resources at our point-of-care (e.g., during image interpretation and reporting). Such resources should be available in electronic format on our diagnostic workstations and, when relevant, be integrated with our clinical applications. Our Radiology Information System (RIS), PACS, and/or Electronic Health Record (EHR) can share study and patient context information with decision support tools to facilitate our diagnostic workflow. Examples to be shared include modern remakes of classic printed atlases in pediatric skeletal imaging, updated to contemporary electronic tools integrated with PACS and EHR applications to expedite workflow and reduce error.

RC253D Advanced Decision Support Tools for the Radiologists

Participants

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

LEARNING OBJECTIVES

View learning objectives under main course title.

RC229

Rectal Carcinoma: Pre and Post Treatment Evaluation with MRI (An Interactive Session)

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



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

Participants

Sub-Events

RC229A Rectal Carcinoma: Setting the Stage, What the Clinician Needs to Know

Participants

Gina Brown, MD, MBBS, Sutton, United Kingdom, (gina.brown@rmh.nhs.uk) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the prognostic relevance of MRI in planning surgical treatment options. 2) MRI assessment for oncologic treatment decisions. 3) Future developments in treatment strategies based on MRI assessment and restaging after chemoradiotherapy.

RC229B Pre Treatment Staging Standardized Reporting: Have you Checked the 'DISTANCE?'

Participants

Caroline Reinhold, MD, MSc, Montreal, QC, (caroline.reinhold@mcgill.ca) (*Presenter*) Consultant, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) To propose a MR imaging protocol for staging newly diagnosed rectal carcinoma. 2) To understand the anatomy of the rectum and mesorectum as pertains to MRI staging. 3) To propose a step-by-step approach for standardized MRI staging of pre-treatment rectal carcinoma using the mnemonic "DISTANCE".

ABSTRACT

In the Western Hemisphere, colorectal cancer is the third most common cancer in men after prostate and lung, and the second most common in women after breast cancer. One-third of colorectal cancers occur in the rectum. Survival rates for rectal cancer have improved in the past decade due to the combined effects of better staging, improved preoperative treatment strategies and total mesorectal excision (TME) surgery. Several studies have been published showing the ability of MRI to accurately stage rectal cancer and predict a negative circumferential resection margin. Moreover, advances in preoperative therapies require accurate preoperative MRI staging to select those patients who may benefit from chemoradiation prior to surgery. To accurately stratify patients according to the risk of local and distant failure, imaging takes on the same importance as tumor type and genetic susceptibility. However, rectal cancer evaluation by MRI continues to pose a challenge in non experts' hands. This presentation will present a mnemonic: "DISTANCE" to enable a systematic and standardized approach to the interpretation of MR imaging in newly diagnosed rectal cancers, thereby enabling all the clinically relevant features to be adequately assessed: DIS: for Distance from the Inferior part of the tumor to the transitional Skin, T: for T staging, A: for Anal complex, N: for Nodal staging, C: for Circumferential Resection Margin, E: for Extramural vascular invasion.

Honored Educators

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

Caroline Reinhold, MD, MSc - 2013 Honored Educator

Caroline Reinhold, MD, MSc - 2014 Honored Educator

RC229C Post Treatment Evaluation: What Criteria and Imaging Protocol Should I Use?

Participants

Stephanie Nougaret, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To highlight current management of rectal cancer including sphincter- and organ-sparing treatment options 2) To describe how pretreatment multi-parametric rectal MRI may serve as a predictive biomarker of subsequent tumor response to chemoradiation (CRT) 3) To propose a step-by-step approach for accurate interpretation of rectal MRI following CRT and to illustrate how the information gleaned from post CRT multi-parametric rectal MRI may influence treatment decisions.

ABSTRACT

Recent changes in the management of patients with locally advanced rectal cancer highlight the need for accurate assessment of tumor response to chemoradiation (CRT). In the past, CRT was followed by surgical resection in nearly all patients, irrespective of response to CRT. However, new data suggest that surgery may not be necessary in patients with complete response. MR imaging has become an essential tool to enable the oncology team to make appropriate treatment decisions. MRI has so far relied on changes in morphology as a measurement for response. However, this evaluation is hampered by the difficulties in differentiating residual tumor from radiation-induced fibrosis. Recent studies have suggested that adding diffusion-weighted imaging (DWI) to conventional MRI can aid this differentiation and thus improve the prediction of response after neoadjuvant therapy. Thus, the

learning objectives for this lecture are as follows:1) To learn about the value of multi-parametric rectal MRI prior to and following CRT for the prediction and subsequent assessment of response to CRT. To understand how rectal MR imaging findings are essential to making patient-centered treatment decisions.2) To become familiar with "DISTANCE" mnemonic and diagnostic clues which provide a systematic approach to the interpretation of rectal MRI images in patients with rectal cancer prior to treatment and following CRT.

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Stephanie Nougaret, MD - 2013 Honored Educator

RC223

Molecular Imaging Mini-Course: Advanced Molecular Imaging

Monday, Nov. 30 8:30AM - 10:00AM Location: E350



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

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC223A Novel Tracers

Participants

Timothy R. DeGrado, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the major considerations when developing a novel molecular imaging probe. 2) Compare the strengths and weaknesses of the various imaging modalities with regard to probe development and implementation. 3) Define appropriate experiments for probe validation. 4) Gain an understanding of the process of translation of a probe to clinical practice.

ABSTRACT

Molecular imaging is rapidly advancing as new imaging biomarkers are invented to allow noninvasive assessment of biochemical function. Those who embark on the process of developing novel probes come to know the excitement of imaging biological processes for the first time, but are also well aware of the great effort and many pitfalls that can impede progress. This introductory lecture will provide an overview of the process of molecular imaging probe conception, development, preclinical validation, and translation. Specific examples will be used to illustrate the presenter's experience with meeting these challenges.

RC223B Novel Instrumentation (PET/MR)

Participants

Ciprian Catana, MD, PhD, Charlestown, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Distinguish the technical approaches that have been proposed for integrating PET and MRI for the purpose of simultaneous data acquisition. 2) Evaluate the latest methodological developments in PET/MRI for improving PET data quantification. 3) Incorporate simultaneous PET/MRI techniques into research and clinical projects.

ABSTRACT

RC223C Molecular Imaging with MR

Participants

Bruce R. Rosen, MD, PhD, Charlestown, MA, (bruce@nmr.mgh.harvard.edu) (*Presenter*) Research Consultant, Siemens AG

RC206

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

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

HN NR

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

Participants

Sub-Events

RC206A Important Head and Neck Anatomy

Participants

Hugh D. Curtin, MD, Boston, MA, (Hugh_Curtin@meei.harvard.edu) (*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 fascial 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 stylomastoid 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.

RC206B Missed Diagnoses in the Head and Neck

Participants

Phillip R. Chapman, MD, Birmingham, AL (*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) Identify easily missed superficial lesions of the dermis that might represent primary cutaneous tumor or dermal metastases. 6) Understand the basic anatomy of the oral cavity including specific anatomic subunits, the appearance of oral cavity neoplasms and pitfalls in imaging oral cavity cancers.

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. The keys to identifying the pertinent findings and making each diagnosis will be highlighted.

RC206C Head and Neck Imaging Pearls

Participants

Christine M. Glastonbury, MBBS, San Francisco, CA, (Christine.glastonbury@ucsf.edu) (*Presenter*) Author with royalties, Reed Elsevier

LEARNING OBJECTIVES

1) To learn the key points that create a succinct imaging differential diagnosis while appreciating the 'big picture' in HandN imaging. 2) To recognize the imaging findings of critical disease and what to do or recommend next with your patient.

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.

RC201

Chest Series: Lung Cancer Screening

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



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

Participants

Caroline Chiles, MD, Winston-Salem, NC (*Moderator*) Nothing to Disclose
Jane P. Ko, MD, New York, NY (*Moderator*) Speaker, Siemens AG

LEARNING OBJECTIVES

1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

Honored Educators

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H. Page McAdams, MD - 2012 Honored Educator

Sub-Events

RC201-01 Current Evidence for Lung Cancer Screening: The North American Perspective

Monday, Nov. 30 8:30AM - 8:50AM Location: S406B

Participants

Caroline Chiles, MD, Winston-Salem, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

ABSTRACT

There is an increasing body of evidence for low-dose CT (LDCT) screening for lung cancer. This multisession course will review data from North American and European trials, with emphasis on mortality reduction, cost-effectiveness, and stage shift; classification of lung nodules by appearance and size, measurement of nodule growth, and management strategies; elements of an effective clinical screening program; and the evidence for limiting screening to patients who meet current eligibility criteria based on age and smoking history versus including patients on the basis of expanded criteria.

RC201-02 Ultra-low-dose Chest CT for Lung Cancer Screening Using Full Iterative Reconstruction: Feasibility Study

Monday, Nov. 30 8:50AM - 9:00AM Location: S406B

Participants

Masayo Fujita, Hiroshima, Japan (*Presenter*) Nothing to Disclose
Toru Higaki, PhD, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshikazu Awaya, MD, Miyoshi, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuko Nakamura, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
So Tsushima, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Kazuo Awai, MD, Hiroshima, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo; ; ; ;
Makoto Iida, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the detectability of pulmonary nodules on low-dose CT (LDCT) scans with hybrid iterative reconstruction (effective radiation dose about 2.0 mSv) and ultra-low dose CT (U-LDCT, about 0.2 mSv) scans and to investigate the feasibility of U-LDCT for lung cancer screening.

METHOD AND MATERIALS

Institutional review board approval and informed consent from all 50 subjects were obtained. The subjects (median age 64 years, range 53-75 years; smoking history median 46.5 packs/year, range 34.5 - 100 packs) underwent CT lung cancer screening with both LDCT and U-LDCT on a 320 detector-row scanner (Aquilion One, Toshiba). For LDCT we used our routine scan parameters for lung cancer screening (120 kVp, tube current regulated automatically [noise index 22], detector configuration 80 x 0.5 mm, pitch factor 1.39, reconstruction slice thickness and interval 2.0 mm). LDCT images were routinely reconstructed with hybrid iterative reconstruction (AIDR 3D, Toshiba). For U-LDCT we applied 5 mAs; the other parameters were as for LDCT. U-LDCT images were reconstructed with newly-developed full iterative reconstruction (FIRST, Toshiba). By consensus, 2 radiologists visually evaluated U-LDCT images as to pulmonary nodules (diameter \geq 4 mm) identified on LDCT images using a 3-point subjective scale where grade

3 = the nature of the nodule, i.e. solid, part-solid, ground glass (SN, p-SN, GGN), could be accurately identified, grade 2 = the nodule, but not its nature, could be easily identified, and grade 1 = the nodule could not be identified.

RESULTS

In the 50 subjects we identified 75 nodules on LDCT images (SN, n=20; p-SN, n=5; GGN, n=50). Of these, all 20 SNs were classified as grade 3, all 5 p-SNs as grade 3, and 30 of the 50 GGNs as grade 3, 15 as grade 2, and 5 as grade 1 (60-, 30-, and 10%, respectively).

CONCLUSION

The detectability of SNs and p-SNs on U-LDCT images with full IR was comparable to LDCT images. However, 10% of GGNs were not detected on U-LDCT images.

CLINICAL RELEVANCE/APPLICATION

As the detectability of pulmonary nodules was almost comparable on LDCT- and U-LDCT images with full IR except GGNs, lung cancer screening using U-LDCT may be feasible.

RC201-03 Current Evidence for Lung Cancer Screening - The European Perspective

Monday, Nov. 30 9:00AM - 9:20AM Location: S406B

Participants

Marjolein A. Heuvelmans, BSc, Groningen, Netherlands, (m.a.heuvelmans@umcg.nl) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

RC201-04 The Role of Volume and Predicted Volume-doubling Time in Differentiating Benign from Potential Malignant New Nodules at Incidence CT Lung Cancer Screening

Monday, Nov. 30 9:20AM - 9:30AM Location: S406B

Participants

Joan E. Walter, BSc, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Marjolein A. Heuvelmans, BSc, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Geertruida H. De Bock, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Pim A. De Jong, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Rozemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (*Presenter*) Nothing to Disclose

Matthijs Oudkerk, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare volume and predicted growth rate of benign and malignant new solid nodules in a large randomized low-dose computed tomography (LDCT) lung screening trial.

METHOD AND MATERIALS

This trial was approved by the Ministry of Health. All participants gave informed consent. Following baseline LDCT screening, incidence-screenings took place after 1, 3 and 5.5 years. For this study, participants were selected with solid non-calcified nodules, newly detected after baseline and also in retrospect not present on any previous screen. Nodule volume was generated semi-automatically by Lungcare software (Siemens, Erlangen, Germany). Growth rate at initial detection was estimated by calculating the slowest predicted volume-doubling time (pVDT), according to the formula $pVDT = [\ln(2) * \Delta t] / [\ln(V2/V1)]$, using the study's detection limit of 15mm³ (V1), the volume of the new nodule at initial detection (V2), and the time interval between current and last screen (Δt [days]). Lung cancer diagnosis was based on histology, and benignity was based on either histology or a stable volume for at least two years. Difference in volume and pVDT between benign and malignant nodules was evaluated by Mann-Whitney U testing.

RESULTS

In total, 1,484 new solid nodules in 949 participants were identified of which 77 (5.2%) were malignant. The median volume of benign (44mm³, interquartile-range [IQR] 22-122mm³) and malignant (373mm³, IQR 120-974mm³) new nodules, as well as the median pVDT of benign (288 days, IQR 153-566 days) and malignant (144 days, IQR 116-213 days) new nodules differed significantly ($P < 0.001$ for both). The calculated median pVDT of adenocarcinomas (183 days, IQR 138-299 days) and squamous-cell carcinomas (150 days, IQR 117-223 days) was comparable to VDT of fast-growing baseline cancers of the same histological type as previously published (196 days, IQR 135-250 days and 142 days, IQR 91-178 days).

CONCLUSION

Volume and pVDT may be used to differentiate between benign and malignant solid nodules, newly detected at incidence LDCT lung cancer screening.

CLINICAL RELEVANCE/APPLICATION

A new nodule's initial growth rate can be estimated by the predicted volume-doubling time, which is a new measure that may be helpful in differentiating benign from malignant new nodules.

RC201-05 Lung Nodule Characterization

Monday, Nov. 30 9:30AM - 9:50AM Location: S406B

Participants

Thomas E. Hartman, MD, Rochester, MN (*Presenter*) Author, Cambridge University Press

LEARNING OBJECTIVES

1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

RC201-06 Can Morphological Features Differentiate between Malignant and Benign Pulmonary Nodules, Detected in a Screen Setting?

Monday, Nov. 30 9:50AM - 10:00AM Location: S406B

Participants

Sarah J. Van Riel, MD, Nijmegen, Netherlands (*Presenter*) Research Grant, MeVis Medical Solutions AG
Francesco Ciompi, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mathilde Winkler Wille, Hellerup, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Ernst T. Scholten, MD, Haarlemmerliede, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Nicola Sverzellati, Parma, Italy (*Abstract Co-Author*) Nothing to Disclose
Santiago E. Rossi, MD, Capital Federal, Argentina (*Abstract Co-Author*) Advisory Board, Koninklijke Philips NV Speaker, Pfizer Inc Royalties, Springer Science+Business Media Deutschland GmbH
Asger Dirksen, Hellerup, Denmark (*Abstract Co-Author*) Nothing to Disclose
Rianne Wittenberg, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Monique Brink, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speaker, Toshiba Corporation
Matiullah Naqibullah, Hellerup, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Mathias Prokop, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group Speakers Bureau, Toshiba Corporation Speakers Bureau, Koninklijke Philips NV Research Grant, Toshiba Corporation
Cornelia M. Schaefer-Prokop, MD, Nijmegen, Netherlands (*Abstract Co-Author*) Advisory Board, Riverain Technologies, LLC
Bram Van Ginneken, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) 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

PURPOSE

Existing nodule classification systems and risk models (e.g., McWilliams model, Lung-RADS) consider only nodule type, size, growth, and the presence of a spiculated border. However, radiologists consider additional morphological features when assigning a malignancy risk. Goal of the study was to determine the power of additional morphological features to differentiate between benign and malignant nodules.

METHOD AND MATERIALS

All 60 cancers were selected from the Danish Lung Cancer Screening Trial, in the first scan where they were visible, and a benign set of 120 randomly selected and 120 size-matched benign nodules from baseline scans were included, all from different participants. Data had been acquired using a low-dose (16x0.75mm, 120 kVp, 40 mAs) protocol, and 1mm section thickness reconstruction. Seven radiologists were asked to score the presence of morphological features for each nodule referring to density distribution (homogeneous, inhomogeneous, high, low), lesion margin (spiculation, lobulation, demarcation by interlobular septa, sharply-defined, ill-defined), lesion surrounding (distortion of the surrounding parenchyma, pleural/fissure retraction, attachment to pleura, fissure or vessel) and lesion architecture (thickened wall of a bulla, bubbles, air bronchogram). Separately per observer and feature, chi square analysis was used to determine the power to discriminate between benign and malignant nodules. Features with a p-value <0.05 in ≥ 4 observers are reported.

RESULTS

Significant differences were seen for inhomogeneous density distribution ($p < 0.001 - 0.003$) and pleural/fissure retraction ($p < 0.001 - 0.047$) in 7 observers. The presence of bubbles ($p < 0.001 - 0.025$), spiculation ($p < 0.001$), lobulation ($p < 0.001$), and an ill-defined nodule border ($p < 0.001 - 0.012$) were significant in 6 observers. The presence of a thickened bulla wall in 5 observers ($p < 0.001 - 0.042$), and air bronchogram ($p < 0.001 - 0.006$) and distortion of surrounding architecture ($p < 0.001 - 0.004$) was significantly different in 4 observers.

CONCLUSION

We have identified several morphological features that are significantly associated with malignancy of pulmonary nodules, but not included in current risk prediction models.

CLINICAL RELEVANCE/APPLICATION

Morphological features can be used to differentiate malignant from benign nodules. Further studies will show whether integration of more morphological features will increase the power of risk prediction.

Honored Educators

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Santiago E. Rossi, MD - 2015 Honored Educator

RC201-07 Questions and Answer

Monday, Nov. 30 10:00AM - 10:15AM Location: S406B

Participants

RC201-08 Lung Nodule Management

Monday, Nov. 30 10:30AM - 10:50AM Location: S406B

Participants

Jane P. Ko, MD, New York, NY (*Presenter*) Speaker, Siemens AG

LEARNING OBJECTIVES

1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

RC201-09 Follow-up Recommendation Compliance in a Clinical CT Lung Screening Program

Monday, Nov. 30 10:50AM - 11:00AM Location: S406B

Participants

Sama Alshora, MD, Burlington, MA (*Presenter*) Nothing to Disclose
Brady J. McKee, MD, Burlington, MA (*Abstract Co-Author*) Spouse, Advisory Board, Medtronic, Inc;
Shawn Regis, PhD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Christopher C. Bolus, MD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Andrea B. McKee, MD, Burlington, MA (*Abstract Co-Author*) Advisory Board, Medtronic, Inc; Speaker, Medtronic, Inc; ;
Robert J. French JR, MD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Sebastian Flacke, MD, Burlington, MA (*Abstract Co-Author*) Consultant, BTG International Ltd; Consultant, Surefire Medical, Inc;
Consultant, Koninklijke Philips BV; Consultant, XACT Robotics

PURPOSE

To assess patient compliance with follow-up recommendations in a clinical CT lung screening program.

METHOD AND MATERIALS

We retrospectively assessed the rate of patient compliance with exam follow-up recommendations in our CT lung screening program. All patients evaluated fulfilled the NCCN high-risk criteria for lung cancer screening and underwent screening between 1/12/2012 and 6/12/2013. Screened patients referred from outside our institution were excluded due to limited follow-up. Patients with negative, benign, or probably benign results were recommended to have a repeat screening exam in 6-12 months. Patients with suspicious findings were recommended to undergo a pulmonary consultation. To be considered compliant, patients had to be no more than 90 days past due for their next recommended exam or clinical evaluation as of 9/12/2014. Patients who died, were diagnosed with cancer, exceeded the program age limit, or became otherwise ineligible for additional screening were considered adherent. Compliance rates were assessed across multiple factors including sex, age, smoking history, baseline exam result, and NCCN high-risk group status.

RESULTS

901 high-risk patients from our institution underwent a baseline CT lung screening exam between 1/12/2012 and 6/12/2013. 772/901 (85.7%) were compliant as of 9/12/2014. 155/901 (17.2%) were non-compliant during the study interval of which 26 (16.8%) returned to screening compliance by 9/12/2014. The most common reasons for non-compliance were refusal to undergo the follow-up exam (66.7%), inability to contact the patient (20.9%), and patient inability to obtain a followup order from their physician (7.8%). 23/901 (2.6%) were discharged for reasons other than non-compliance. Subgroup analysis demonstrated a statistically significant increase in screening compliance among female patients ($p = 0.035$) and among those patients 65-73 years old ($p=0.040$).

CONCLUSION

High rates of compliance with CT lung screening recommendations are achievable in clinical practice.

CLINICAL RELEVANCE/APPLICATION

Monitoring patient compliance with exam follow-up recommendations and reviewing reasons for non-compliance are important quality initiatives in a clinical CT lung screening program.

RC201-10 Building a Clinical Program

Monday, Nov. 30 11:00AM - 11:20AM Location: S406B

Participants

Jared D. Christensen, MD, Durham, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

RC201-11 Trends in CT Screening for Lung Cancer at Leading Academic Medical Centers from 2013 to 2015

Monday, Nov. 30 11:20AM - 11:30AM Location: S406B

Participants

Phillip M. Boiselle, MD, Boston, MA (*Presenter*) Nothing to Disclose
Caroline Chiles, MD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
James G. Ravenel, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Charles S. White, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine trends in CT lung cancer screening at leading academic medical centers (AMCs).

METHOD AND MATERIALS

A survey was emailed in March 2015 to thoracic radiologists at 21 leading AMCs, identified from the US News and World Report listings of top hospitals, cancer centers, and pulmonary medicine centers. Radiologists who currently offer lung cancer screening were asked additional questions ranging from patient selection policies to implementation of Lung-RADS in their practice. 2015 survey results were compared to March 2013 and March 2014 survey results for select questions that overlapped between the 3 surveys.

RESULTS

Of the 18 survey respondents (86% response rate), 17 (94%) have an active CT screening program, similar to 2014. Concerning patient volumes, 14 of 17 (82%) sites reported that the number screened was stable to increased over the past 3 to 6 months, and substantially fewer sites scan ≤ 5 patients per week compared to prior years (29% in 2015; 74% in 2014; and 87% in 2013). Regarding charges, a self-pay model was used exclusively at only 1 of 17 sites (6%) in 2015, a decrease from 47% in 2014. NLST entry criteria remained the most common patient selection criteria in 2015, but 4 sites (24%) have adopted the new CMS guidelines and 5 sites (29%) are now using expanded NCCN criteria. Concerning solid nodule size thresholds for defining a positive screen, 12 of 17 sites (71%) now use ≥ 6 mm, an increase from 11% in 2014. With regard to accreditation, 8 of 17 sites (47%) are designated as an ACR screening site and almost all other sites are planning to apply for this designation. A majority of sites (13 of 17, 76%) have incorporated Lung-RADS, whereas the remaining sites use other guidelines such as NCCN. Nearly half of all sites (8 of 17, 47%) have introduced local training and/or credentialing policies for participating radiologists. Only 1 site uses software for volumetric nodule measurement and computer aided detection, whereas 5 of 17 (29%) sites use data management software for tracking patient data.

CONCLUSION

Screening practices are rapidly evolving at leading AMCs, with greater conformity to nodule size criteria and management guidelines following the release of updated screening guidelines and Lung-RADS.

CLINICAL RELEVANCE/APPLICATION

Over the last 2 years, leading AMCs have experienced greater patient volumes, increased payor mix, revised solid nodule size threshold from 4 mm to ≥ 6 mm, and incorporation of Lung-RADS.

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Phillip M. Boiselle, MD - 2012 Honored Educator

RC201-12 Screening: Out of the Box

Monday, Nov. 30 11:30AM - 11:50AM Location: S406B

Participants

Brady J. McKee, MD, Burlington, MA (*Presenter*) Spouse, Advisory Board, Medtronic, Inc;

LEARNING OBJECTIVES

1) Compare evidence LDCT screening for lung cancer from the North American and European trials. 2) Classify screen-detected lung nodules and recommend appropriate management. 3) Incorporate the essential elements of a clinical lung cancer screening program. 4) Critique the evidence for and against screening patients who do not meet current eligibility criteria for LDCT screening.

RC201-13 Panel Discussion

Monday, Nov. 30 11:50AM - 12:00PM Location: S406B

Participants

RC222

MRI: Imaging for Treatment Guidance and Verification

Monday, Nov. 30 8:30AM - 10:00AM Location: S502AB

MR RO PH

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

FDA Discussions may include off-label uses.

Participants

Rojano Kashani, Saint Louis, MO (*Moderator*) Investigator, Koninklijke Philips NV; Investigator, ViewRay, Inc

Sub-Events

RC222A In-room MRI for Treatment Guidance

Participants

Rojano Kashani, Saint Louis, MO (*Presenter*) Investigator, Koninklijke Philips NV; Investigator, ViewRay, Inc

LEARNING OBJECTIVES

1) Understand the main concepts of MRI-guided radiation therapy. 2) Understand the advantages and limitations of MRI-guided radiotherapy systems currently in use or under development. 3) Understand the use of in-room MRI guidance for management of intr- and inter-fraction variations in anatomy.

RC222B Integrating MRI, the Clinician Perspective

Participants

Cynthia Menard, MD, Montreal, QC, (cynthia.menard@umontreal.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the clinical benefits associated with the integration of MRI into Radiotherapy. 2) Describe the uncertainties and challenges that exist in MR for radiotherapy.

RC220

Imaging Evaluation of Post-Radiation Therapy Normal Tissue Effects

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



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

Participants

Sub-Events

RC220A Post-radiation Therapy Lung Imaging

Participants

Gregory Videtic, MD, FRCPC, Cleveland, OH, (videtig@ccf.org) (*Presenter*) Nothing to Disclose
Michelle S. Ginsberg, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review short term and long term changes following radiation therapy. Post SBRT changes will also be reviewed which can differ from more traditional conformal radiotherapy changes. 2) To distinguishing evolving post RT changes from recurrence which is critical in the follow up of these patients. Use of PET/CT in these cases will be discussed.

ABSTRACT

RC220B Post-radiation Therapy Pediatric Body Imaging

Participants

Ralph P. Ermoian, MD, Seattle, WA, (ralphpe@uw.edu) (*Presenter*) Nothing to Disclose
R. Paul Guillerman, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Attendees will be able to list at least one common late body imaging finding associated with radiation treatment for Ewing sarcoma, Hodgkin lymphoma, Wilms tumor and transplant conditioning with total body irradiation. 2) Attendees will be able describe the relationship between dose and target volume in discussing late imaging findings on the musculoskeletal, hepatic and gastrointestinal systems.

ABSTRACT

With the improvement of outcomes of treatment for pediatric cancers, the number of long-term survivors continues to rapidly grow. Although the use of radiation therapy has generally declined over recent decades, it continues to play an essential role in treatment of many children with Wilms tumor, Ewing sarcoma, rhabdomyosarcoma, or Hodgkin lymphoma and some patients undergoing bone marrow transplant for leukemia. Though cured of their disease, long-term survivors often experience late-effects from radiation therapy with accompanying findings on body imaging. The session will describe late effects on multiple organ systems including musculoskeletal, gastrointestinal, and pulmonary, and relate the imaging findings to radiation techniques including dose and radiation fields.

RC220C Post-radiation Therapy Liver Imaging

Participants

Michael I. Lock, MD, FRCPC, London, ON, (michael.lock@lhsc.on.ca) (*Presenter*) Research Consultant, Accuray Incorporated; Speaker, AbbVie Inc
Ashkan A. Malayeri, MD, Bethesda, MD, (ashkan.malayeri@nih.gov) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the current literature on radiological liver changes induced by radiation. 2) Describe the incidence and long-term morphology/natural history of these changes. 3) Apply practical concepts that distinguish recurrence from normal changes in a growing subject area where evidence is just emerging.

ABSTRACT

Primary and secondary liver cancer is becoming a larger proportion of the radiology case load due to increasing incidence and the introduction of new treatment techniques. In particular, new radiotherapy techniques like stereotactic body radiotherapy (SBRT) are being applied routinely for hepatic lesions. However, SBRT induces changes that are difficult to distinguish from local recurrence. Many changes manifest over time and knowledge of the natural history of radiation changes is important. Some changes are transient and others are predictive of critical clinical outcomes. Radiologists are being pressured to provide clinical input as their opinions often result in significant changes in management. These management changes include high risk and expensive treatments. Therefore, we review the literature and provide practical case examples to assist radiologists in a) identifying normal changes b) determining the appropriate investigations with multidisciplinary input c) selecting appropriate predictive parameters for clinically important endpoints such as recurrence.

RCC21

Imaging Informatics: Year in Review (RSNA/AMIA/SIIM Joint Sponsorship)

Monday, Nov. 30 8:30AM - 10:00AM Location: S501ABC



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

Participants

Sub-Events

RCC21A Best of Ontologies, Reporting, and Natural Language Processing

Participants

Charles E. Kahn JR, MD, MS, Philadelphia, PA, (charles.kahn@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the year's most significant advances in imaging informatics. 2) Understand current directions in biomedical informatics research of importance to radiology, including ontologies, data mining, natural language processing, reporting systems, and decision support. 3) Describe recent advances in image processing and analysis, and their applications in radiology, including filtering, image reconstruction and visualization, computer-aided diagnosis, and pattern recognition.

ABSTRACT

Informatics plays an increasingly important role in radiology research and practice. This session, developed in partnership with the American Medical Informatics Association (AMIA) and the Society for Imaging Informatics in Medicine (SIIM), highlights the year's most important advances in imaging informatics. We present leading research in image processing, image analysis, and other areas of biomedical and health informatics that impact medical imaging, including filtering, image reconstruction and visualization, computer-aided diagnosis, and pattern recognition, decision support, ontologies, reporting, data mining, and natural language processing. The presentations will feature techniques that address clinical problems and systems that have been tested in clinical trials. This course provides a comprehensive 'Year in Review' of informatics in medical imaging.

URL

<http://www.rsna.org/Informatics/2015/>

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Charles E. Kahn JR, MD, MS - 2012 Honored Educator

RCC21B Best of Image Processing and Analysis

Participants

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

LEARNING OBJECTIVES

1) In this session, important advances in knowledge about image processing will be reviewed.

ABSTRACT

A number of key papers have been published in the past year focusing on image processing, information extraction, and computer aided diagnosis. We will review these papers and describe the relevance of them to current and future practice.

URL

<http://www.rsna.org/Informatics/2015/>

RC203

Imaging Nonischemic and Ischemic Disease of the Myocardium

Monday, Nov. 30 8:30AM - 10:00AM Location: S504AB

CA **CT** **MR**

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

FDA Discussions may include off-label uses.

Participants

LEARNING OBJECTIVES

ABSTRACT

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Suhny Abbara, MD - 2014 Honored Educator

Sub-Events

RC203A MRI and CT of Cardiac Masses

Participants

Phillip M. Young, MD, Rochester, MN, (young.phillip@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review role of MR and CT in assessing cardiac masses. 2) To highlight the potential for detection, characterization, staging, and guiding surgical decision making with cardiac MR and CT through clinical cases. 3) To review some practical tips and tricks to keep in mind when imaging these challenging cases.

ABSTRACT

RC203B Infiltrative Diseases (Amyloid, Hemochromatosis Fabrys, Sarcoid)

Participants

Kristopher W. Cummings, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of cardiac MR in the evaluation of infiltrative cardiomyopathy. 2) Describe typical patterns and locations of MR late gadolinium enhancement associated with various types of infiltrative disease. 3) Explain the role of noncontrast MR in the evaluation for myocardial iron deposition.

ABSTRACT

RC203C Non Infiltrative Non-ischemic Cardiomyopathies (HCM, Noncompaction, ARVD, Myocarditis, Takatzubo etc.)

Participants

Karen G. Ordovas, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand how to differentiate ischemic from non-ischemic cardiomyopathies on cardiac MRI. 2) To recognize the cardiac MR findings suggestive of the diagnosis of different types of non-ischemic cardiomyopathies. 3) To identify cardiac MR findings that have a prognostic role in patients with non-ischemic cardiomyopathies

ABSTRACT

RC203D T1-mapping, T2 Mapping and Quantitative Imaging

Participants

Arthur E. Stillman, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the role of T1, T2 and ECV mapping for aiding cardiac disease diagnosis. 2) To review the potential of T1 and T2 mapping for monitoring therapy.

ABSTRACT

Recent advances permit quantitative MRI imaging using T1- and T2- maps. These provide a new method for tissue characterization

Recent advances permit quantitative MRI imaging using T1- and T2- maps. These provide a new method for tissue characterization and can be used to aid diagnosis and for monitoring treatment. Examples relating to cardiac imaging include acute myocardial infarction, myocarditis, amyloid and Fabry disease. Recent literature suggests that quantitative T1- and T2- maps improve diagnostic capabilities compared with T1- and T2 weighted MRI. When used following the administration of gadolinium contrast, T1- maps can be used to calculate the extracellular volume maps of myocardium. This literature will be reviewed and illustrated with case examples.

Nuclear Medicine Series: Assessment of Cancer Treatment Response: Updates

Monday, Nov. 30 8:30AM - 12:00PM Location: S505AB

BQ **NM** **OI**AMA PRA Category 1 Credits™: 3.25
ARRT Category A+ Credits: 3.75**Participants**Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Moderator*) Nothing to Disclose
Haesun Choi, MD, Houston, TX (*Moderator*) Nothing to Disclose**Sub-Events****RC21101 Imaging Response - Earning Biomarker Status**

Monday, Nov. 30 8:30AM - 9:15AM Location: S505AB

ParticipantsTerence Z. Wong, MD, PhD, Chapel Hill, NC (*Presenter*) Nothing to Disclose**LEARNING OBJECTIVES**

1) Compare and contrast prognostic, predictive, and pharmacodynamic biomarkers. 2) Understand the difference between integrated and integral biomarkers in clinical trials. 3) Discuss advantages and limitations of imaging biomarkers.

ABSTRACT

Serum, pathological, and imaging biomarkers are becoming increasingly important to define potential biological targets, select which patients may benefit from a particular targeted agent, and to follow patients during and following therapy. Traditionally, imaging has not been formally recognized as a biomarker, and standardization of quantitative imaging techniques remains a major challenge. However, functional and quantitative imaging techniques are now being used routinely to evaluate early response to therapy. Unlike conventional cytotoxic chemotherapy, targeted therapy can be cytostatic and selects only susceptible populations of cells. Imaging response criteria is therefore often different from standard anatomic (RECIST, WHO) criteria, and the response may be heterogeneous. In the future, both serum and imaging biomarkers will have an increasingly important role in managing patients undergoing conventional and targeted therapy.

RC211-02 Can Interim [18F]-FDG-PET or Diffusion-weighted MRI Predict End-of-Treatment Outcome in MALT Lymphoma after Immunotherapy? A Prospective Study in 15 Patients

Monday, Nov. 30 9:15AM - 9:25AM Location: S505AB

Participants

Marius E. Mayerhoefer, MD, PhD, Vienna, Austria (*Presenter*) Nothing to Disclose
Georgios Karanikas, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Kurt Kletter, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Matthias Pones, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Michael Weber, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Raderer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether, in patients with MALT lymphoma, quantitative changes of glycolytic activity on interim [18F]-FDG-PET, or quantitative changes of cell density on interim diffusion-weighted MRI (DWI), relative to pre-therapeutic scans, can predict the end-of-treatment (EOT) outcome after immunotherapy.

METHOD AND MATERIALS

Our prospective IRB-approved study included patients with untreated, histologically proven, FDG-avid MALT lymphoma that underwent whole-body [18F]-FDG-PET/CT and DWI at three time-points: before treatment (baseline); after three cycles (interim); and after six cycles of rituximab-based immunotherapy (EOT). The up to three largest nodal or extranodal lymphoma lesions that were visible on both [18F]-FDG-PET and DWI were defined as target lesions at baseline. Maximum and mean SUVs (SUVmax, SUVmean), and minimum and mean apparent diffusion coefficients (ADCmin, ADCmean) were measured, and their rates of change between baseline and interim examinations (Δ SUVmax, Δ SUVmean, Δ ADCmin, and Δ ADCmean) were compared, using ANOVAs, between the four EOT outcomes: complete remission (CR), partial remission (PR), stable disease (SD), or progressive disease (PD). The relationship between Δ SUVs and Δ ADCs was also assessed by Pearson correlation coefficients (r).

RESULTS

Fifteen patients with 25 lesions were included. Lesion-based post-hoc tests showed significant differences between CR and PR for Δ SUVmax ($P < 0.001$), Δ SUVmean ($P < 0.001$), and Δ ADCmin ($P = 0.044$); and between CR and SD for Δ SUVmax ($P < 0.001$), Δ SUVmean ($P < 0.001$), Δ ADCmin ($P = 0.021$), and Δ ADCmean ($P = 0.022$); but not between CR and PR for Δ ADCmean ($P = 0.012$); and also not between PR and SD for Δ SUVmax ($P = 0.98$), Δ SUVmean ($P = 0.96$), Δ ADCmin ($P = 0.85$), or Δ ADCmean ($P = 0.99$). No lesion showed PD at EOT. A substantial and significant, negative correlation between Δ SUVmax and Δ ADCmin ($r = -0.71$, $P < 0.001$), and Δ SUVmean and Δ ADCmean ($r = -0.70$, $P < 0.001$), was observed.

CONCLUSION

Both quantitative interim [18F]-FDG-PET measures and interim DWI measures may be able to predict lesion-based complete response to immunotherapy at end-of-treatment in MALT lymphoma.

CLINICAL RELEVANCE/APPLICATION

[18F]-FDG-PET and DWI may be useful for early treatment outcome prediction in patients with MALT lymphoma undergoing rituximab-based immunotherapy.

RC211-03 Whole-Body FDG-PET/MRI vs. Whole-Body MRI with DWI vs. Integrated FDG-PET/CT with Brain CE-MRI: Capability for Recurrence Assessment in Patients with Postoperative Non-Small Cell Lung Cancer

Monday, Nov. 30 9:25AM - 9:35AM Location: S505AB

Participants

Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA; Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisanobu Koyama, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kota Aoyagi, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Hitoshi Yamagata, PhD, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Sumiaki Matsumoto, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Yoshimori Kassai, MS, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Katsusuke Kyotani, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuro Sugimura, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE

To compare the diagnostic performance for postoperative lung cancer recurrence assessment among whole-body FDG-PET/MRI, MRI with diffusion weighted imaging (DWI) and integrated FDG-PET/CT with brain contrast-enhanced (CE-) MRI in non-small lung cancer (NSCLC) patients.

METHOD AND MATERIALS

96 consecutive postoperative NSCLC patients (52 men, 44 women; mean age 72 years) prospectively underwent whole-body MRI with and without DWI at 3T MRI system, integrated PET/CTs and conventional radiological examinations as well as follow-up examinations. When recurrence was suspected in each NSCLC patients, pathological examination was performed. Then, all patients were divided into recurrence (n=17) and non-recurrence (n=79) groups based on pathological and follow-up examinations. All co-registered PET/MRIs were generated by means of our proprietary software. Then, probability postoperative recurrence in each patient was visually assessed on all methods by means of 5-point visual scoring system. To compare diagnostic performance among all methods, receiver operating characteristic analyses were performed. Finally, diagnostic accuracy of each factor and clinical stage was statistically compared each other by using McNemar's test.

RESULTS

Area under the curves (Azs) of whole-body PET/MRI (Az=0.99) and MRI with DWI (Az=0.99) were significantly larger than that of PET/CT (Az=0.92, p<0.05) and conventional examination (Az=0.91, p<0.05). When applied feasible threshold values, specificities (SPs) and accuracies (ACs) of PET/MRI (SP: 96.2 [76/79] %, and AC: 96.8 [93/96] %) and MRI with DWI (SP: 100 [79/79] %, and AC: 96.8 [93/96] %) were significantly higher than those of PET/CT with CE-brain MRI (SP: 81.0 [64/79] %, p<0.05; AC: 84.4 [81/96] %, p<0.05) and conventional radiological examination (SP: 79.7 [63/79] %, p<0.05; AC: 83.3 [80/96] %, p<0.05).

CONCLUSION

Whole-body PET/MRI and MRI with DWI have better potential for recurrence evaluation than PET/CT with CE-brain MRI and conventional radiological examination in postoperative NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

Whole-body PET/MRI and MRI with DWI have better potential for recurrence evaluation than PET/CT with CE-brain MRI and conventional radiological examination in postoperative NSCLC patients.

RC211-04 Lung Cancer: PET/CT Interpretation (Hopkins Criteria) for Therapy Assessment and Survival Outcome Prediction

Monday, Nov. 30 9:35AM - 9:45AM Location: S505AB

Participants

Rick Wray, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Charles Marcus, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Sheikhabahaei, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Rathan M. Subramaniam, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Travel support, Koninklijke Philips NV

PURPOSE

The aim of the study was to test a simple, reproducible, qualitative, therapy response interpretation method (Hopkins Criteria) that can be implemented on the post treatment 18F-FDG PET/CT study and to evaluate its impact on prognosis in patients with lung cancer.

METHOD AND MATERIALS

This was a retrospective study of 204 biopsy-proven lung cancer patients, who underwent a post treatment PET/CT study after completion of primary treatment from 2003 to 2012. The median follow-up was 12.1 months. The PET/CT studies were interpreted using a qualitative 5-point scoring system - Hopkins Criteria. The primary outcome was overall survival (OS), which was analyzed by Kaplan-Meier plots with a Mantel-Cox long-rank test.

RESULTS

Of the 204 patients, 88 were women and 116 were men. A total of 140 (68.6%) patients died during the follow-up period. There were 123 (61.3%) with a positive Hopkins Criteria score for residual disease and 81 (39.7%) patients with a negative score. The median survival time for patients with a positive score was 29.6 months in comparison to 51.2 months in those with a negative score ($p < 0.001$). There was a significant difference in the OS between patients with a positive score versus those with a negative score (HR 2.01; 95%CI: 1.42-2.84; Logrank $P < 0.001$). The Kaplan-Meier analysis also showed a significant difference in OS between patients with a positive and negative score who were treated with surgery (HR 4.72; 95%CI: 1.84-12.08; Logrank $P < 0.001$) and those treated with chemoradiation alone (HR 1.62; 95%CI: 1.11-2.37; Logrank $P = 0.012$). There was also a significant difference in the OS between patients with scores 1 and 2 versus score 3 versus score 4 and 5 (Logrank $P < 0.0001$).

CONCLUSION

The 5-point qualitative therapy response Hopkins Criteria provides valuable prognostic information in patients with lung carcinoma.

CLINICAL RELEVANCE/APPLICATION

The 5-point qualitative therapy response Hopkins Criteria can predict survival outcome in post therapy patients with lung carcinoma and is recommended for surveillance in this population.

RC211-05 Response Assessment Recommendations in Solid Tumors: RECIST vs PERCIST

Monday, Nov. 30 9:45AM - 10:30AM Location: S505AB

Participants

Heather Jacene, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To compare anatomic and metabolic imaging for response assessment. 2) To discuss limitations of current widely used criteria for assessing response. 3) To discuss the benefits and limitations of metabolic imaging for response assessment.

ABSTRACT

RC211-06 Challenges of Solid Tumor Measurements and Techniques to Address This

Monday, Nov. 30 10:45AM - 11:30AM Location: S505AB

Participants

Haesun Choi, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The currently available response evaluation criteria of solid tumors and its limitations. 2) New concept of response evaluation of solid tumors. 3) Future of response evaluation of solid tumors.

ABSTRACT

RC211-07 Is There an Influence of the PERCIST Analysis Approach Used with FDG PET/CT for Evaluation of Tumor Response on Outcome Prediction in Stage IV Breast Cancer Patients?

Monday, Nov. 30 11:30AM - 11:40AM Location: S505AB

Participants

Katja Pinker, MD, New York, NY (*Presenter*) Nothing to Disclose

Christopher C. Riedl, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Leonard Ong, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Maxine S. Jochelson, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Gary A. Ulaner, MD, PhD, New York, NY (*Abstract Co-Author*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd

Maura Dickler, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Wolfgang A. Weber, MD, New York, NY (*Abstract Co-Author*) Consultant, Endocyte, Inc

PURPOSE

PET Response Criteria in Solid Tumors (PERCIST) 1.0, is a framework for the evaluation of tumor response to therapy by FDG PET/CT. PERCIST recommends measuring changes in tumor FDG uptake of 1-5 lesions as measured by SUV_{peak} normalized for body weight. The purpose of this study was to compare analysis of 1 lesion (PERCIST₁) to analysis of up to 5 lesions (PERCIST₅) and to changes of tumor/liver ratio (TLR) of one lesion for prediction of progression-free (PFS) and disease-specific survival (DSS) in stage IV breast cancer patients under systemic therapy.

METHOD AND MATERIALS

This HPA compliant IRB approved retrospective study included 65 patients with stage IV breast cancer who received 1st or 2nd line systemic therapy in clinical trials and had a FDG PET/CT at baseline and within 3 months after therapy initiation. Treatment response according to PERCIST₁, PERCIST₅ and TLR was correlated with PFS and DSS using Kaplan-Meier analysis/log-rank tests.

RESULTS

Response classifications using PERCIST₁, PERCIST₅ and tumor/liver ratio analysis are summarized in Table 1. All three approaches resulted in highly significant ($p < 0.01$) differences between responders (CR+PR) and nonresponders (SD+PD) for both PFS and DSS (Figure 1). When comparing the PFS and DSS of responders there were no significant differences for PERCIST₁ vs PERCIST₅ ($p = 0.74$), PERCIST₁ vs TLR ($p = 0.88$) and PERCIST₅ vs TLR ($p = 0.64$). There were also no significant differences of PFS in the group of nonresponders: (PERCIST₁ vs PERCIST₅, $p = 0.3$; PERCIST₁ vs TLR, $p = 0.54$; and PERCIST₅ vs TLR, $p = 0.62$).

CONCLUSION

In metastatic breast cancer a metabolic response according to PERCIST₁, PERCIST₅ and TLR is highly significantly correlated with PFS and

In metastatic breast cancer, a metabolic response according to RECIST 1.1 and PET is highly significantly correlated with PFS and OS. The exact definition of a metabolic response does not have a major impact on the prognostic value of response assessment.

CLINICAL RELEVANCE/APPLICATION

Response assessment by FDG PET/CT appears to be a robust approach for monitoring tumor response to therapy in patients with metastatic breast cancer.

RC211-08 Assessment of Early Response to Treatment Using FDG PET/CT in Patients with Advanced Melanoma Receiving Immune Checkpoint Inhibitors

Monday, Nov. 30 11:40AM - 11:50AM Location: S505AB

Participants

Steve Cho, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Evan J. Lipson, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Hyung Jun Im, MD, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Esther Mena, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Steven P. Rowe, MD, PhD, Parkville, MD (*Abstract Co-Author*) Nothing to Disclose
Drew M. Pardoll, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Suzanne Topalian, MD, Baltimore, MD (*Abstract Co-Author*) Consultant, Bristol-Myers Squibb Company Research Grant, Bristol-Myers Squibb Company
Richard L. Wahl, MD, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Nihon Medi-Physics Co, Ltd;

PURPOSE

Immune checkpoint inhibitors (ICI) have demonstrated antitumor activity and prolonged survival in patients with advanced melanoma. Evaluation of response to early treatment response with these agents using standard CT imaging can be challenging. A recent report of FDG-PET/CT after two cycles of ICI has been reported to be highly predictive of the final outcome. We evaluated the use of FDG-PET/CT scans as early predictors of response to therapy in patients with melanoma receiving ICI.

METHOD AND MATERIALS

Twenty patients with advanced melanoma treated with ICI therapy underwent FDG PET/CT prior to initiation of therapy (day -28 to 0; SCAN1), at day 23-28 (SCAN2) and at 16 weeks (SCAN3). FDG-PET scans were evaluated for changes in maximum standardized uptake value (SUVmax), peak SUV (SUVpeak), metabolic tumor volume (MTV), and total lesion glycolysis (TLG). CT images were used to evaluate response according to RECIST 1.1 and immune-related response criteria (irRC). Receiver-operating characteristic (ROC) analysis for prediction of tumor response used area under curve (AUC) to compare baseline SCAN1 and the percent change in PET and CT parameters between SCAN1 and SCAN2. These values were also compared to the standard RECIST 1.1 response at SCAN3.

RESULTS

Twenty evaluable patients who had completed SCAN1 and SCAN2 and had a documented radiologic and/or clinical outcome were evaluated. By RECIST 1.1 criteria 2 had partial responses (PR) and 2 complete responses (CR) at 16 weeks. One patient had stable disease >6 months and 15 had progressive disease (PD). SUVmax and SUVpeak at SCAN1 and SUVmax and SUVpeak percent change from SCAN1 to SCAN2 were not strongly predictive of tumor response, with AUC of 0.480, 0.547, 0.680, and 0.680, respectively. CT-based irRC and RECIST 1.1 were also not strongly predictive of tumor response with AUC of 0.760 and 0.787, respectively. Analyses of PET based MTV and TLG parameters are in progress.

CONCLUSION

Standard parameters of PET and CT response at baseline and early in the course of ICI therapy were not strongly predictive for response to ICI treatment in patients with advanced melanoma. These findings require further validation in a larger cohort of patients.

CLINICAL RELEVANCE/APPLICATION

Standard PET and CT parameters of early tumor response to ICI therapy are not sufficient for predicting response to therapy, and therefore development of improved imaging metrics and methods are needed.

Honored Educators

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

Richard L. Wahl, MD - 2013 Honored Educator

RC211-09 Analysis of PET/CT Patterns of Response to Ipilimumab in Patients with Metastatic Melanoma

Monday, Nov. 30 11:50AM - 12:00PM Location: S505AB

Participants

Brandon A. Howard, MD, Durham, NC (*Presenter*) Nothing to Disclose
Bhavana Singh, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
April Salama, Durham, NC (*Abstract Co-Author*) Consultant, Bristol-Myers Squibb Company; Advisory Board Member, Bristol-Myers Squibb Company; Institutional Research Grant, Bristol-Myers Squibb Company; Institutional Research Grant, Merck & Co, Inc
Brent Hanks, MD, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Mustafa R. Bashir, MD, Cary, NC (*Abstract Co-Author*) Research support, Siemens AG; Research support, Bayer AG; Research support, Guerbet SA; Research support, General Electric Company; Consultant, Bristol-Myers Squibb Company
Tracy A. Jaffe, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Andrew R. Barina, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Melanoma is a serious public health problem with rising incidence worldwide. Although surgery is efficacious for early stage disease, prognosis is poor for metastatic melanoma, with median survival of less than 1 year. Previous therapies, such as interleukin-2 and chemoradiation, have had minimal impact on survival. Ipilimumab (Ipi; Bristol- Meyers Squibb, Princeton, NJ), a human monoclonal antibody against the cytotoxic T-lymphocyte associated antigen 4 (CTLA-4), was recently introduced and demonstrates improved survival in metastatic melanoma. CTLA-4 is a negative regulator of T cell activation and is exploited by melanoma cells to evade T cell immune- mediated destruction. CTLA-4 blockade by Ipi enhances host anti-tumor response. F-18 fluorodeoxyglucose PET-CT is routinely used in melanoma, however is subject to false positives when inflammatory or immune mediated processes are involved. It has recently been reported that in the setting of Ipi therapy, certain findings such as colitis, lymphadenopathy, inflammatory fat stranding may portend a favorable prognosis. We aim to further characterize the spectrum of PET/CT findings relevant to response to ipilimumab in our population.

METHOD AND MATERIALS

Patients who underwent FDG PET-CT from 2005 through Sept. 2014, and received at least one cycle of Ipi were retrospectively reviewed. PET/CT results, including unusual findings (i.e. those neither clearly malignant or benign on imaging) were recorded and correlated with clinicopathologic records and subsequent imaging.

RESULTS

103 patients met criteria for the study. Indeterminate findings on PET-CT included FDG-avid lymphadenopathy, diffuse thyroid uptake, subcutaneous nodularity, gallbladder uptake, and intracardiac uptake. A mixed pattern of response was often reported.

CONCLUSION

The most common PET/CT findings in metastatic melanoma patients on ipilimumab were FDG- avid lymphadenopathy, thyroid uptake, and subcutaneous nodularity, which did not correlate with an adverse outcome. A mixed response was often noted. Further analysis of clinical outcome data and clinical benefit analysis will be performed, including Kaplan-Meier analysis, to determine whether these correlated with improved outcomes.

CLINICAL RELEVANCE/APPLICATION

Characteristic patterns on PET/CT may imply a favorable outcome to treatment with ipilimumab in melanoma. Care must be taken not to interpret FDG uptake in lymph nodes, thyroid, and subcutaneous fat as progression.

MSCM21

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

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



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

Participants

John R. Leyendecker, MD, Dallas, TX (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be familiar with the MRI appearance of common musculoskeletal derangements of the hip. 2) Develop a differential diagnosis for musculoskeletal soft tissue tumors based on MRI appearance. 3) Distinguish between common benign and malignant liver neoplasms. 4) Be familiar with the typical MRI appearance of select female pelvic disorders.

ABSTRACT

This session will help attendees recognize and manage select, commonly encountered musculoskeletal and abdominopelvic abnormalities based on their MRI appearances using a case-based, interactive format.

Sub-Events

MSCM21A Musculoskeletal MRI of the Hip and Pelvis

Participants

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

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCM21B MRI of Soft Tissue Masses of the Extremities

Participants

Kirkland W. Davis, MD, Madison, WI, (kdavis@uwhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Distinguish characteristic extremity soft tissue masses on the basis of signal characteristics, such as high signal on T1-weighted images or low signal on all sequences.

ABSTRACT

MSCM21C MRI of the Liver

Participants

Nicole M. Hindman, MD, New York, NY, (Nicole.Hindman@nyumc.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize and analyze benign but unusual liver lesions. 2) Analyze uncommon presentations of liver lesions. 3) Recognize neoplastic mimics of benign lesions in the liver (eg, a colon metastasis mimicking a hemangioma) .

ABSTRACT

This session will cover common and uncommon presentations of liver lesions on several modalities (ultrasound, CT and MRI). A brief interactive review of common, but atypical presentations of both benign and malignant liver lesions will be presented. Malignant mimics of benign liver lesions will also be shown, with features that should be analyzed in order to better characterize the lesion, and appropriately raise concern (eg, for a metastasis or intrahepatic cholangiocarcinoma instead of a benign hemangioma). Recent advances in liver lesion characterization will be covered.

MSCM21D MRI of the Female Pelvic Organs

Participants

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

LEARNING OBJECTIVES

View learning objectives under main course title.

Honored Educators

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

Lasting Cultural Shift - Platitudes to Attitudes: Roundtable with ACR Leaders

Monday, Nov. 30 8:30AM - 10:00AM Location: E260

HP LM

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

Participants

Bibb Allen JR, MD, Birmingham, AL (*Coordinator*) Nothing to Disclose

Bibb Allen JR, MD, Birmingham, AL (*Moderator*) Nothing to Disclose

ABSTRACT

Because of changing federal policy and reimbursement models, the next five years may be the most tumultuous for medicine and our specialty since the adoption of Medicare. Leaders in organized radiology are working to place our specialty in the best possible position, but we face complex issues requiring complex and potentially counterintuitive solutions. Strategic decisions made by our organizations need to be informed by and have buy-in from those in the trenches of clinical practice. The imperatives of health reform and the dynamic shift from volume based transactional care to value based population care are creating the critical issues facing our specialty. In this roundtable session, we discuss a number of the critical issues facing our practices and discuss proactive strategic initiatives that can empower radiologists to transition from volume based to value based care and position their practices to succeed in the new paradigm. While integral to providing optimal radiological care, the value of the interpretations we provide will ultimately be taken for granted by our systems and policy makers. In order to provide additional value we must look beyond just the value of our interpretations. By engaging in the care prior to and following image interpretation, radiologists can improve individual patients' safety, outcomes and engagement as well as improve population health. This measurable role for radiology in providing cost effective care will increase our relevance to the healthcare system beyond image interpretation. Participants can share their ideas and concerns with leaders in organized radiology as well as take away a number of tools they can use in their practices to begin or enhance the shift to value based care. Using these strategies, radiologists can leverage the value they create to enhance their position in their health systems and your professional organizations can leverage that same value with policy makers to impact federal health policy.

Sub-Events

RC227A Awareness to Accountability: Coping with the Mandates for Documenting Higher-Value Care

Participants

Bibb Allen JR, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the economic, political and practice issues facing our specialty. 2) Analyze the federal policy, private payer, health system and consumer initiatives that are signaling the shift toward value-driven care and reimbursement models. 3) Review organized radiology's efforts to raise awareness and promote culture change among radiologists to adapt to the mandates of health reform. 4) Discuss organized radiology's role in empowering radiologists to document the delivery of higher value care through metrics development, policy maker engagement, and data collection/registry development for reporting quality data to policy makers and certification bodies. 5) Examine how registry reporting can enable socioeconomic researchers to assess ways imaging can improve outcomes.

ABSTRACT

Health and Human Services Secretary Sylvia Burwell along with the US Congress have set ambitious targets for value-based payments in the US Medicare program with the goal of tying 85% of Medicare fee-for-service payments to quality or value metrics by 2016. Raising awareness will not be enough to achieve a lasting cultural shift required to cope with these mandates. Empowering radiologists to transition from volume based to value based care and position their practices requires development of meaningful metrics specific to radiology for quality reporting is essential and developing tools to capture this meaningful information as part of our daily workflow is requisite for efficient practice. By standardizing these metrics we have an opportunity for national registry reporting, which offers not only opportunity for internal process improvement but also benchmarking for government agencies to be used for quality reporting in the Physician Quality Reporting System (PQRS) and potentially by American Board Radiology for meeting Practice Quality Improvement (PQI) requirements for Maintenance of Certification (MOC). The goal is for radiologists to seamlessly participate in PQRS and potentially PQI and MOC by automatically reporting their metrics to the registries and monitoring their dashboards for areas that need improvement. Additionally, registry reporting allows data mining that will support future socioeconomic research in radiology, so that we can learn where there are opportunities for further improvement in the care of our patients and cost efficiencies.

RC227B Providing Higher-Value Care through Population Health Management: What Is the Radiologist's Role?

Participants

James A. Brink, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Examine current trends and mandates for physician involvement in population health management. 2) Explain the differences and synergies between population health management and the art of medical practice. 3) Discuss the value radiologists can bring to population health management and how this role will become an important resource for their health systems. 4) Identify the tools radiologists can use in their practices to be effective in population health management by reducing variation in radiological care. 5) Discuss the role of precision and personalized medicine in population health management.

ABSTRACT

Specialists may leverage several strategies when seeking to manage population health. For radiologists, reducing variation in the

Specialists may leverage several strategies when seeking to manage population health. For radiologists, reducing variation in the imaging examinations that we recommend and how we report key findings has the potential to support more uniform and appropriate care at the population level. Under-utilization of medical imaging risks decrements in the health of our population while over-utilization leads to increased cost and heightened morbidity from unnecessary follow-on imaging and interventional procedures. Moreover, increased precision in the quantitative nature of our reports promises to yield more effective treatments as therapies are personalized to precise patient phenotypes and disease states. Appropriateness criteria and referral guidelines take the guesswork out of which tests to recommend, and imaging-based care algorithms narrow the range of recommendations that referrers may receive in response to a clinical imaging scenario. However, such changes to our practice threaten the 'art of medicine' where intuition plays an important role in establishing diagnoses and understanding disease severity. Art can take many forms, and the transition from personal impression to consensus and fact-based conclusion in the tests we recommend and the reports that we generate mirror the transition from abstract art to photorealism. The increase in precision does not make 'art' any less artistic; rather, it is simply based on a different set of principles.

RC227C Involving Patients in Their Radiological Care: Radiologist Visibility, Personalized Care and Improving Outcomes

Participants

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

LEARNING OBJECTIVES

1) Discuss the ways radiologists can enhance patients' experiences throughout the continuum of radiological care. 2) Identify tools and resources for patient education regarding their radiological care. 3) Describe the current mandates for patient access to medical records and discuss ways for effective communication between radiologists and patients. 4) Leverage the value of patient-centered radiological care as a resource for health systems. 5) Identify ways to improve patient outcomes through effective communication.

ABSTRACT

Reform of the healthcare delivery system has as a stated goal the so-called "Triple Aim": to reduce costs while improving both population health as well as the individual experience of care. For radiologists, many of whom do not typically meet the patients whose images they interpret, this represents both a challenge as well as a significant opportunity. Across the continuum of imaging care delivery there are points at which radiologists can engage patients to improve not only the patient's level of satisfaction but also their eventual outcome. For example a patient who understands the nature of the imaging test they will undergo is more likely to be able to cooperate in the process of making sure the images are of the highest diagnostic quality. We will review the resources available to radiologists to support them in engaging their patients at each step of the imaging care process. We will focus on disruptive innovations around direct communication of results to patients and sharing of images and discuss how payment models and regulations are fuelling these changes. We will also highlight how providing a more patient-centered imaging care experience will align radiologists with a value based approach to healthcare delivery providing opportunities to demonstrate the value that imaging provides to stakeholders both internal such as health system administration and external such as payers.

US-guided Interventional Breast Procedures (Hands-on)

Monday, Nov. 30 8:30AM - 10:00AM Location: E264

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

Jocelyn A. Rapelyea, MD, Washington, DC (*Moderator*) Consultant, General Electric Company
Margaret M. Szabunio, MD, Lexington, KY (*Presenter*) Nothing to Disclose
Shambhavi Venkataraman, MD, Boston, MA (*Presenter*) Nothing to Disclose
Angelique C. Floerke, MD, Washington, DC (*Presenter*) Consultant, CareFusion Corporation
Rachel F. Brem, MD, Washington, DC (*Presenter*) Board of Directors, iCAD, Inc Board of Directors, Dilon Technologies LLC Stock options, iCAD, Inc Stockholder, Dilon Technologies LLC Consultant, U-Systems, Inc Consultant, Dilon Technologies LLC Consultant, Dune Medical Devices Ltd
Karen S. Johnson, MD, Durham, NC, (karen.johnson2@dm.duke.edu) (*Presenter*) Research Consultant, Siemens AG
Nicole S. Lewis, MD, Washington, DC (*Presenter*) Nothing to Disclose
Kathleen R. Gundry, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Michael N. Linver, MD, Albuquerque, NM (*Presenter*) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd

LEARNING OBJECTIVES

1) Describe the equipment needed for ultrasound guided interventional breast procedures. 2) Review the basic principles of ultrasound guidance and performance of minimally invasive breast procedures. 3) Practice hands-on technique for ultrasound guided breast interventional procedures.

ABSTRACT

This course is intended to familiarize the participant with equipment and techniques in the application of US guided breast biopsy and needle localization. Participants will have both basic didactic instruction and hands-on opportunity to practice biopsy techniques on tissue models with sonographic guidance. The course will focus on the understanding and identification of: 1) optimal positioning for biopsy 2) imaging of adequate sampling confirmation 3) various biopsy technologies and techniques 4) potential problems and pitfalls

RC231

Master Class in Musculoskeletal Ultrasound (Hands-on)

Monday, Nov. 30 8:30AM - 10:00AM Location: E258



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

Participants

Marnix T. van Holsbeeck, MD, Detroit, MI (*Presenter*) Consultant, General Electric Company Consultant, Koninklijke Philips NV Stockholder, Koninklijke Philips NV Stockholder, General Electric Company Grant, Siemens AG Grant, General Electric Company
Catherine J. Brandon, MD, Ann Arbor, MI (*Presenter*) Stock options, VuCOMP, Inc
Michael A. Dipietro, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Alberto S. Tagliafico, MD, Genova, Italy (*Presenter*) Nothing to Disclose
Joseph H. Introcaso, MD, Neenah, WI (*Presenter*) Nothing to Disclose
Humberto G. Rosas, MD, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize and identify pitfalls of scanning that lead to false positive or false negative musculoskeletal ultrasound results. 2) Perform skills for scanning difficult patients. 3) Follow rigorous protocols for the examination of different anatomic regions. 4) Position patients for more complicated musculoskeletal ultrasound examinations. 5) Recognize and integrate the importance of tissue movement in judging the functionality of the extremities.

ABSTRACT

In this Musculoskeletal Ultrasound Master class, an opportunity will be given to participants to start a written dialogue in advance to RSNA 2012. The electronically submitted questions will be sorted by instructors and organized per topic. A select number of recurrent themes in these questions will be prepared for dialogue on stage. When the questions focus on a particular scanning skill, the authors of the questions will be invited on the examination platform to show problems they encounter in their practice. By using a step-by-step approach in solving the scanning issues, all who are present should benefit from the technical interactions on stage. Cameras will project scanning details on large screens. The seating in the master class will guarantee close proximity for an enriching interaction between audience and stage. At the end of the master class, the audience will be broken up in smaller groups for a more personal interaction with the instructors with the intent of improving scanning skills on an individual level.

RC202

Strategies for ABR Certifying Exam Preparation and ACGME Program Requirements

Monday, Nov. 30 8:30AM - 10:00AM Location: S102D

ED

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

Participants

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

Sub-Events

RC202A The ABR Certifying Exam: Are You Ready?

Participants

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

LEARNING OBJECTIVES

1) Discuss the components of the ABR Certifying examination. 2) List a variety of item types that will appear on the examination. 3) Discuss the preliminary results of the most recent administration.

RC202B Fresh from the First ABR Certifying Exam: Perspectives on the Exam Experience while Starting an Academic Job

Participants

Kim L. Sandler, MD, Nashville, TN, (kim.sandler@vanderbilt.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe resources to help prepare for the new ABR certifying exam. 2) Discuss perspectives on how to balance ABR certifying exam preparation with starting a job in academic medicine.

ABSTRACT

The American Board of Radiology offered the Certifying Exam for the first time in October of this year. Unlike the oral board system where the examination was offered during the fourth year of residency, this year's candidates completed the Core Exam in 2013 and have now been in fellowship and/or practicing radiology for the past two years. Graduates of radiology residency are now board eligible and have the challenge of preparing for this exam while also being in a new work environment. Perspectives on preparing for the exam during fellowship and while practicing in an academic center will be discussed.

RC202C Fresh from the First ABR Certifying Exam: Perspectives on the Exam Experience while Starting a Private Practice Job

Participants

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

LEARNING OBJECTIVES

1) Describe resources to help prepare for the new ABR certifying exam. 2) Discuss perspectives on how to balance ABR certifying exam preparation with starting a private practice job.

ABSTRACT

Since the 2007 American Board of Radiology (ABR) announcement of a change in the ABR examination format, timing and content, radiology educators have been analyzing these changes and their potential impact on interviewing for and starting an academic or private practice job. The first cohort of radiologists eligible for the new ABR certifying examination will have completed this exam approximately two months prior to the RSNA meeting. Perspectives on preparing for the exam while starting a private practice job will be discussed. Ideas on how future board eligible radiologists might approach the ABR certifying exam preparation process will be highlighted during the presentation.

RC202D Noninterpretive Skills: Not Unimportant Skills

Participants

Mark E. Mullins, MD, PhD, Atlanta, GA, (memulli@emory.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

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

ABSTRACT

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

tips on how to teach and assess these essential skills.

Communicating Effectively with Patients (Sponsored by the RSNA Public Information Committee)

Monday, Nov. 30 8:30AM - 10:00AM Location: S104A

PRAMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**Participants**

Judy Yee, MD, Clayton, CA, (judy.yee@ucsf.edu) (*Moderator*) Research Grant, EchoPixel, Inc
Stephen D. Brown, MD, Boston, MA, (stephen.brown@childrens.harvard.edu) (*Presenter*) Nothing to Disclose
Stuart G. Silverman, MD, Brookline, MA, (sgsilverman@partners.org) (*Presenter*) Author, Wolters Kluwer nv
Michael J. Callahan, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Answer patient questions about radiation dose and address concerns about risk. 2) Apply a standardized checklist to the informed consent conversation that is patient centered, quality driven, and legally sound. 3) Effectively deliver good and bad results and disclose medical errors.

ABSTRACT

Patients are becoming increasingly involved in their healthcare. Frequently, they turn to the Internet for information on their conditions, diagnosis and treatment options. With the vast amount of information available-both reliable and unreliable-to patients, it is critical that radiologists be able to provide context, help patients to be better informed decision makers in their healthcare, and educate patients on benefits versus risks of the procedures they may undergo. This course will provide specific examples and a strategy for communicating honestly and directly with patients.

Emergency Radiology Series: Emergency Radiology: Optimize Your Imaging

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



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

Participants

Meir H. Scheinfeld, MD, PhD, Bronx, NY, (mscheinf@montefiore.org) (*Moderator*) Nothing to Disclose
 Aaron D. Sodickson, MD, PhD, Wayland, MA, (asodickson@bwh.harvard.edu) (*Moderator*) Research Grant, Siemens AG; Consultant, Bracco Group
 Ferco H. Berger, MD, Amsterdam, Netherlands (*Moderator*) Nothing to Disclose

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Douglas S. Katz, MD - 2013 Honored Educator
 Douglas S. Katz, MD - 2015 Honored Educator
 Aaron D. Sodickson, MD, PhD - 2014 Honored Educator

Sub-Events**RC208-01 Optimizing Pulmonary Embolism CT**

Monday, Nov. 30 8:30AM - 8:55AM Location: S102AB

Participants

Aaron D. Sodickson, MD, PhD, Wayland, MA, (asodickson@bwh.harvard.edu) (*Presenter*) Research Grant, Siemens AG; Consultant, Bracco Group

LEARNING OBJECTIVES

1) Review the meaning of the X-ray tube output metrics CTDIvol and DLP. 2) Understand practical radiation dose reduction techniques including, among others, how tube current modulation works and is configured. 3) Demonstrate practical CT strategies to optimize CT parameters and IV contrast infusion to achieve excellent image quality at low radiation dose .

ABSTRACT**Honored Educators**

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Aaron D. Sodickson, MD, PhD - 2014 Honored Educator

RC208-02 Expiratory Phase CT Pulmonary Angiography: Improving Contrast Enhancement of the Pulmonary Arteries in Failed Diagnostic Studies

Monday, Nov. 30 8:55AM - 9:05AM Location: S102AB

Participants

Joao R. Inacio, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
 Maha A. Al Dajani, MD, MBBS, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
 Katrina Newbiggin, MBBS, Brisbane, Australia (*Abstract Co-Author*) Nothing to Disclose
 Carolina A. Souza, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
 Ashish Gupta, MD, Ottawa, ON (*Abstract Co-Author*) Grant, Medtronic, Inc
 Elena Pena, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
 Adnan M. Sheikh, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
 Matthew D. McInnes, MD, FRCPC, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
 Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
 Carole J. Dennie, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT pulmonary angiography (CTPA) is performed in end-inspiration. Non-diagnostic studies resulting from inadequate pulmonary arterial contrast opacification may be secondary to poor thoracic inflow of contrast and are routinely repeated in end-inspiration. We aimed to prospectively assess the benefit of performing the repeat study in end-expiration to obtain diagnostic studies.

METHOD AND MATERIALS

From November 2013 to April 2014, a prospective protocol was implemented to identify consecutive non-diagnostic CTPA studies due to poor pulmonary arterial contrast opacification in a tertiary center. All studies identified as non-diagnostic at the CT console by the technologist, were followed by a repeat contrast injection and image acquisition was performed in end-expiration. Measurement of pulmonary arterial attenuation and lung volumes was compared in all failed inspiration and repeated end-expiration studies (t test). A retrospective cohort of repeated CTPA studies performed in end-inspiration was compared with the prospective

cohort.

RESULTS

Of 1700 consecutive CT pulmonary angiograms performed, 13 patients had a non-diagnostic inspiration study (<200HU attenuation in the MPA) and had a repeat end-expiration study. Expiratory phase CTPA studies had higher contrast enhancement in the MPA ($p<0.001$). Expiratory studies were diagnostic (MPA >200HU) in 92% of patients (12 of 13).

CONCLUSION

End-expiration CTPA studies demonstrate significant improvement in pulmonary arterial enhancement compared to failed inspiration studies, allowing diagnostic salvage studies.

CLINICAL RELEVANCE/APPLICATION

End-expiration CTPA studies can be used to salvage non diagnostic CTPA inspiratory studies.

RC208-03 New Contrast Injection Protocol for Dual Energy Chest CT: Does it Obviate the Need for Bolus Tracking and Arbitrary Scan Delay?

Monday, Nov. 30 9:05AM - 9:15AM Location: S102AB

Participants

Alexi Otrakji, MD, Boston, MA (*Presenter*) Nothing to Disclose
Azadeh Tabari, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jo-Anne O. Shepard, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT pulmonary angiography (CTPA) is often triggered with bolus tracking (BT) techniques. We compared effects of bolus tracking and new fixed delay split bolus (FD-SB) contrast injection on vascular enhancement (pulmonary and aortic) and artifacts on dual energy CTPA.

METHOD AND MATERIALS

Of the 80 adult patients included in our study, 40 patients underwent CTPA using BT (4 cc/second, 370 mg%, 80-100 ml) (n= 20 patients with single energy CT(SECT): M:F 9:11, mean age 62 ± 11 years, mean weight 75 ± 15 kg and n= 20 patients with dual energy CT(DECT) M:F 11:9, mean age 61 ± 15 years, mean weight 76 ± 13 kg) and 40 weight matched patients were scanned with FD-SB (M:F 21:19, mean age 62 ± 10 years, mean weight 73 ± 16 kg). In FD-SB (80ml, 370 mg%), 44ml of contrast was injected at rate of 0.6ml/second followed by 36ml contrast at rate of 1.8ml/second with DECT scanning at 100 second fixed delay. DECT was performed on dual source MDCT or single source 64-row MDCT. All exams were assessed subjectively for vascular enhancement (lobar, segmental and subsegmental pulmonary arteries, aorta, and left atrial appendage) and artifacts. HU in MPA, and CTDI vol and DLP were recorded.

RESULTS

There was no significant difference between patient weights in BT and FD-SB groups ($p=0.6$). CTDI vol for BT SECT: 14 ± 6 mGy; and BT DECT: 9 ± 1.7 mGy; and FD-SB DECT; 7 ± 0.7 mGy. For FD-SD DECT, mean HU in main pulmonary arteries was 353 ± 132 HU. Optimal to excellent qualitative contrast enhancement up to subsegmental levels was seen for both BT and FD-SB examinations in 97.5% of cases (39/40) and limited in one patient (2.5%, 1/40). FD-SB DECT resulted in significantly superior enhancement in left atrium and thoracic aorta in all patients compared to all BT (SECT and DECT) ($p<0.05$). Contrast streak artifacts were also substantially lower on FD-SB DECT than on BT exams. Pulmonary blood volume images were uniform and superior on FD-SB DECT than on BT DECT.

CONCLUSION

Fixed delay split bolus contrast injection with DECT results in better contrast enhancement in pulmonary arteries, heart, and aorta with less contrast related artifacts as compared to bolus tracking technique for single energy- or DE-CT pulmonary angiography.

CLINICAL RELEVANCE/APPLICATION

Fixed delay split bolus DECT of the chest has the potential to replace bolus tracking CTPA for the evaluation of chest vasculature.

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Subba R. Digumarthy, MD - 2013 Honored Educator

RC208-04 Dual-energy CT in the Emergency Department

Monday, Nov. 30 9:15AM - 9:40AM Location: S102AB

Participants

Savvas Nicolaou, MD, Vancouver, BC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the basic principles of dual energy CT/Spectral imaging. 2) Discuss novel techniques implemented using dual energy CT in the acute setting including: material characterization/decomposition, bone subtraction, virtual non-contrast, iodine distribution

maps, and monoenergetic spectral imaging. 3) To explain the utility of dual energy/spectral imaging in the acute care setting with examples in cardiopulmonary imaging, vascular imaging, intracranial aneurysms and stroke imaging, blunt vascular neck injuries, abdominal imaging and musculoskeletal applications.

ABSTRACT

RC208-05 Is Dual-Energy CT Pulmonary Angiography (CTPA) a Viable Alternative to Single-energy CTPA in Pregnant and Post-partum Patients? Initial Results

Monday, Nov. 30 9:40AM - 9:50AM Location: S102AB

Participants

Shaunagh McDermott, FFR(RCSI), Boston, MA (*Presenter*) Nothing to Disclose
Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Alexi Otrakji, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Kalra K. Mannudeep, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jo-Anne O. Shepard, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare single-energy (SE) and dual-energy (DE) CT pulmonary angiogram (CTPA) protocols in pregnant and postpartum women.

METHOD AND MATERIALS

Our IRB approved study included 64 patients. Fifty patients underwent CTPA to assess for pulmonary embolism with either DE-CTPA (mean age 34 years, range 27-45; mean weight 106+49kg; mean gestation 21.5 weeks; mean postpartum 11 days) or SE-CTPA (mean age 30 years, range 19-44; mean weight 92+45kg; mean gestation 26 weeks; mean postpartum 9 days). Fourteen weight-matched non-pregnant women underwent DE-CTPA (mean age 33 years, range 22-44; mean weight 93+33kg). Scans were performed on single and dual source DECT capable CT scanners. Images were assessed qualitatively for image quality, contrast enhancement (up to subsegmental pulmonary arteries) and artifacts. CT numbers were measured in the pulmonary trunk, right and left main and lower lobar arteries. Noise was also measured in the pulmonary trunk. CTDIvol and DLP were also recorded.

RESULTS

A third (32%) of pregnant/postpartum women had limited or unacceptable SE-CTPA studies compared to just 14% limited or unacceptable DE-CTPA studies (identical to non-pregnant group undergoing DE-CTPA). Limited or unacceptable DE-CTPA occurred only in heavier patients (>190 kg) from excess noise due to application of incorrect scan parameters in these patients (80/140 kV instead of correct higher dose setting of 100/140 kV). Suboptimal SE-CTPA was noted in patients of all sizes (61-139 kg). Mean HU values of the pulmonary trunk were 588+373 HU in the DE-CTPA pregnant/postpartum group, 245+72 HU in the SE-CTPA pregnant/postpartum group ($p<0.05$). DE-CTPA in the pregnant/postpartum group was optimal for evaluation of subsegmental pulmonary arteries in 64% of patients relative to only 37% patients in the SE-CTPA group. Frequency of contrast streak artifacts on DE- and SE-CTPA was similar ($p>0.05$). The CTDIvol for DE-CTPA and SE-CTPA were 9 and 19 mGy, respectively (<0.05).

CONCLUSION

DE CTPA provides better contrast enhancement and fewer suboptimal studies compared to SE CTPA for evaluation of pulmonary embolism in pregnant or postpartum women.

CLINICAL RELEVANCE/APPLICATION

Pulmonary embolism is an important cause of morbidity and mortality in pregnant and postpartum women. DE CTPA produces better quality images when compared to SE CTPA with equal or reduced radiation in this group. Therefore, it is logical to utilize this modality whenever available.

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Subba R. Digumarthy, MD - 2013 Honored Educator

RC208-06 Improved Signal and Image Quality at the Cervicothoracic Junction Using Dual-Energy CT and Monoenergetic Plus Reconstruction

Monday, Nov. 30 9:50AM - 10:00AM Location: S102AB

Participants

Dennis Parhar, BSc, Vancouver, BC (*Presenter*) Nothing to Disclose
Teresa I. Liang, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Luck J. Louis, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Tim O'Connell, MD, Meng, Vancouver, BC (*Abstract Co-Author*) President, Resolve Radiologic Ltd; Speake, Siemens AG
Patrick D. McLaughlin, FFRCSI, Cork, Ireland (*Abstract Co-Author*) Speaker, Siemens AG
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Attempts to reduce radiation exposure at the cervical spine are frequently and negatively limited by beam hardening artifact and photon starvation at the cervicothoracic junction. The purpose of this study is to examine whether dual-energy CT (DECT) with advanced monoenergetic (Mono+) reconstruction can reduce these artifacts and improve image quality through the cervicothoracic junction.

METHOD AND MATERIALS

In this retrospective study, 19 consecutive patients underwent DECT scanning of the cervical spine using a dual source 128-slice CT scanner (Definition FLASH, Siemens Healthcare, Germany) between February 1 and March 31, 2015. The DECT data was reconstructed using the Mono+ algorithm at five different energy levels (ranging 100 to 190 keV). Attenuation was measured at each energy level by placing regions of interest within the vertebral bodies and spinal cord. Statistical analysis of the objective data was carried out by student's t-test. Subjective analysis of image quality was conducted on a semi-objective 4 point scoring scheme by 4 radiologists. These results were subjected to a Wilcoxon Signed-Rank Test for statistical analysis.

RESULTS

Attenuation of the spinal cord at the level of C7 to T1 was significantly reduced as compared to C2 due to beam hardening. In the 100 keV reconstruction, there was a 69.9% decrease (-27.7HU, $p < 0.0001$) in attenuation at C7 and 60.2% (-23.9HU, $p < 0.0001$) at T1 compared to C2. However, cord attenuation substantially improved with increased energy. The maximal improvement was seen with Mono+ images reconstructed at 190 keV, where cord attenuation at C7 resulted in an increase of 61.0% (7.28HU, $p = 0.0391$) over 100keV. Subjective analysis also revealed improved image quality at the cervicothoracic junction. Compared to the mixed energy scans, at 190keV, there was a significant improvement in the quality of spinal cord visualization at C7 (median =3.0, $p < 0.0001$) and at T1 (median=3.000, $p < 0.0001$). Beam hardening artifacts were also reduced by 44.8% ($p < 0.0001$) at the C7-T1 junction.

CONCLUSION

Data derived from DECT and reconstructed using the Mono+ algorithm significantly reduces beam hardening artifacts at the cervicothoracic junction and significantly improves image quality.

CLINICAL RELEVANCE/APPLICATION

CT imaging at the cervicothoracic junction suffers from extensive artifact and noise. Due to its superior image quality, Mono+ can provide a significant benefit by improving assessment of this region.

RC208-07 Question and Answer

Monday, Nov. 30 10:00AM - 10:15AM Location: S102AB

Participants

RC208-08 Optimizing Abdominal CT Protocols and Utilization

Monday, Nov. 30 10:15AM - 10:40AM Location: S102AB

Participants

Jamlik-Omari Johnson, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To overview the current status of emergency abdominal and pelvic CT imaging protocols. 2) To review the current literature of abdominal and pelvic emergency CT imaging protocols, with an emphasis on optimizing diagnostic information while minimizing radiation dose reduction. 3) To review areas of continuing controversy regarding emergency abdominal CT protocols.

RC208-09 Noncalcified Gallstones: Making the Invisible Visible with Dual Energy CT

Monday, Nov. 30 10:40AM - 10:50AM Location: S102AB

Participants

Jennifer W. Uyeda, MD, Boston, MA (*Presenter*) Nothing to Disclose

Aaron D. Sodickson, MD, PhD, Wayland, MA (*Abstract Co-Author*) Research Grant, Siemens AG; Consultant, Bracco Group

PURPOSE

To assess whether virtual monochromatic imaging (VMI) increases the detection of noncalcified gallstones on dual-energy CT (DECT) compared with conventional polychromatic scanning.

METHOD AND MATERIALS

25 patients (20F, 5M) with noncalcified gallstones confirmed on abdominal ultrasound and/or MR were included in this IRB approved, HIPAA compliant study. All patients had a DECT on a dual-source 128x2 slice scanner (Siemens FLASH) with either 80/Sn140 or 100/Sn140 kVp pairs depending on patient size. 0.75x0.5 mm source images at high and low kVp were used for DE postprocessing (Syngo via, version VA30) using the Monoenergetic Plus application. Within 3 mm reconstructed slices, regions of interest of 0.5 cm² were placed on noncalcified gallstones and bile to record Hounsfield Units (HU) at VMI energy levels ranging from 40-190 keV.

RESULTS

Noncalcified gallstones uniformly demonstrate HU that are lowest at 40 keV and increase at higher keV. Bile HU values generally decrease at higher keV. Few of the noncalcified stones are visible at 70 keV (simulating a conventional 120 kVp scan), with measured contrast (bile-stone HU) <10 HU in 76%, 10-20 in 20%, and >20 in 4%. Contrast is maximal at 40 keV, where 100% demonstrate >20 HU difference, 75% > 38 HU difference, and 50% > 55 HU difference. A paired t-test demonstrates a significant difference ($p < 0.0001$) between this stone:bile contrast at 40 keV vs 70 keV.

CONCLUSION

Low VMI energy of 40 keV increases conspicuity of noncalcified gallstones compared to conventional 120 kVp polychromatic scanning, potentially improving detection.

CLINICAL RELEVANCE/APPLICATION

DECT optimizes visualization of noncalcified gallstones, many of which are invisible on conventional 120kVp scans. This may reduce the need for further imaging for suspected cholelithiasis.

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Aaron D. Sodickson, MD, PhD - 2014 Honored Educator

RC208-10 Comparison of Abdominal Radiograph and Non-contrast Ultralow Dose CT for Kidney Stones (CANUCKS Study)

Monday, Nov. 30 10:50AM - 11:00AM Location: S102AB

Participants

Patrick D. McLaughlin, FFRCRCSI, Cork, Ireland (*Presenter*) Speaker, Siemens AG
Ben Chew, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Jean Buckley, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
James Nugent, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
John R. Mayo, MD, Vancouver, BC (*Abstract Co-Author*) Speaker, Siemens AG
Luck J. Louis, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Hugue A. Ouellette, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Charles V. Zwirewich, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

At our institution, Kidney-Ureter-Bladder (KUB) radiographs are routinely performed immediately prior to shockwave lithotripsy (SWL). Conventional low dose CT-KUBs (2.2-3.0 mSv) are only performed if stones are not visible on KUB (10-15% of cases). Recent advances in integrated circuit CT detector design (STELLAR, Siemens Healthcare) and image reconstruction algorithms have made sub-millisievert ultra-low dose CT (ULDCT) acquisition feasible, but the diagnostic performance of these ULDCTs in comparison with KUB has not yet been reported. In this prospective study we compare the radiation dose and diagnostic performance of ULDCT to KUB in patients prior to SWL. We hypothesized that ULDCT will detect more symptomatic calculi than KUB at less radiation exposure prior to SWL.

METHOD AND MATERIALS

Patients enrolled in this study consented and received both a KUB radiograph and an ULDCT (32x0.6mm,100kV, refmAs=10,pitch 1.5) prior to SWL. If no stones were identified, then a standard low dose abdominal CT was obtained. Radiation exposure parameters were recorded and both examinations were read in random order by 2 blinded radiologists to determine image quality and diagnostic accuracy.

RESULTS

102 patients (M:F, 72:32) with a mean age of 55.7 ± 13.8 y were enrolled. The effective radiation dose was 48% lower with ULDCT (0.28 ± 0.08 mSv) compared to KUB (0.54 ± 0.11 mSv, $p < 0.001$). Mean CT DIvol and DLP of ULDCT were 0.47 ± 0.26 mGy and 20 ± 12 mGy.cm respectively. The number of stones seen on both modalities was equivalent: KUB was 1.59 ± 1.27 vs 1.92 ± 0.51 for ULDCT ($p = 0.35$). However in 12 cases (12%), the ULDCT helped localize ureteral stones that were not detected on KUB. Measurement of stone size was equivalent using ULDCT (6.47 ± 3.34 mm) compared to KUB (6.98 ± 3.41 mm, $p = 0.455$). ULDCT reduced the requirement for repeat conventional dose CT-KUB and altered treatment priority of treating the ureteral stones first.

CONCLUSION

ULDCT delivers 48% less radiation than a KUB radiograph and was equivalent in detecting the number and size of stones. In 12% of cases, ULDCT identified and localized ureteric stones prior to SWL that were not seen on KUB.

CLINICAL RELEVANCE/APPLICATION

This prospective single centre study demonstrates that ULDCT is suitable to replace KUB as it delivers 48% less radiation, more frequently detects ureteric calculi and reduces the requirement for repeat conventional dose CT-KUB prior to SWL.

RC208-11 Optimizing Emergency Musculoskeletal MRI

Monday, Nov. 30 11:00AM - 11:25AM Location: S102AB

Participants

Joseph S. Yu, MD, Columbus, OH, (joseph.yu@osumc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand when to use MRI in urgent and emergent MSK conditions. 2) To optimize the types and number of sequences for urgent studies. 3) To review the use of IV gadolinium in the emergent situation.

RC208-12 Utility of a Virtual Non-contrast Dual Energy CT Algorithm for Detection of Bone Marrow Edema in Non-displaced Hip Fractures

Monday, Nov. 30 11:25AM - 11:35AM Location: S102AB

Participants

Trenton T. Kellock, MD, Vancouver, BC (*Presenter*) Nothing to Disclose
Sandra Kim, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Patrick D. McLaughlin, FFRCRCSI, Cork, Ireland (*Abstract Co-Author*) Speaker, Siemens AG
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Paul I. Mallinson, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Tim O'Connell, MD, Meng, Vancouver, BC (*Abstract Co-Author*) President, Resolve Radiologic Ltd; Speake, Siemens AG
Hugue A. Ouellette, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hip fractures are associated with high disability, health care costs and mortality. The purpose of this study is to describe our experience with a dual energy CT (DECT) virtual non contrast (VNC) algorithm for detection of bone marrow (BM) edema in patients presenting to the emergency department with suspected non-displaced traumatic hip fractures.

METHOD AND MATERIALS

77 patients were identified that presented to a level one trauma center emergency department between Jan 1, 2014 and June 30, 2014, and received CT imaging due to clinical suspicion of a traumatic hip fracture. 66 underwent DECT of the hip or pelvis. Those with hip prosthesis (N=7) were excluded. Those with displaced hip fractures (N=9) were also excluded as they are not a diagnostic challenge on CT. VNC images were generated using prototype software. These were read in isolation, and then compared to standard bone reconstructions, by a staff radiologist. Both VNC and standard bone reconstruction images were graded for interpretation confidence (1-10 scale). Radiological and/or clinical diagnosis of fracture at 30-day follow up was used as the reference standard.

RESULTS

Of the 50 included patients, 8 were positive for VNC BM edema. All of these were true positives (Sn = 100%). Mean interpreter confidence of VNC images was 8.4 (range 4-10). On standard bone reconstructions, 7 of these true positives were recognized as fractures (Sn = 88%), with a mean interpreter confidence of 9.6 (range 6-10). 42 studies were negative for VNC BM edema, and all were true negatives (Sp = 100%). These were also all described as negative on the CT bone reconstructions (Sp=100%). Mean interpreter confidence was 8.3 (range 3-10) for VNC images, and 9.7 (range 6-10) for standard bone reconstructions.

CONCLUSION

Our study demonstrates that DECT VNC algorithm is an effective tool to supplement standard bone reconstructions in non-displaced traumatic hip fractures. Fractures that were subtle (or in one case not visible) on bone reconstructions all demonstrated BM edema, most with a high level of interpreter confidence. While our study is limited by a small sample size, current results suggest that DECT VNC algorithm is both highly sensitive and specific for identifying BM edema in non-displaced hip fractures.

CLINICAL RELEVANCE/APPLICATION

DECT VNC algorithm is an effective tool to supplement the interpretation of standard CT bone reconstructions in non-displaced traumatic hip fractures.

RC208-13 Dual-Energy CT for Analysis of Bone Marrow Edema in Acute and Chronic Carpal Bone Fractures

Monday, Nov. 30 11:35AM - 11:45AM Location: S102AB

Participants

Teresa I. Liang, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Ismail T. Ali, MBChB, MD, Vancouver, BC (*Presenter*) Nothing to Disclose
Memoona Mian, MD, FRCR, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Carpal bone fracture identification is often a challenging diagnosis, commonly underestimated on radiographs. CT helps to identify subtle fractures that may be radiographically occult. With the implementation of Dual Energy CT (DECT), the virtual non-calcium subtraction (VNC) technique can be applied to remove calcium to evaluate for bone marrow edema in fractures. In this study, we evaluate the utility of DECT VNC for assessment of bone marrow edema in patients with acute and chronic carpal bone fractures.

METHOD AND MATERIALS

The images of forty-seven patients between September 3, 2014 and March 9, 2015 with the suspicion of carpal bone fractures who underwent a DECT scan of their hand and wrist were reviewed by two readers using the VNC algorithm to determine the visual presence and absence of bone marrow edema in each carpal bone. The mean and standard deviation of the CT values within each carpal bone were recorded. Chi squared test and receiver operating characteristic (ROC) curve were used for statistical analysis, and $p < 0.05$ was considered significant.

RESULTS

In the 47 patients, 376 carpal bones were reviewed. 24 patients had acute (DECT-A), and 23 patients had chronic (DECT-C) carpal bone fractures. Visual analysis demonstrated that significantly more patients in DECT-A group had bone marrow edema (BME) (20/24, 83.3%) than the DECT-C group (3/23, 13.0%, $p < 0.0001$). The average CT values of the BME on the VNC images in the DECT-A and DECT-C groups were 61.6 ± 26.3 HU and 39.6 ± 26.3 HU respectively, whereas, in the non-BME carpal bones in the DECT-A and DECT-C groups, they measured -34.3 ± 27.5 HU and -24.9 ± 13.0 HU respectively. CT numbers for diagnosis of BME associated with acute carpal fractures revealed the area under the ROC curve of 0.993. An ideal cut-off value of 15.4HU for detection of BME associated with acute carpal fractures results in 100% sensitivity, 98.3% specificity, and 99.3% accuracy.

CONCLUSION

VNC DECT allows accurate visual assessment of bone marrow edema in acute carpal bone fractures. Using a cut-off of 15.4 HU provides a valid and reliable tool for detection of BME related to acute carpal bone fractures.

CLINICAL RELEVANCE/APPLICATION

Visual assessment of bone marrow edema and a quantitative cut-off of 15.4HU on VNC DECT images is useful for accurate and reliable identification of acute carpal bone fractures.

RC208-14 Question and Answer

Monday, Nov. 30 11:45AM - 12:00PM Location: S102AB

Participants

MSRO21

BOOST: Gynecology-Oncology Anatomy - Radiologic Evaluation of Pelvic Malignancies in the Era of Imaging Biomarkers (An Interactive Session)

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



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

Participants

Saurabh Gupta, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose
Robert S. Hellman, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose
Paul M. Knechtges, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose
Mark D. Hohenwarter, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose
Beth A. Erickson, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review uterine/cervical anatomy and current anatomic imaging methods for the evaluation of pelvic malignancy. 2) Review the current role of PET in the imaging of pelvic malignancy. 3) Discuss the growing role of imaging biomarkers (e.g. diffusion weighted imaging and perfusion imaging) in determining prognosis and treatment response for pelvic malignancies.

MSRO24

BOOST: Head and Neck-Oncology Anatomy (An Interactive Session)

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

HN **NR** **RO**

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

Participants

Sub-Events

MSRO24A Imaging of Larynx and Hypopharynx: Applied Anatomy

Participants

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

LEARNING OBJECTIVES

1) Review the normal anatomy of the larynx. 2) Discuss the spread patterns of the different primary sites of the larynx. 3) Explain the information that imaging provides that directly affects staging and management.

ABSTRACT

This session will demonstrate the value of laryngeal imaging. This talk will review the normal anatomy of the larynx. The talk will also discuss the spread patterns of the different primary sites of the larynx and illustrate the information that imaging provides that directly affects staging and management of laryngeal cancer.

MSRO24B Current Concepts and Controversies in Contouring for Treating Laryngeal Carcinoma

Participants

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

LEARNING OBJECTIVES

1) Review anatomy of larynx as it relates to patterns of spread of squamous cell carcinoma. 2) Discuss how patterns of spread affects how to contour larynx for radiation therapy.

MSRO24C QandA

Participants

MSRO24D Imaging of the Oral Cavity and Oropharynx: Applied Anatomy

Participants

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

LEARNING OBJECTIVES

1) Review the normal anatomy of the oral cavity and oropharynx. 2) Illustrate the normal spread patterns of the various subsites of the oral cavity and oropharynx. 3) Explain the information that imaging provides that directly affects staging and management.

ABSTRACT

Imaging plays a crucial role in evaluating the evaluating the primary site. The information provided on pre-treatment imaging directly affects the stage of the tumor and provides information regarding management and treatment that cannot be ascertained through physical exam or staging. This talk will review the normal anatomy and malignancies involving the oral cavity and oropharynx. The presentation will also provide information on technique and provide a "checklist" of information that should be included in the radiologist's report that will help determine treatment and management.

MSRO24E Current Concepts and Controversies in Contouring and Treatment of Oral Cavity/Oropharynx Carcinoma

Participants

Clifton D. Fuller, MD, PhD, Houston, TX (*Presenter*) In-kind support, General Electric Company; Research Grant, Elekta AB; ; ;

LEARNING OBJECTIVES

1) Review imaging anatomy of or pharynx as it relates to patterns of spread of squamous cell carcinoma. 2) Discuss oropharyngeal contouring patterns for radiation therapy. 3) Discuss treatment indications for surgery, radiotherapy, and chemoradiotherapy and the requisite contouring guidelines across oropharynx cancer staging.

MSRO24F QandA

Participants

Quantitative CT and MR Perfusion Imaging

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



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

Participants

Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (*Moderator*) GE NFL advisory board;

LEARNING OBJECTIVES

1) To understand the principles of CT perfusion analysis for tumor assessment. 2) To understand the pathophysiological basis of CT perfusion parameters for tumors. 3) To understand unique CT perfusion analysis of the liver due to its characteristic dual blood supply. 4) To describe the potential clinical applications, with a focus on hepatic and extrahepatic applications and clinical trials. 5) To discuss several recent challenging issues regarding CT perfusion. 6) To discuss areas for further development including assessment of tumor heterogeneity.

ABSTRACT

With the emergence of novel targeted therapies for cancer, imaging techniques that assess tumor vascular support have gained credence for response assessment alongside standard response criteria. CT perfusion techniques that quantify regional tumour blood flow, blood volume, flow-extraction product, and permeability-surface area product through standard kinetic models, are attractive in this scenario by providing evidence of a vascular response or non-response. Additionally, these techniques may provide prognostic and predictive information to the clinician. Their increasing acceptance in oncological practice in recent years has been related to the combination of clinical need and technological improvements in CT, including faster tube rotation speeds, higher temporal sampling rates, the development of dynamic 3D acquisitions and development of commercial software programmes embedded within the clinical workflow. Recently published consensus guidelines provide a way forward to performing studies in a more standardized manner. To date single centre studies have provided evidence of clinical utility. Future studies that include good quality prospective validation correlating perfusion CT to outcome endpoints in the trial setting are now needed to take CT perfusion forward as a biomarker in oncology. These presentations will cover the principles of CT perfusion analysis for tumor assessment and its pathophysiological basis. Clinical applications will be discussed focusing on hepatic and extrahepatic applications and clinical trials. Areas for further development including assessment of tumor heterogeneity will also be discussed.

Sub-Events

RC217A CT Perfusion in Oncology: Hepatic Imaging

Participants

Se Hyung Kim, Seoul, Korea, Republic Of (*Presenter*) Research Grant, Mallinckrodt plc; Research Grant, Samsung Electronics Co Ltd

LEARNING OBJECTIVES

1) To understand basic principles, acquisition protocol, and pharmacokinetic models of CT perfusion. 2) To learn unique CT perfusion analysis of the liver due to its characteristic dual blood supply. 3) To describe the potential clinical applications, with a focus on hepatic applications. 4) To discuss several recent challenging issues regarding CT perfusion.

ABSTRACT

RC217B CT Perfusion in Oncology: Extrahepatic Imaging

Participants

Vicky J. Goh, MBBCh, London, United Kingdom (*Presenter*) Research Grant, Siemens AG; Speaker, Siemens AG

LEARNING OBJECTIVES

1) To understand the principles of CT perfusion analysis for tumor assessment. 2) To understand the pathophysiological basis of CT perfusion parameters for tumors. 3) To describe the potential clinical applications, with a focus on extrahepatic applications and clinical trials. 4) To discuss areas for further development including assessment of tumor heterogeneity.

ABSTRACT

With the emergence of novel targeted therapies for cancer, imaging techniques that assess tumor vascular support have gained credence for response assessment alongside standard response criteria. CT perfusion techniques that quantify regional tumour blood flow, blood volume, flow-extraction product, and permeability-surface area product through standard kinetic models, are attractive in this scenario by providing evidence of a vascular response or non-response. Additionally, these techniques may provide prognostic and predictive information to the clinician. Their increasing acceptance in oncological practice in recent years has been related to the combination of clinical need and technological improvements in CT, including faster tube rotation speeds, higher temporal sampling rates, the development of dynamic 3D acquisitions and development of commercial software programmes embedded within the clinical workflow. Recently published consensus guidelines provide a way forward to performing studies in a more standardized manner. To date single centre studies have provided evidence of clinical utility. Future studies that include good quality prospective validation correlating perfusion CT to outcome endpoints in the trial setting are now needed to take CT perfusion forward as a biomarker in oncology. This presentation will cover the principles of CT perfusion analysis for tumor assessment and its pathophysiological basis. Clinical applications will be discussed focusing on extrahepatic applications and clinical trials. Areas for further development including assessment of tumor heterogeneity will also be discussed.

RC217C Quantitative MR Perfusion Imaging of the Brain

Participants

Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (*Presenter*) GE NFL advisory board;

LEARNING OBJECTIVES

1) Understand the difference between quantitative and qualitative perfusion measurements. 2) Distinguish several approaches for obtaining quantitative perfusion maps in the brain. 3) Appreciate the strengths and weaknesses between the two major techniques, arterial spin labeling and bolus contrast dynamic susceptibility imaging.

RC254

Health IT Policy Panel: The New Federal Requirement for Imaging Decision Support (H.R. 4302)

Monday, Nov. 30 8:30AM - 10:00AM Location: S102C



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

Participants

David B. Larson, MD, MBA, Los Altos, CA (*Moderator*) Intellectual property license agreement, Bayer AG; Potential royalties, Bayer AG

Honored Educators

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

David B. Larson, MD, MBA - 2014 Honored Educator

Sub-Events

RC254A Overview of the Imaging Decision Support Requirement

Participants

Curtis P. Langlotz, MD, PhD, Menlo Park, CA, (langlotz@stanford.edu) (*Presenter*) Shareholder, Montage Healthcare Solutions, Inc; Advisory Board, Reed Elsevier; Advisory Board, Activate Networks, Inc;

LEARNING OBJECTIVES

1) Understand the requirements and scope of the new U.S. Federal decision support requirement in the Protecting Access to Medicare Act of 2014. 2) Learn the legal definition of appropriate use criteria. 3) Calculate the financial penalties for non-compliance. 4) Recognize the challenges CMS will face in implementing the law. 5) Recognize the challenges health care organizations will face in responding to the law.

RC254B The Origins of the Imaging Decision Support Legislation

Participants

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

RC254C Experience and Recommendations of the High Value Health Care Collaborative

Participants

Keith S. White, MD, Murray, UT, (keith.white@imail.org) (*Presenter*) Software support, Jidoka Systems

RC254D CMS Approach to Implementing the Legislation: Current Status

Participants

Joseph Hutter, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the key provisions of Section 218(b) of PAMA 2014. 2) Understand the CMS Final Rule setting up a new nationwide program for appropriate use criteria for imaging. 3) Understand the timetable for future components of the CMS program.

MSAS21

Global Health (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

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

OT

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

Participants

Alexander Yule, DSc, Cardiff, United Kingdom (*Moderator*) Nothing to Disclose

Susan Crowley, RT, MEd, Toronto, ON (*Moderator*) Nothing to Disclose

Sub-Events

MSAS21A Challenges of Medical Imaging in Resource Limited Communities

Participants

Melissa Culp, MEd, RT(R)(MR), Chevy Chase, MD, (mculp@rad-aid.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will learn about challenges related to working in a resource limited community. 2) The participant will understand differences in radiology workflow that result from imaging in a resource limited community. 3) The participant will comprehend the importance of working with and recognizing partners involved in a radiology global health initiative to address challenges and have successful outcomes.

ABSTRACT

Radiology enterprises in low-resource settings often have unique challenges as a result of limited infrastructure and funding, difficulty obtaining service and maintenance for equipment, and the need for human resource and capacity building. Successful radiology global health initiatives in resource limited environments require an objective analysis of site Radiology Readiness and open communication with partners bilaterally. As a 501(c)(3) non-profit with United Nations affiliation and official relations with the World Health Organization, RAD-AID International is uniquely positioned to work with local stakeholders, professional organizations, and volunteers to address these needs and have successful outcomes.

MSAS21B Role of Medical Imaging on Global Health

Participants

Miriam N. Mikhail, MD, Geneva, Switzerland (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Participants will learn about the role of the WHO in radiology-related public health initiatives, including support of imaging referral guidelines and the launch of AFROSAFE (African counterpart of Image Gently/Image Wisely and EUROSAFE). 2) Participants will learn about the potential for continued and greater collaboration of the WHO and radiology entities: synergies in dealing with priority public health trends.

ABSTRACT

The World Health Organization (WHO), a U.N. agency with a mandate as the directing and coordinating authority of international public health work, facilitates collaboration to promote global health in a strategic, harmonized fashion concordant with specific core functions. With radiology in mind, this presentation provides an overview of some priority public health issues and trends, the increase in global non-communicable diseases and the proportionate need for greater availability of medical imaging, governance and the importance of WHO interaction with radiology-related professional societies and organizations, recurrent problems encountered during medical equipment donations, priority design needs for imaging equipment for use in low-resource settings, radiation protection initiatives, and a few words on the Ebola epidemic and personal protective equipment.

MSAS21C Organizational Support for Global Imaging Needs

Participants

Jonathan Mazal, MS, RRA, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will learn about the role of radiology-specific professional societies in global health. 2) The participant will understand the strategy for seeking and lending expert opinion on global imaging guidelines from an international membership base. 3) The participant will comprehend the importance of having professional societies present to advocate on behalf of imaging professionals on an international level.

ABSTRACT

National radiology-specific professional societies often work with their local governments, representing the perspectives and needs of their members to ensure they are provided with the necessary tools and working conditions required to provide optimal care to their patients. The same proves true on the international level in regards to development and dissemination of guidelines impacting the practice of radiology within a global health perspective. As one of the leading organizations advocating on behalf of imaging professionals in over 90 countries worldwide, the International Society of Radiographers and Radiologic Technologists (ISRT) holds official relations with the United Nations and routinely convenes with their key health related agencies on matters affecting the field of radiology.

SSC10

Physics (CT II-Radiation Dose)

Monday, Nov. 30 10:30AM - 12:00PM Location: S504CD

CT **PH** **SQ**

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

FDA Discussions may include off-label uses.

Participants

Cynthia H. McCollough, PhD, Rochester, MN (*Moderator*) Research Grant, Siemens AG
Robert G. Gould, DSc, San Francisco, CA (*Moderator*) Research Grant, Koninklijke Philips NV

Sub-Events

SSC10-01 Size-Specific Fetal Dose Estimates in Tube Current Modulation CT Examinations of Pregnant Patients

Monday, Nov. 30 10:30AM - 10:40AM Location: S504CD

Participants

Kyle McMillan, Los Angeles, CA (*Presenter*) Institutional research agreement, Siemens AG; Research support, Siemens AG;
Maryam Bostani, PhD, Los Angeles, CA (*Abstract Co-Author*) Research support, Siemens AG
Erin Angel, PhD, Tustin, CA (*Abstract Co-Author*) Employee, Toshiba Corporation
Christopher H. Cagnon, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ;

PURPOSE

Fetal dose estimates have previously been limited to fixed tube current CT exams of pregnant patients. However, in current clinical practice, nearly all CT exams are performed using tube current modulation (TCM). The purpose of this work is to develop patient size-specific CTDIvol-to-fetal-dose conversion coefficients for TCM CT examinations of pregnant patients of various gestational ages.

METHOD AND MATERIALS

For 18 IRB approved pregnant patients of gestational age ranging from 12 to 36 weeks who underwent clinically-indicated CT examinations, models of maternal and fetal anatomy were created from the image data, and fetal dose was estimated using Monte Carlo simulation of TCM scans of the abdomen and pelvis for a 64-slice MDCT scanner. Predicted TCM schemes were generated for each pregnant patient model using a validated method that accounts for patient attenuation and scanner limits to determine TCM functions for each voxelized model. Fetal doses were normalized by scan-specific 32 cm CTDIvol values based on the average tube current across the entire scan (scanner-reported CTDIvol) to obtain scan technique-independent CTDIvol-to-fetal-dose conversion coefficients for each patient. Patient size was described using water equivalent diameter (WED) measured at the image containing the three-dimensional geometric centroid of the fetus. The relationship between the WED patient size metric and CTDIvol-to-fetal-dose conversion coefficients was then examined to determine if a correlation exists.

RESULTS

An exponential relationship between CTDIvol-to-fetal-dose conversion coefficients and patient size was observed with a coefficient of determination of 0.81.

CONCLUSION

For TCM examinations, strong correlation exists between CTDIvol-normalized fetal dose and WED. These results indicate that fetal dose from TCM CT examinations of pregnant patients of various gestational ages may be reasonably estimated with: (a) fetal dose normalized by scanner-reported CTDIvol to account for scan technique variation and (b) a WED patient size metric to account for patient size variation.

CLINICAL RELEVANCE/APPLICATION

Results from this work can be used to readily estimate fetal dose for TCM CT exams of pregnant patients given only the scanner-reported CTDIvol and an attenuation-based estimate of patient size.

SSC10-02 How Low Can We Go in Radiation Dose for the Data Completion Scan on a Prototype Whole-Body Photon-Counting CT System

Monday, Nov. 30 10:40AM - 10:50AM Location: S504CD

Awards

Trainee Research Prize - Fellow

Participants

Zhicong Yu, Rochester, MN (*Presenter*) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Ahmed Halaweish, PhD, Rochester, MN (*Abstract Co-Author*) Employee, Siemens AG
Zhoubo Li, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Steffen Kappler, Dipl Phys, Forchheim, Germany (*Abstract Co-Author*) Researcher, Siemens AG
Erik L. Ritman, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

A hybrid (dual-source) prototype CT system (Siemens Healthcare, Germany), which consists of an energy integrating detector (EID) and a photon-counting detector (PCD), is currently under investigation. The field-of-views (FOVs) of the EID and PCD systems are 500 mm and 275 mm, respectively. For an object larger than 275 mm, the PCD system needs a DCS (data completion scan) using the EID to avoid truncation artifacts. This work aimed to find the lowest possible mAs for the DCS such that image quality for the PCD system was maintained.

METHOD AND MATERIALS

The DCS should have the same kV as, and slightly greater longitudinal coverage than, the PCD scan. Other parameters such as mAs can be freely chosen. A semi-anthropomorphic phantom (lateral width: 38.9 cm) with iodine and bone-like inserts was scanned with the PCD system using 210 mAs and 140 kV (CTDI_{vol} = 23.21 mGy). Next, a DCS using the maximal available mAs was performed to serve as the image quality reference. Finally, a series of DCS from 10 mAs (the lowest available on the scanner) to 50 mAs at intervals of 5 mAs was acquired. Images were reconstructed using the same slice thickness (2 mm) and reconstruction kernel (D30). The difference in CT number between the PCD images using no DCS or low mAs DCS and that using the reference DCS were measured within regions-of-interest (ROI) in the iodine and bone-like inserts, and the water-equivalent material at top, left, center, and right of the PCD FOV. These data were used for CT number accuracy and uniformity analyses. The lowest mAs of the DCS that maintained CT number accuracy and uniformity was determined, and further validated with an anthropomorphic torso phantom.

RESULTS

PCD images using a 10 mAs DCS at 140 kV (CTDI_{vol} = 0.93 mGy) were free of cupping artifacts, and had CT number accuracy and uniformity within 1 HU of the reference image. With the 10 mAs DCS, the PCD images of the shoulder, chest, and abdominal regions of the torso phantom demonstrated equivalent image quality to their reference images. Image quality improvement was limited when a larger mAs (>10) was used in the DCS.

CONCLUSION

DCS using less than 1 mGy is sufficient to maintain clinically viable image quality for PCD scans.

CLINICAL RELEVANCE/APPLICATION

The DCS significantly improve the image quality of the PCD system at a markedly low cost of radiation dose.

SSC10-03 Size-Specific Effective Dose Estimates in Abdominal and Chest CT Exams Using Either Fixed Tube Current or Tube Current Modulation

Monday, Nov. 30 10:50AM - 11:00AM Location: S504CD

Participants

Kyle McMillan, Los Angeles, CA (*Presenter*) Institutional research agreement, Siemens AG; Research support, Siemens AG;
Maryam Bostani, PhD, Los Angeles, CA (*Abstract Co-Author*) Research support, Siemens AG
Lifeng Yu, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Christopher H. Cagnon, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Maria Zankl, PhD, Neuherberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ;

PURPOSE

Conventional estimates of effective dose do not account for patient size or the effects of tube current modulation (TCM). The purpose of this study was to extend that work by developing size-specific effective dose estimates for both fixed tube current (FTC) and TCM abdominal and chest CT scans.

METHOD AND MATERIALS

Using detailed Monte Carlo simulations of a 128-slice multi-detector row CT scanner, doses to all radiosensitive organs for eight patient models from the GSF family of voxelized phantoms and the male and female ICRP adult reference computational phantoms were determined for both FTC and TCM abdominal and chest CT examinations. Patient-specific TCM schemes were generated using a validated method that accounts for patient attenuation and scanner limits to determine TCM functions for each voxelized model. For abdominal scans, the scan range was set from the top of the liver to the sacroiliac joint. For chest scans, the scan range was set from the top of the lungs to the top of the kidneys. A summation of organ dose values weighted by the appropriate ICRP 103 tissue weighting factors produced an estimate of effective dose for each simulated scan. Effective dose estimates were normalized by scan-specific 32 cm CTDI_{vol} values to obtain scan technique-independent CTDI_{vol}-to-effective-dose conversion coefficients for each patient model. In order to estimate patient size, water equivalent diameter (WED) was measured at the center of the scan range. Correlations between patient size and CTDI_{vol}-to-effective-dose conversion coefficients were then determined.

RESULTS

For all scan scenarios, an exponential relationship between CTDI_{vol}-to-effective-dose conversion coefficients and patient size was observed with coefficients of determination ranging from 0.76 to 0.88. When all scan scenarios were evaluated collectively, an exponential relationship was observed with a coefficient of determination of 0.76.

CONCLUSION

Strong correlation exists between CTDI_{vol}-normalized effective dose and WED. Results suggest that a general relationship between CTDI_{vol}-to-effective-dose conversion coefficients and patient size may be sufficient to estimate size-specific effective dose for both FTC and TCM routine body CT examinations.

CLINICAL RELEVANCE/APPLICATION

Results from this work provide a reasonable estimate of effective dose that accounts for patient size and can be applied for FTC and TCM abdominal and chest CT examinations.

SSC10-04 Reconciling Constant-noise versus Variable-noise Automatic Exposure Control Techniques for Multi-

vendor Body CT Protocol Optimization

Monday, Nov. 30 11:00AM - 11:10AM Location: S504CD

Participants

Jia Wang, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Lior Molvin, Stanford, CA (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Ken Lim, MBA, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Hans-Christoph R. Becker, MD, PhD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Dominik Fleischmann, MD, Palo Alto, CA (*Abstract Co-Author*) Research support, Siemens AG;

Background

Automatic exposure control (AEC) techniques vary across different CT vendors. Some keep image noise constant across all patient sizes, while some allow more noise in larger patients. The variability of vendor-dependent AEC scheme puts a challenge in designing CT protocols across diverse CT systems for consistent image quality and dose. We aim to match the AEC exposure output between two manufacturers by utilizing patient dose metric information.

Evaluation

CT scanner exposure output (CTDIvol), AEC settings (QRM for Siemens CareDose4D or Noise index for GE SmartmA) and patient weight of all adult chest-abdomen-pelvis (CAP) CT scans in one calendar year 2014 were accumulated for three CT scanners (Siemens Definition Flash, GE CT750 HD, and GE LightSpeed VCT) using commercial dose tracking software (DoseWatch, GE). The AEC driven relationship between CTDIvol and body weight was modeled using patient dose metrics data. The patient population was divided into three weight groups: less than 150lbs, 150 to 200lbs, and 201 to 265lbs. For each weight group, the AEC models were used to determine the optimized noise index settings on GE scanners that match CTDIvol from Siemens CareDose4D.

Discussion

A total of 997, 871, and 453 CAP cases were collected on the Flash, CT750 and VCT scanners, respectively. An exponential curve of CTDIvol vs. weight was fitted for CareDose4D technique with QRM at 200mAs (Fig.a), which is our routine clinical setting with diagnostically acceptable image quality. On GE scanners with SmartmA technique, the dependence of CTDIvol on weight shows different exponential curves at corresponding NI values (Fig.b-c). The optimized NIs of CT750 were found to be at 31, 37 and 46 for three weight groups respectively (Fig.d). The model predicted CTDIvol from two different GE AEC techniques agreed within one standard deviation of the target CareDose4D curve.

Conclusion

Using dose metric data from a large patient population, AEC from two vendors were modeled to explore the dependence of CTDIvol on patient weight. Model predicted AEC settings provide consistent dose performance between different vendors across a wide body weight range.

SSC10-05 A New Noise Index-mAs Correspondence System for CT Systems with Model Base Iterative Reconstruction (MBIR)

Monday, Nov. 30 11:10AM - 11:20AM Location: S504CD

Participants

Daniel Gomez-Cardona, Madison, WI (*Presenter*) Nothing to Disclose
Ke Li, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Adam Budde, MS, Madison, WI (*Abstract Co-Author*) Employee, General Electric Company
Meghan G. Lubner, MD, Madison, WI (*Abstract Co-Author*) Grant, General Electric Company; Grant, NeuWave Medical, Inc; Grant, Koninklijke Philips NV
Perry J. Pickhardt, MD, Madison, WI (*Abstract Co-Author*) Co-founder, VirtuoCTC, LLC; Stockholder, Collectar Biosciences, Inc; Research Consultant, Bracco Group; Research Consultant, KIT ; Research Grant, Koninklijke Philips NV
Jiang Hsieh, PhD, Waukesha, WI (*Abstract Co-Author*) Employee, General Electric Company
Guang-Hong Chen, PhD, Madison, WI (*Abstract Co-Author*) Research funded, General Electric Company; Research funded, Siemens AG

PURPOSE

Given the quantitative relationship between noise variance and exposure level, the Noise Index (NI) allows the operators of clinical CT systems to establish a quantitative correspondence between the noise magnitude and the mAs before prescribing each scan. The introduction of MBIR to clinical CT systems has fundamentally changed the relationship between noise variance and the exposure level. The purpose of this study was to investigate how to develop a new NI system for MBIR.

METHOD AND MATERIALS

An IACUC-approved in vivo swine study and an IRB-approved prospective trial with 110 human subjects were performed. All studies were performed using a 64-slice CT scanner (Discovery CT750 HD, GE Healthcare) equipped with MBIR (Veo, GE Healthcare). For the swine study, six mAs levels ranging from (10 to 290) were used. For the human subject trial, an additional reduced dose (RD) scan was performed immediately after the standard dose (SD) scan for each subject; the specific mAs used for the two scans varied across subjects depending on patient size and clinical indications. Noise variances were measured by drawing regions of interest (ROI) on relatively homogeneous anatomical sites such as the liver. Power-law fittings ($\sigma^2 = \alpha * (\text{mAs}^\beta)$) of the measured noise variance-mAs plots were performed to explore any deterministic relationship between the two parameters.

RESULTS

For the swine study, the exponent of the power law, β , was -1.0 for FBP and -0.4 for MBIR. Results of the clinical trial were consistent with the in vivo animal study: the β value measured in the liver was -1.0 ± 0.10 for FBP and -0.4 ± 0.12 for MBIR, and the β value measured in fat was -1 ± 0.12 for FBP and -0.4 ± 0.12 for MBIR. The difference in the measured β value between FBP and MBIR was statistically significant ($p < 0.001$). Similar to FBP, the value of the parameter, α , depended on the patient size; for a given size of 28 cm, $\alpha = 1.2 \times 10^5$ for FBP and $\alpha = 600$ for MBIR.

CONCLUSION

We found it is still feasible to establish a new noise index system for MBIR using an empirical power-law relationship between noise and mAs.

CLINICAL RELEVANCE/APPLICATION

With the increasing popularity of MBIR in clinical CT, there is an urgent need to develop a new Noise Index system that can prospectively determine the noise magnitude of MBIR images at reduced dose levels.

Honored Educators

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

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

SSC10-06 Correlation of Size-Specific Dose Estimates (SSDE) to Mean Dose in the Center of a CT Scan Under Conditions of Tube Current Modulation

Monday, Nov. 30 11:20AM - 11:30AM Location: S504CD

Participants

Kyle McMillan, Los Angeles, CA (*Presenter*) Institutional research agreement, Siemens AG; Research support, Siemens AG;
Maryam Bostani, PhD, Los Angeles, CA (*Abstract Co-Author*) Research support, Siemens AG
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Christopher H. Cagnon, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Maria Zankl, PhD, Neuherberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ;

PURPOSE

AAPM Report 204 demonstrated that size-specific dose estimates (SSDE) are a reasonable estimate of mean dose in the center of the scan range for fixed tube current (FTC) body CT examinations. The purpose of this work is to determine if that concept extends to tube current modulation (TCM) CT examinations of the chest and abdomen.

METHOD AND MATERIALS

For eight patient models from the GSF family of voxelized phantoms, and the male and female ICRP adult reference computational phantoms, SSDE and mean dose in the center of a scan range were calculated for both abdominal and chest CT examinations under the conditions of FTC and TCM. TCM schemes were generated using a validated method that accounts for patient attenuation and scanner limits to determine TCM functions for each voxelized phantom. Using Monte Carlo simulations of a 128-slice multi-detector row CT scanner, mean dose in the center of the scan range was calculated as the average dose to all voxels of a patient model over five slices (approximately 25-50 mm depending on the model) in the center of the scan range. Using the methodology outlined in AAPM Report 204, SSDE was calculated using the CTDI_{vol} value based on the average tube current across the entire scan (scanner-reported CTDI_{vol}), a conversion factor based on the 32 cm diameter body CTDI phantom and a measurement of patient size in the center of the scan range (water equivalent diameter (WED), calculated according to AAPM Report 220). SSDE and mean dose in the center of the scan range were then compared for all combinations of anatomy and tube current type.

RESULTS

For abdominal scans, the average absolute difference between SSDE and mean dose in the center of the scan range for FTC and TCM was 3.46% and 7.12%, respectively. For chest scans, the average absolute difference was 5.51% and 7.48%, respectively.

CONCLUSION

For both abdominal and chest CT examinations using FTC and TCM, SSDE calculated using scanner-reported CTDI_{vol} and an estimate of patient size in the center of the scan range closely matched detailed simulations of mean dose in the center of the scan range.

CLINICAL RELEVANCE/APPLICATION

For both FTC and TCM, SSDE provides an estimate of mean dose in the center of the scan range. This work extends the use of SSDE as a reasonable estimate of patient dose for FTC and TCM body CT exams.

SSC10-07 The Effects of Size-Specific Phantom-to-Patient Matching for Monte Carlo Based Computed Tomography Dosimetry

Monday, Nov. 30 11:30AM - 11:40AM Location: S504CD

Participants

Elliott J. Stepusin, MS, Gainesville, FL (*Presenter*) Nothing to Disclose
Daniel J. Long, PhD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
Wesley E. Bolch, PhD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Due to the rapid growth in Computed Tomography (CT) use over the past few decades, there has become a clear need for accurate organ dosimetry. The Monte Carlo method, which is one means of performing CT dosimetry, relies on a computational representation of a patient (a phantom). The purpose of this study is to compare a previously validated Monte Carlo based CT

dosimetry methodology performed on patient-specific computational phantoms (based on segmented patient images) to equivalent dosimetry performed on patient-dependent (matched) phantoms, and reference (50th percentile height and weight) phantoms.

METHOD AND MATERIALS

Twenty-seven patient-specific computational phantoms were created based on CT images sets of adult patients (14 male and 13 female). Each patient-specific phantom had organ doses calculated based on a previously validated CT dosimetry methodology for four torso exams (chest-abdomen-pelvis, chest, abdomen, and pelvis) with tube current modulation (TCM). Additionally, organ doses were calculated on five computational phantoms (three size-specific and two reference) and compared, per patient. The three matching criteria were: height and weight, effective diameter (AAPM Report No. 204), and water equivalent diameter (AAPM Report No. 220). The two reference phantoms were hybrid computational and stylized (ORNL 2006).

RESULTS

The average magnitude of percent difference in organ dose calculations across all patients and organs was 11.1% for the height and weight matched phantoms, 12.3% for the effective diameter matched phantoms, 29.2% for the hybrid computational reference phantom, and 35.5% for the stylized reference phantom.

CONCLUSION

Although an inherent error exists in matching a patient to a computational phantom for CT dosimetry, matching the patient to a size-specific phantom has a clear increase in organ dose certainty.

CLINICAL RELEVANCE/APPLICATION

Matching a patient to a size-specific computational phantom will allow for a more accurate assessment of organ doses from a computed tomography examination.

SSC10-08 Breast and Lung Dose in Chest CT: A Comparison between Standard, Organ-based TCM and Flash Speed Protocols in Cadavers

Monday, Nov. 30 11:40AM - 11:50AM Location: S504CD

Participants

Xochitl Lopez-Rendon, MSc, Leuven, Belgium (*Presenter*) Nothing to Disclose
Guozhi Zhang, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Walter Coudyzer, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Wim Develter, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Raymond H. Oyen, MD, PhD, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Hilde Bosmans, PhD, Leuven, Belgium (*Abstract Co-Author*) Co-founder, Qaelum NV Research Grant, Siemens AG
Federica Zanca, PhD, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare breast and lung dose associated with three chest CT protocols with different tube current modulation techniques.

METHOD AND MATERIALS

Three female cadavers with different BMI (underweight, normal and overweight) were scanned with a Siemens Definition Flash CT scanner using a Standard chest protocol (3D TCM), XCare (organ-based TCM) and Flash (3D TCM flash speed), all at 120 kVp and with the CTDI_{vol} of all protocols matched to the patient specific CTDI_{vol} of the Standard examination. The doses to the lungs and breasts were calculated with a MC simulation framework (EGSnrc) for each voxel model of the cadavers, created by segmenting the CT images. To obtain the tube current modulation information for the different protocols, the raw projection data were collected (xyz modulation). Tube current modulation curves were compared and the dose percentage differences between the standard (reference) and the two other protocols (XCare and Flash) were calculated.

RESULTS

Tube current modulation profiles showed large differences between the three protocols and depended on patient BMI. Both breast and lung doses associated with the XCare and Flash protocols were lower than the doses associated with the Standard protocol for underweight and normal size. The maximum dose reductions for the lungs for the XCare and Flash protocols were respectively 8.3% and 39.3%; dose reductions for the breast were 13.8% and 45.3%. For the overweight size, we observed a reduction in lung dose for both protocols with a maximum of 37.2%. Breast dose reduction was 41.8% for the Flash protocol but we found an increase of 3.6% for XCare.

CONCLUSION

The tube current modulation scheme of each protocol, as well as the patient habitus, have a strong impact on organ doses. The Flash protocols reduced dose to the lungs and breast for all sizes and with the highest percentage (max 39.3% and 45.3%, respectively). This is related to the fact that the total mAs used for the examination is lower (34% on average) for the same CTDI_{vol}. XCare slightly reduced breast dose for underweight and normal size patients but increased it for the overweight patient.

CLINICAL RELEVANCE/APPLICATION

Flash protocol reduces lung and breast dose more than XCare when compared to the standard protocols. Depending on the clinical indication and image quality needed Flash protocol might be preferred.

SSC10-09 Development of a Computational Adult Brain Model and Applications to Radiation Dosimetry of Brain Structures during Computed Tomography Examinations

Monday, Nov. 30 11:50AM - 12:00PM Location: S504CD

Participants

Nelia Long, PhD, Victor, NY (*Presenter*) Nothing to Disclose
Elliott J. Stepusin, MS, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
Daniel J. Long, PhD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose

Kathleen Egan, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Wesley E. Bolch, PhD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to calculate sub-region radiation doses within the brain for an array of head/brain CT imaging protocols. Although methods that use an estimated average whole brain dose may be sufficient to estimate risks using the current stochastic risk models, they may not be sufficient in future radiation epidemiology risk studies that require absorbed radiation doses to specific brain sub-regions thought to be associated with brain cancer induction.

METHOD AND MATERIALS

Computational brain models of reference adult male and female patients were constructed. A total of 43 different brain sub regions separated by hemisphere were created. Radiation doses to the different sub regions in the brain during CT examinations were calculated using computational models of three CT scanners of varying manufacturer using Monte Carlo particle transportation methods. Considerations were made for simulation settings regarding gantry angle, scan length, beam energy, filtration, collimation, pitch, and starting angle.

RESULTS

Differences between an individual brain sub-region and the averaged brain dose can be substantial (up to 140%) depending upon the protocol being studied. Depending on the exam taking place some brain structures may not be included in the primary x-ray beam. As a result, out-of-field structures receive doses that are lower than given by the average brain dose. On the other hand, structures that are entirely in the primary beam and therefore receive the bulk of the radiation field energy deposition receive doses that are significantly higher than the calculated whole brain dose.

CONCLUSION

The average brain dose, depending on the application, may not always be a true representation of the dose to the tissues from which glioma, meningioma, or other types of central nervous system cancers arise. The moderate dose gradients across the brain, as well as the anatomical coverage during a CT exam are two of the main factors that influence these differences. The dose database developed in this study can be used in future epidemiology studies that require estimates of absorbed radiation doses to specific brain structures rather than to the entire brain.

CLINICAL RELEVANCE/APPLICATION

Average brain dose may not be sufficient for radiation epidemiology studies that require absorbed radiation doses to specific brain sub-regions thought to be associated with brain cancer induction.

MSAS22

Got Smart Data? Trailblazing the Path from Insights to Actions in Radiology (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Monday, Nov. 30 10:30AM - 12:00PM Location: S105AB

IN

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

Participants

Patricia Kroken, Albuquerque, NM (*Moderator*) Nothing to Disclose
Dana Aragon, RT, Albuquerque, NM (*Moderator*) Nothing to Disclose
Jon Hernandez, Parker, CO (*Presenter*) Nothing to Disclose
Nicole Newsom, MHA, Greenville, SC, (nnewsom@advbi.com) (*Presenter*) Employee, MSN Innovative Strategies
Philip Heckendorn, Dallas, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the importance of innovative solutions in value-based care delivery. 2) Describe Business Intelligence terminology and differentiate the concept of smart, meaningful data in radiology informatics. The value equation will be explored. 3) Examine practical applications of radiology insights that drive quality, efficiency, and collaboration.

MSRO25

BOOST: Head and Neck-Integrated Science and Practice (ISP) Session

Monday, Nov. 30 10:30AM - 12:00PM Location: S103CD

HN **OI** **RO**

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

FDA Discussions may include off-label uses.

Participants

John C. Grecula, MD, Columbus, OH (*Moderator*) Research Grant, Teva Pharmaceutical Industries Ltd; Research Grant, Soligenix, Inc;
Sung Kim, MD, New Brunswick, NJ (*Moderator*) Nothing to Disclose

Sub-Events

MSRO25-01 Invited Speaker:

Monday, Nov. 30 10:30AM - 10:40AM Location: S103CD

Participants

Bahman Emami, MD, Maywood, IL (*Presenter*) Nothing to Disclose

MSRO25-02 Impact of Patient and Tumor Characteristics on Time from Diagnosis to Treatment in Patients Undergoing Radiation Therapy for Head and Neck Cancer

Monday, Nov. 30 10:40AM - 10:50AM Location: S103CD

Participants

Muhammad M. Qureshi, MBBS, MPH, Boston, MA (*Presenter*) Nothing to Disclose
Bhartesh A. Shah, BA, Edison, NJ (*Abstract Co-Author*) Nothing to Disclose
Minh T. Truong, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Treatment delay is a significant impediment to effective cancer management and could potentially impact disease progression and survival, especially in Head and Neck Cancer (HNC) patients who are often diagnosed with locally advanced stage disease. The purpose of this study was to determine the impact of patient and tumor characteristics on time-to-treatment (TTT) from diagnosis in HNC patients treated with curative intent radiation therapy (RT). Materials/Methods: From August 2004 to May 2011, 131 non-metastatic and non-recurrent biopsy proven HNC patients completed definitive RT at an urban academic safety net hospital. Patient and tumor factors examined included: race/ethnicity (Black, White, Hispanic, Other), English proficiency (English proficient, EP, Limited English proficient, LEP), marital status (Married, Non-married), insurance coverage (Private/Medicare, Medicaid/Free care), age at diagnosis (years) (median, =50) and AJCC stage (stage I-III versus stage IV). TTT was calculated from date of biopsy to date of first treatment received (surgery, induction chemotherapy/IC, radiotherapy alone/RT or concurrent radiotherapy/CCRT). Analysis of Variance was performed using SAS version 9.1 to determine the drivers of TTT. Data were analyzed using a 0.05 level of significance. Results: The median TTT was 41 days (range 6-249 days). Surgery, IC, RT or CCRT was the first treatment received in 45 (34.4%), 22 (16.8%), 13 (9.9%) and 51 (38.9%) patients, respectively. TTT did not differ by first treatment received (time to surgery 48 days, time to IC 47 days, time to RT 40 days and time to CCRT 51 days), P=0.802. No statistically significant differences in TTT were noted for gender (P=0.637), race/ethnicity (P=0.996), marital status (P=0.737), insurance coverage (P=0.836), age at diagnosis (P=0.571), and AJCC stage (P=0.889). TTT among EP and LEP patients was 46 and 57 days, respectively (P=0.197). Conclusion: Limited English proficient patients had longer TTT compared to EP, although this result failed to reach statistical significance. Other patient and tumor factors were not found to be predictive of TTT.

MSRO25-03 Prediction of Weight Loss in Irradiated Head and Neck Cancer Patients Based on the Clinical and Dosimetric Big Data

Monday, Nov. 30 10:50AM - 11:00AM Location: S103CD

Participants

Minoru Nakatsugawa, PhD, Baltimore, MD (*Presenter*) Employee, Toshiba Corporation; Research support, Toshiba Corporation;
Zhi Cheng, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Scott Robertson, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
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Mysha Allen, RN,BSN, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Sarah Afonso, RN,BSN, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda Choflet, MS, RN, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
John Wong, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Elekta AB; Research Grant, Xstrahl Ltd; Research Grant, Toshiba Corporation; Co-founder, JPLC Associates LLC; Royalty, Elekta AB; Consultant, Xstrahl Ltd
Todd R. McNutt, PhD, Baltimore, MD (*Abstract Co-Author*) Research collaboration, Koninklijke Philips NV; Research collaboration, Toshiba Corporation; Research collaboration, Elekta AB
Harry Quon, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The quality of life (QOL) of irradiated head and neck cancer (HNC) patients is significantly limited by toxicities leading to weight loss. The ability to predict and reduce toxicities by applying a learning health system (LHS) model is thus an important goal. The aim of this study is to determine the predictors for weight loss based on the outcomes of similar patients previously treated with

radiation therapy (RT) to develop a real-time clinical decision-support system.

METHOD AND MATERIALS

From a database of systematically captured prospective data elements, NCI-CTCAEv4.0 toxicity assessments and all aspects of RT planning, 326 HNC patients with longitudinal records from 2007 to 2014 were identified. The records consisted of 2,985 variables, including planned dose-volume histogram at 1% volume increments (2,020 variables), distance between planning target volume (PTV) and organs at risk, diagnostic ICD-9 code, QOL and toxicities during treatment. Weight loss of 5kg or more at 3 months post-RT was predicted by the Classification and Regression Trees algorithm. Two different prediction models at the time of RT planning and at the end of treatment were developed.

RESULTS

Weight loss predictors during treatment were 1) patient reported outcome of oral intake, 2) ICD-9 code, N stage, 3) nausea, esophagitis/pharyngitis, skin toxicity, pain intensity, 4) dose to larynx, parotid, cricopharyngeal muscle and 5) minimum distance between low dose PTV and larynx. The weight loss prediction at RT planning was also developed excluding assessment variables during treatment. The sensitivity of the model at treatment / RT planning was 0.988 / 0.860 and the positive predictive value (PPV) was 0.467 / 0.451 respectively.

CONCLUSION

The informatics framework combined with data mining tools can facilitate large-scale analysis predicting for weight loss and is encouraging for the development of a LHS model to reduce the risk of toxicities. The two prediction models at RT planning / treatment show the potential for a real-time decision-support based on the incremental data collection in each patient's RT course. Given the importance of diagnostic modality, we believe that incorporation of imaging features is an important next step to improve PPV.

CLINICAL RELEVANCE/APPLICATION

The weight loss prediction model at RT planning / treatment can support decisions regarding treatment planning and toxicity management during treatment.

MSRO25-04 Short Treatment Time and Excellent Treatment Outcome in Accelerated Hyperfractionated Radiation Therapy for T1 Glottic Cancer

Monday, Nov. 30 11:00AM - 11:10AM Location: S103CD

Participants

Yukihisa Tamaki, Izumo, Japan (*Presenter*) Nothing to Disclose
Yoko Hieda, MD, PhD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Rika Yoshida, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshizako, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hajime Kitagaki, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Taisuke Inomata, MD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Accelerated hyperfractionated radiotherapy was performed as treatment for patients with T1 glottic cancer, and its utility was evaluated based on treatment outcomes and adverse effects. Materials/Methods: Subjects were 58 men (median age, 70 years) who underwent radiotherapy at a University Hospital between January 2000 and November 2013. Tumor classification was Tis (6.9%) in 4 patients, T1a (65.5%) in 38, and T1b (27.6%) in 16. Histological examination revealed squamous cell carcinoma in the majority of cases (55 patients, 94.8%). Travel time from home to hospital was 2 h for 25 patients (43.1%). Laser vaporization was performed prior to radiotherapy in 38 patients (65.5%), and 19 patients (32.8%) received concurrent chemotherapy with an agent such as S-1. Patients were irradiated twice daily (morning and evening) using an irradiation container. Most patients received a dose of 1.5 Gy/fraction up to a total of 60 Gy. Results: The median overall treatment time was 30 days (range, 26–45 days), with a median observation period of 59.6 months. After completion of radiotherapy, a complete response was observed in all patients. The overall 5-year and 7-year survival rates were 97.2% and 86.1%, respectively, and the 5-year and 7-year disease-free survival rates were 93.2% and 82.2%, respectively. The 5-year and 7-year local control rates were both 97.8%. Seven patients died either of other cancer (3/7) or disease (4/7), with no death due to glottic cancer or treatment-related causes. Although grade 3 pharyngeal mucositis was observed in 2 (3.4%) patients, there were no other grade 3 or higher acute adverse events. As late toxicity, grade 2 laryngeal edema and grade 1 laryngeal hemorrhage were observed in 1 patient each, but no serious events such as laryngeal necrosis or laryngeal stenosis were observed. Conclusion: The outcome of accelerated hyperfractionated radiotherapy for T1 glottic cancer was excellent, and the adverse events were acceptable. The present treatment method will substantially reduce the treatment duration among patients who need to stay at nearby hotels while undergoing treatment at hospitals in rural areas.

MSRO25-05 Are Contouring Time and Multimodality Imaging Prognostic Factors for Radiation Therapy of Head and Neck Cancer?

Monday, Nov. 30 11:10AM - 11:20AM Location: S103CD

Participants

Michael W. Schmuecking, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
O Elicin, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Bernd Klaeser, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Alan Dal Pra, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Dario Terribilini, PhD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Beat Bojaxhiu, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Natalie D. Klass, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
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Jan Tille, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Nando Mertineit, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
A Geretschlaeger, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In the DEGRO-Quiro Trials correlation of clinical outcome with contouring time in the planning process of radiation therapy and the amount of multimodality imaging has not been analyzed. To evaluate if contouring time and multimodality imaging are prognostic factors for radiation therapy of advanced head and neck cancer 207 patients were analyzed retrospectively between 2001 and 2012.

METHOD AND MATERIALS

Before 2007 radiation treatment planning CT was done without contrast enhancement, MR imaging and 18F-FDG PET/CT as additional imaging modalities were used only occasionally. From 2007 contrast enhanced planning CT in addition to multimodality imaging consisting of MR imaging (including DWI and ADC) and 18F-FDG PET/CT was used routinely for every head and neck cancer patient. Additionally, in unclear or equivocal imaging findings of lymph nodes a re-report was performed with a higher sensitivity at the expense of specificity to minimize geographical miss in the contouring procedure for radiation treatment and to maximize the binary decision for each lymph node (malignant vs benign). The re-reports were done in conjunction with radiooncologists, nuclear physicians and radiologists. The mean contouring time was 60 min before 2007 and 150 min after 2007 (including the time of a re-report). Clinical outcome (local, regional and locoregional control) of advanced oropharyngeal, laryngeal and hypopharyngeal cancers with lymph node metastases was assessed in two groups (group I: 2001-2007 vs group II: 2008-2012).

RESULTS

Group I: n=113, group II: n=94. Regional recurrence was significantly reduced in group II (log-rank-test $p = 0.03$. regional control after 1, 2 and 3 years was 88%, 79% and 76%, respectively as compared to 95%, 92% and 88%, retrospectively. Locoregional control for 207 patients shows no difference in survival ($p = 0.08$), inclusion of 340 patients leads to a p -value $p < 0.05$.

CONCLUSION

Imaging findings of multimodality imaging and a critical re-report of these imaging findings in conjunction with a longer contouring time may have an impact on clinical outcome of advanced head and neck cancers. However, this overtime is not reimbursed.

CLINICAL RELEVANCE/APPLICATION

A close collaboration of radiooncologists, nuclear physicians and radiologists in the radiation treatment planning process may have a benefit for patients with advanced head and neck cancer.

MSRO25-06 Lessons from a Standardized Program Using PET-CT to Avoid Neck Dissection after Primary Radiation Therapy for N2 Squamous Cell Carcinoma of the Oropharynx: Beware the Late Recurrence and Salvage Is Unlikely

Monday, Nov. 30 11:20AM - 11:30AM Location: S103CD

Participants

Kathryn E. Hitchcock, MD, PhD, Gainesville, FL (*Presenter*) Nothing to Disclose
Robert J. Amdur, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
William M. Mendenhall, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
John Werning, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
Walter E. Drane, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
Anthony A. Mancuso, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To report the results of a standardized program using positron emission tomography (PET)-computed tomography (CT) approximately 12 weeks after primary radiotherapy to determine the need for a planned neck dissection in patients with radiographic N2 squamous cell carcinoma (SCC) of the oropharynx. **Materials/Methods:** Fifty consecutive patients with T1-4 and hemineck radiographic stage N2A-B SCC of the oropharynx for whom the only indication for planned neck dissection was a positive PET-CT performed ~12 weeks after completing primary treatment with radiotherapy. Endpoints to determine the value of 12-week PET-CT in identifying residual neck disease were pathologic status of planned neck dissection specimens and neck recurrence at any time during the follow-up period. **Results:** All patients at risk for neck recurrence at last follow-up had =1 year of follow-up after PET-CT (median, 2.0 years). Results of PET-CT to identify residual neck disease were as follows: Sensitivity and positive predictive value: 0% (zero true positive) Specificity: 89% (4 False Negatives), and negative predictive value: 91% Potential neck recurrence from using this 12-week PET-CT program: 2% (Three of 4 neck recurrences would not have been prevented by historic approaches.) Time between negative PET-CT and detection of neck recurrence was 0.8, 0.9, 2.4, and 2.7 years. Rate of successful (>1 year) salvage of neck recurrence: 25% (1/4). **Conclusion:** PET-CT approximately 12 weeks after radiotherapy for oropharyngeal cancer is an excellent way to identify patients who do not need neck dissection, but low-risk is not no-risk. Approximately half of neck recurrences present over 2 years after negative PET-CT and the chance of successful salvage is low. Accurate results for this kind of program will require long-term follow-up and support a policy of frequent neck imaging for years in patients with N2 oropharyngeal cancer who do not undergo neck dissection after primary treatment with radiotherapy.

MSRO25-07 Megavoltage Radiation Therapy of Skin Malignancies of the Nose Using Custom Nasal Paraffin Bolus

Monday, Nov. 30 11:30AM - 11:40AM Location: S103CD

Participants

Randy Wei, MD, Orange, CA (*Presenter*) Nothing to Disclose
Anna-Marie Hosking, Orange, CA (*Abstract Co-Author*) Nothing to Disclose
Juying Zhang, PhD, Long Beach, CA (*Abstract Co-Author*) Nothing to Disclose
Samar Azawi, MD, Long Beach, CA (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To treat surface malignancies, bolus materials are used to enhance the dose delivered at the surface and to reduce hot and cold spots due to sharp surface irregularities and oblique incident angles. Radiation treatment of skin

malignancies on the nose is challenging due to the irregular surface anatomy of the nose to which homogenous dose must be delivered. Materials/Methods: Superflab is a commonly used bolus material that is non-conformal for irregular surface contours of the nose making it difficult to reproducibly apply and maintain. Additionally, air gaps from non-conformal bolus will result in dose inhomogeneity. We present our experiences and outcomes using custom-made paraffin bolus to conform to the shape of the nose for the treatment of basal cell cancer (BCC) or squamous cell cancer (SCC). A mold of the patient's nose was created and a negative impression was made in a paraffin rectangle block. Minimum thickness was 1.5 cm laterally and 1 cm anterior-posteriorly. Thin coating of petroleum jelly was applied within bolus to reduce air gaps. Nine patients were treated to 60 Gy at 2 Gy per with parallel opposing 6x MV photon beams using three-dimensional conformal treatment planning. Six patients had BCC and three patients had SCC. Six patients had two or more distinct sites of disease. Results show that 100% prescription isodose line conforms to the planned target volume and dose to critical structures are well below tolerance limits. Daily kilovoltage orthogonal and weekly cone beam CT show close patient and wax bolus contact and reproducibility. Six thermoluminescent dosimetry (TLD) chips (LiF) were used to measure doses deposited and matched the planned dosimetry for each patient. TLD measurements showed a 2.6% average difference between planned dose and delivered dose. Results: Of the 9 patients treated with this method, maximum hot spot was 102.7% (101.1%-104%) for all 9 plans. Mean follow-up time was 25 months (10 – 58 months). Of the 9 treated, two patients developed new lesions on the nose and one patient had recurrent disease at the columella. Acute side effects were erythema and congested nose. None of the patients developed RTOG Grade 3 skin toxicity immediately following radiation treatment. Followup visits reported no telangiectasia and good cosmetic outcomes. Conclusion: This study demonstrates a practical approach to radiotherapy of the nose which minimizes air gaps and daily setup variability, while achieving dose homogeneity with minimal hotspots.

MSRO25-08 Superior Carotid Artery Sparing by Proton Radiation Therapy Compared to IMRT/VMAT for Reirradiation of Locally Recurrent Cancers of the Base of Tongue

Monday, Nov. 30 11:40AM - 11:50AM Location: S103CD

Participants

Upendra Parvathaneni, MBBS, FRANZCR, Seattle, WA (*Presenter*) Nothing to Disclose
Yolanda D. Tseng, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Quang Dang, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
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Kent McCune, CMD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jay J. Liao, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Salvage treatment options for isolated in-field local recurrences in the base of tongue (BOT) after previous radiotherapy (RT) are limited. Total glossectomy is extremely morbid and re irradiation (reRT) is often preferred in an attempt to preserve function. However, the close anatomical proximity of the carotid arteries to the BOT makes it difficult to avoid this structure with photon based conformal planning such as IMRT or VMAT. Adding radiation dose to a previously irradiated carotid artery may increase the risk of a carotid blow out, which is a fatal complication. Although a clear dose threshold for this complication has not been established, a treatment plan that delivers the least dose to the carotid would be preferred. We hypothesized that compared with photon based planning (IMRT/VMAT), proton radiotherapy (PRT) may decrease the dose to the carotids as there is no exit dose distal to the target, thereby limiting cumulative dose to surrounding organs at risk (OARs). We compared the dose to carotid arteries and other OARs with IMRT/VMAT versus PRT for two patients who had reRT for locally recurrent cancers of the tongue base. Materials/Methods: Comparative plans with photons using an IMRT or VMAT technique and PRT with uniform scanning or pencil beam scanning technique were generated for two patients on Eclipse and RayStation planning systems. Both patients had BOT recurrences that were located centrally within the high dose region of previous RT fields. They also received elective nodal RT for their initial BOT cancers and hence their carotid arteries were irradiated. The patients developed local recurrences after one and 3 years following initial RT. The BOT recurrences were treated to a dose of 66-72 Gy. Elective nodal RT was not given with reRT. Target cover and OAR doses, including dose to the carotid artery were evaluated by standard dose volume histograms. Results: In both patients, the proton plans spared the surrounding OARs including carotid arteries better than IMRT or VMAT photon plans. For patient 1, mean dose to both carotids was lower with protons (right, 3.0 vs 28.0 Gy; left, 4.8 vs 15.7 Gy). Dose to the spinal cord (max, 0 vs 14.9 Gy) was also lower with protons versus photons. Similarly, in patient 2, the proton plan had a lower mean dose to both carotids (right, 5.9 vs 15.9 Gy; left, 0.7 vs 8.1 Gy) and parotids (right, 1.6 vs 19.0 Gy; left, 0 vs 10.7 Gy). Both techniques provided adequate target coverage. Conclusion: Compared with conformal photon techniques such as IMRT/VMAT, proton radiotherapy reduces dose to previously irradiated carotid arteries and other surrounding OARs during treatment of recurrent cancers of the base of tongue. In the re irradiation setting, this advantage may translate to a reduced risk of a fatal carotid blow out. This case study suggests that proton therapy should be considered for reirradiation of locally recurrent tongue base cancers.

MSRO25-09 Hyperbaric Oxygen Therapy for Radiation Induced Toxicity: A Retrospective Review from a Single Institution

Monday, Nov. 30 11:50AM - 12:00PM Location: S103CD

Participants

Leah Katz, MD, MPH, New York, NY (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Adverse radiation (RT) side effects pose an important barrier to progress in the field of radiation oncology. While hyperbaric oxygen therapy (HBOT) is recognized as an effective treatment for RT side effects, in particular for osteoradionecrosis (ORN); many radiation oncologists fail to refer patients. We evaluated NYU's HBOT experience over the past three years to assess its safety and efficacy in treating various RT toxicities. It is our hope that clinicians consider HBOT more frequently and develop a prophylactic referral pattern. Materials/Methods: A retrospective 3-year (2013-2015) chart review of a prospectively maintained database was performed. Thirty-three patients were evaluated with a median age of 62 (range 37-80,) 16 F, 17 M. Sites of initial therapeutic RT included truncal and extremity soft tissue sarcoma (12 %,) squamous cell and adenocarcinoma, anorectum (9 %,) adenocystic vulvar cancer (3%), adenocarcinoma, prostate (12%), squamous cell carcinoma, head and neck (12%), adenocarcinoma, breast (6%), and squamous cell carcinoma, cervix (9%). RT induced toxicities were non-healing soft tissue wounds (39%), mandibular ORN (37%), radiation cystitis (15%), and rectal bladder fistula (3%). The median time from end of radiation therapy to HBOT initiation was 7 years, and median follow-up was 8 months. Patients were treated with a median of 35 HBOT treatments (range 5-90.) All patients were treated at the NYU Hyperbaric Center with no adverse effects. Results: Each RT injury category was evaluated. Symptoms associated with RT soft tissue injury included chronic wound

infection, vaginal bleeding/pain, rectal pain, dyspareunia, and perineal pain. 38% of patients had complete resolution of symptoms after HBOT alone, 31% underwent adjuvant flap closure with complete wound healing, and 31% experienced no wound healing. For radiation cystitis, 60% had complete symptom resolution within a one month period after HBOT. A single patient treated for a rectal bladder fistula enjoyed complete resolution of the fistula with cessation of rectal urine drainage within one month after HBOT. Patients with ORN of the mandible with BRONJ stage I experienced complete resolution of intraoral deficits. Patients with BRONJ stage 2 experienced complete resolution of infection after HBOT with adjuvant debridement. Patients with BRONJ stage 3 experienced complete fracture healing after HBO with adjuvant mandibulectomy. Conclusion: The NYU experience demonstrates both safety and efficacy in ameliorating symptoms and improving patient quality of life with various types of RT morbidity. Our data encourages early referral to HBOT in an effort to save patients time, medical costs, energy, and psychological stress associated with ineffective medical measures. This study encourages further research with longer follow-up to better define the benefit and durability of HBOT.

SSC05

ISP: Health Service, Policy and Research (Evidence-based Medicine/Guidelines/Outcomes)

Monday, Nov. 30 10:30AM - 12:00PM Location: S102D

HP RS

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

FDA Discussions may include off-label uses.

Participants

Fabian Bamberg, MD, MPH, Munich, Germany (*Moderator*) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Research Grant, Siemens AG;
Marta E. Heilbrun, MD, Salt Lake City, UT (*Moderator*) Nothing to Disclose

Sub-Events

SSC05-01 Health Service, Policy and Research Keynote Speaker: How to Establish a New Imaging Modality with Decent Evidence in Clinical Practice: What the Radiology Community Can Learn from Cardiac CT

Monday, Nov. 30 10:30AM - 10:40AM Location: S102D

Participants

Fabian Bamberg, MD, MPH, Munich, Germany (*Presenter*) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Research Grant, Siemens AG;

SSC05-02 Is There an Association between STARD Statement Adherence and Citation Rate?

Monday, Nov. 30 10:40AM - 10:50AM Location: S102D

Participants

Marc Dilauro, MD, MSc, Ottawa, ON (*Presenter*) Nothing to Disclose
Matthew D. McInnes, MD, FRCPC, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Daniel Korevaar, Netherlands, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Christian B. Van Der Pol, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Quon, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Stefan Walther, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Darya Kurowecki, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
William Petrcich, MSc, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Patrick M. Bossuyt, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if adherence to the STARD checklist is associated with post-publication citation rates.

METHOD AND MATERIALS

A comprehensive search of multiple databases including PubMed, EMBASE and Cochrane was performed in order to identify published studies that have evaluated adherence of diagnostic accuracy studies to the Standards for Reporting of Diagnostic Accuracy (STARD) statement. Each study was searched in PubMed and Reuters Web of Science to yield a date of publication, journal impact factor (IF), and a citation rate (citations/month). Univariate correlations were performed to identify any association between post publication citation rate and STARD score as well as impact factor. A multivariate analysis was performed to explore the effect of journal impact factor.

RESULTS

Our search included 1002 eligible articles from 8 studies. The median journal IF was 3.97 (IQR: 2.32-6.21), the median STARD score was 15 (IQR 12-18), and the median citation rate was 0.0073 citations/month (IQR 0.0032-0.017). A weak positive correlation of STARD score with citation rate was identified ($r=0.096$, $p=0.0024$). There is a moderate positive correlation between impact factor and citation rate ($r=0.58$, $p<0.0001$). A weak positive correlation of impact factor with STARD score was identified ($r=0.13$, $p<0.0001$). A multivariate analysis revealed that when the effect of impact factor is partialled out, the positive correlation of citation rate with STARD score does not persist ($r=0.026$, $p=0.42$).

CONCLUSION

There is a positive correlation between journal impact factor and citation rate as well as impact factor and STARD score. When adjusted for journal impact factor, the positive correlation of citation rate with STARD score does not persist.

CLINICAL RELEVANCE/APPLICATION

The variation in journal citation rate is influenced primarily by journal impact factor and to a lesser degree by STARD score.

SSC05-03 Carotid Imaging in Canada: A Cost-Effectiveness Analysis

Monday, Nov. 30 10:50AM - 11:00AM Location: S102D

Participants

Eli Lechtman, PhD, MSc, Toronto, ON (*Presenter*) Nothing to Disclose
Alan R. Moody, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Kevin Chen, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Sylvia Urbanik, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Pascal N. Tyrrell, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Diagnosing carotid artery disease relies on accessible and cost effective imaging to provide an accurate measure of stenosis. Currently, doppler ultrasound (DUS) is considered the first line modality of choice for suspected stenosis, while MR angiography (MRA) is often used to confirm the diagnosis and plan surgical interventions. In this simulation study, we explored the cost effectiveness of MRA alone vs DUS followed by MRA, for diagnosing suspected stenosis.

METHOD AND MATERIALS

Cost effectiveness analysis (CEA) was conducted using TreeAge Pro. Decision trees were modeled for three populations: those with stenosis less than 50%, those with stenosis between 50-69%, and those with stenosis above 70%. Based on the imaging findings, the decision trees included surgical intervention, medical management, or standard care arms. Effectiveness was measured in terms of quality adjusted life years accounting for surgery and complications, stroke, and medical management. Values for the relevant input variables were extracted from the literature, except the cost of imaging, which was reported from our institution.

RESULTS

Based on the CEA, MRA as a first line modality was more cost effective in populations with a high pretest probability of severe stenosis >70%. In a clinical setting, this would reflect patients with multiple risk factors for carotid disease, or patients presenting with symptoms of carotid stenosis such as a transient ischemic attack (TIA). While DUS as a first line modality was more cost effective for imaging the majority of patients suspected of having carotid stenosis <70%, CEA sensitivity analysis indicated that reducing MRA costs by shortening MRA protocol time and increasing effectiveness of information reported, MRA as a first line modality could be cost effective for an even larger portion of the at-risk population.

CONCLUSION

MRA alone may be more cost effective for patients with a high pretest probability of severe stenosis. Future simulations will explore the effect of wait times on cost effectiveness, as well as the cost effectiveness of emerging MR imaging techniques to identify plaque characteristics for stroke risk stratification and treatment decision making.

CLINICAL RELEVANCE/APPLICATION

Magnetic resonance angiography is shown to be a cost effective first line imaging modality to assess carotid disease, provided there is a high pretest probability of finding severe carotid stenosis.

SSC05-04 Computed Tomography and Magnetic Resonance Imaging of Peritoneal Metastases: Systematic Review and Meta-analysis

Monday, Nov. 30 11:00AM - 11:10AM Location: S102D

Awards

Trainee Research Prize - Resident

Participants

Davide Bellini, MD, Latina, Italy (*Presenter*) Nothing to Disclose

Damiano Caruso, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Marco Rengo, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Domenico De Santis, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Andrea Laghi, MD, Rome, Italy (*Abstract Co-Author*) Speaker, Bracco Group Speaker, Bayer AG Speaker, General Electric Company Speaker, Koninklijke Philips NV

PURPOSE

Primary end point was to assess diagnostic accuracy of CT and MR in detecting Peritoneal Metastases (PM). Secondary end-points were determining sensitivity and specificity of CT scans in detecting PM for the thirteen regions according to Sugarbaker's Peritoneal Cancer Index (PCI), investigating correlation between radiological PCI and surgical PCI, and comparing diagnostic yield of CT versus PET/CT.

METHOD AND MATERIALS

In June 2014, the MEDLINE, EMBASE, Cochrane Library, Sumsearch2 and Web of Science databases were searched. Methods for analysis were based on PRISMA. Characteristics of patients and studies included were collected. QUADAS2 tool was used to assess the methodological quality of the primary studies. Pooled estimates of sensitivity, specificity, positive and negative likelihood ratios were calculated using fixed and random effects models. I² was used to evaluate heterogeneity.

RESULTS

Twenty-two articles out of the 529 initially identified were selected (934 patients). Cumulative data of CT diagnostic accuracy on per patient basis were: Se 83% (95%CI: 79-86%; I²: 83.3%), Sp 86% (95%CI: 82-89%; I²: 65.5%), pooled positive LR 4.37 (2.58 to 7.41; I²: 81.2%), pooled negative LR 0.20 (0.11 to 0.35; I²: 85.4%). On per region basis according to PCI, sensitivity of CT was higher in two regions: epigastrium, 78% (95%CI 64-92%) and pelvis, Se 74% (95%CI 64-83%). Correlation between CT-PCI score and Surgical-PCI score were high, ranging from 0.49 to 0.96. MRI and PET/CT showed similar diagnostic accuracy of CT on per patient basis.

CONCLUSION

By a good overall diagnostic accuracy on per patients basis and on per region basis according to PCI, CT should be considered the imaging modality of choice in patients affected by PM.

CLINICAL RELEVANCE/APPLICATION

The role of imaging in detection of peritoneal metastases (PM) is still under debate. A systematic evaluation of diagnostic yield of imaging modality is required to provide a better evidence-based advice to physicians in this area. CT should be considered the imaging modality of choice in patients affected by PM. Because of the good overall diagnostic accuracy on per region basis according to PCI, CT may lead surgeons to refer the patient to the best treatment option. MRI and PET/CT, at the moment, should be considered second choices and further investigations are recommended.

SSC05-05 Computed Tomography (CT) in the Emergency Department: A Real-Time Study of Changes in Physician Decision-Making

Monday, Nov. 30 11:10AM - 11:20AM Location: S102D

Participants

Pari Pandharipande, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose
Andrew T. Reisner, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
William D. Binder, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Atif Zaheer, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Martin L. Gunn, MBChB, Seattle, WA (*Abstract Co-Author*) Research support, Koninklijke Philips NV; Spouse, Consultant, Wolters Kluwer NV; Medical Advisor, TransformativeMed, Inc;
Ken F. Linnau, MD, MS, Seattle, WA (*Abstract Co-Author*) Speaker, Siemens AG; Royalties, Cambridge University Press;
Chad M. Miller, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Laura L. Avery, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Maurice S. Herring, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Angela C. Tramontano, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Emily C. Dowling, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hani H. Abujudeh, MD, MBA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jonathan D. Eisenberg, BA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Elkan F. Halpern, PhD, Boston, MA (*Abstract Co-Author*) Research Consultant, Hologic, Inc
Karen Donelan, DSc, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
G. Scott Gazelle, MD, PhD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, Marval Biosciences Inc

PURPOSE

To determine how physicians' diagnoses, diagnostic uncertainty, and management decisions are affected by CT in emergency department (ED) settings.

METHOD AND MATERIALS

In this prospective, four-center study, ED patients referred to CT with abdominal pain, chest pain/dyspnea, or headache were identified. Before CT, physicians were surveyed to obtain their leading diagnosis, diagnostic confidence (0-100%), an alternative "rule out" diagnosis, and management plan (were CT not available). After CT, surveys were repeated. Primary measures included proportions of patients for which leading diagnoses or admission decisions changed, and median changes in diagnostic confidence. Secondary measures addressed alternative diagnoses and return-to-care visits (e.g. to the ED) at one-month follow-up. Regression analysis identified associations between primary measures and site and participant (physician and patient) characteristics.

RESULTS

Paired surveys were completed for 1503 patients by 265 physicians. For abdominal pain, chest pain/dyspnea, and headache, leading diagnoses changed in 51% (278/545), 44% (208/471), and 25% (122/487) of patients. Pre-CT diagnostic confidence was consistently, inversely associated with the likelihood of a diagnostic change ($p < 0.0001$). Median changes in confidence were substantial (+25%, +20%, +13% ($p < 0.0001$)); median Post-CT confidence was high (95%, 93%, 95%) (Fig. 1). When reported, CT helped to confirm or exclude 'rule out' diagnoses in 95% or more of patients (96% (411/428), 97% (382/393), 95% (392/414)). Admission decisions changed in 25% (134/542), 18% (86/471), and 20% (94/480) of patients. During follow-up, 15% (82/545), 14% (64/471), and 10% (50/487) of patients returned for the same indication. Results correlated with site and participant characteristics in isolated circumstances.

CONCLUSION

Physicians' diagnoses and admission decisions changed frequently after CT, and valid diagnostic uncertainty was alleviated. These findings suggest that current ordering practices are clinically justified.

CLINICAL RELEVANCE/APPLICATION

For common referral indications to CT in emergency department settings, physicians' diagnoses and admission decisions change frequently after CT, and valid diagnostic uncertainty is alleviated; these findings suggest that current ordering practices are clinically justified.

Honored Educators

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

Atif Zaheer, MD - 2012 Honored Educator

SSC05-06 Quenching MRI Anxiety: Complementary Alternative Medicine for Magnetic Resonance Imaging Anxiety

Monday, Nov. 30 11:20AM - 11:30AM Location: S102D

Participants

Selena I. Glenn, MA, BSRT, Portland, OR (*Presenter*) Nothing to Disclose

PURPOSE

Claustrophobia during MRI exams is a problem in imaging departments worldwide causing prematurely cancelled exams with financial losses to medical facilities and delays patient care. A pilot study was conducted hypothesizing complementary alternative medicine (CAM) modalities aromatherapy and breathing techniques would decrease patient anxiety.

METHOD AND MATERIALS

Thirty eight claustrophobic patients participated. They were four study arms, two experimental and two control groups. Experimental arms included participants who used anxiety medication (n=5), and non-medicated (n=13). The control arms included participants who used anxiety medication (n=8) and, non-medicated (n=12). All scans except one were performed on a 1.5T wide short bore scanner, and were of the hip region and above. Aromatherapy and breathing techniques was performed by the experimental groups just before entering scanner bore. The control group was provided standard care and sham aromatherapy. Study theoretical schools of thoughts were integrative medicine and mixing humanistic and cognitive therapy methods. Study design was concurrent triangulation mixed methods. Quantitative data included Likert scales, physiological data and were analyzed using an exact distributions based test, and regression analysis respectively. Qualitative data included open ended questions analyzed by mapping common themes and quantified for histogram analysis.

RESULTS

A 76.5% statistically significant ($p = .02 < 0.05$) reduction in anxiety from pre scan anxiety to post CAM treatment in experimental groups, while control group experienced a statistically insignificant 66.7% ($p = .12 > 0.05$) anxiety reduction. Likewise there was a 76.5% ($p = 0.02 < 0.05$) average anxiety reduction in the experimental group during the MRI compared to pre scan levels, while control group anxiety reduction was not statistically significantly ($p = 0.69 > 0.05$). Qualitative data findings were 33% of experimental group said their anxiety was reduced, compared to 22% of the control group. Physiological data showed that as the heart rate increased the average anxiety increased.

CONCLUSION

Aromatherapy and breathing techniques may reduce anxiety during MRIs.

CLINICAL RELEVANCE/APPLICATION

Fewer cancelled MRI exams with cost savings to medical facilities. Less interrupted medical treatment increasing patient care quality. A low cost skill based intervention for technologists.

SSC05-07 **Quest for More Personalized Lung Cancer Screening Strategy: Proximity of Smoking Cessation as a Predictor of Lung Cancer Events in High-risk Individuals Selected for Screening, Analysis with Propensity Score**

Monday, Nov. 30 11:30AM - 11:40AM Location: S102D

Participants

Recai Aktay, MD, Pepper Pike, OH (*Presenter*) Nothing to Disclose
Pingfu Fu, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Thomas Love, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Purpose: To determine if proximity of smoking cessation (PoSC) is a predictor of incremental lung cancer events (LCE) among those already selected for lung cancer screening (LCS).

METHOD AND MATERIALS

Methods and Materials: We stratified National Lung Screening Trial (NLST) cohort by PoSC (time from SC to randomization) into three groups (>10 yrs and <5 identifying "remote-" and "recent-quitters" respectively). For each case, we estimated the propensity (PS) for remote-quitter using multivariable logistic regression (LR) -with 34 variables. From remote- (n=8,361) and recent-quitters (n=9,435), we produced 6,866 unique pairs of "remote-" and "recent-quitter" cases using PS matching. In the matched, and the entire groups of former smokers (FS) (n=27,692), we estimated the association between PoSC and incidences of LC and LC-death (LCD) using LR and restricted spline fit (RSF) of PoSC. We tested the models' goodness of fit (GOF) in quantiles of predicted probabilities and calculated the area-under-the-curve (AUC) in ROC analysis for predictive performance.

RESULTS

Results: In the FS group, there were 149:331 respective LCD:LC cases of recent- and 98:205 cases of remote-quitters compared to 102:244 and 69:145 LCD:LC cases respectively in the matched group. Recent-quitters were 71% more likely to have LC ($OR=1.71; 95\%CI=1.39-2.12$) and 50% more LCD ($OR=1.50; 95\%CI=1.10-2.06$) in the follow-up. Each proximate yr of SC is associated with 4.8% increased risk for LC ($OR=1.048; 95\%CI=1.032-1.065$) and 4.5% for LCD ($OR=1.045; 95\%CI=1.021-1.070$). On RSF, PoSC had significant ($P<0.001$ for LC and LCD), and linear associations with LC ($P=0.788$) and LCD ($P=0.086$). Validated and calibrated LR models predicted LC and LCD with AUCs of 0.64 and 0.66 respectively with favorable GOF ($P=0.739$ for LC and 0.095 for LCD).

CONCLUSION

Conclusion: In those already selected for LCS, the proximity of SC is linearly associated with increased risk for LCEs. Time-to-event analyses would explore the clinical usefulness of these relationships.

CLINICAL RELEVANCE/APPLICATION

Clinical Relevance: A personalized LCS strategy may be devised through a second-round of risk profiling of those selected for LCS and PoSC may be used as one of the risk predictors in this endeavor.

SSC05-08 **Quest for More Personalized Lung Cancer Screening Strategy: Age Older Than 54 Years as a Predictor of Lung Cancer Events in Individuals Selected for Screening**

Monday, Nov. 30 11:40AM - 11:50AM Location: S102D

Participants

Recai Aktay, MD, Pepper Pike, OH (*Presenter*) Nothing to Disclose
Pingfu Fu, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Thomas Love, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Purpose: To determine if age can increment the prediction of lung cancer events (LCE) in individuals who are already selected for lung cancer screening (LCS).

METHOD AND MATERIALS

Methods and Materials: We stratified the National Lung Screening Trial cohort by age into three groups (≥ 64 years and 54-59 identifying "senior-" and "young-group" respectively). For each case, we estimated the propensity (PS) for senior-group using multivariable regression (LR) -with 34 variables such as socio-demographic, exposure history,... From senior- (n=16,958) and young-groups (n=18,844), we produced 12,034 unique pairs of "senior" and "young" cases using PS matching. In the matched, and the entire cohort (n=53,452), we estimated the association between participants' age and incidences of LC and LC-death (LCD) using LR and restricted spline fit (RSF) of age. We tested the models' goodness of fit (GOF) in quantiles of predicted probabilities and calculated the area-under-the-curve (AUC) in ROC analysis for predictive performance.

RESULTS

Results: In the entire group, there were 519:1016 and 203:422 respective LCD:LC cases in the senior- and the young-group respectively and in the matched group, 356:712 cases were senior and 129:286 cases were young. Seniors were more likely -than young- to have LC (OR=2.58;95%CI=2.24-2.97) and LCD (OR=2.78;95%CI=2.27-3.42) in the follow-up. In the entire group, LR showed 8.7% increased risk of LC (OR=1.087; 95%CI=1.077-1.096) per year of age, however, this relationship was non-linear (P=0.0237) on RSF. For LCD, the risk increment was 8.9% per year (OR=1.089;95%CI=1.076-1.103) and this was linear (P=0.842) and significant (P<0.001). Calibrated LR with RSF predicted LC and LCD with AUCs of 0.63 and 0.68 respectively. GOF test was favorable with P-value of 0.421 for LC and 0.760 for LCD.

CONCLUSION

Conclusion: In those selected for LCS, age is a predictor of incremental LCEs. However, further time-to-event analyses are needed to determine the method for its potential clinical use.

CLINICAL RELEVANCE/APPLICATION

Clinical Relevance: In those already selected for LCS, a second-round of risk profiling may allow the LCS strategy to be personalized and age may be used as one of the predictors of LCEs in this process.

SSC05-09 Health Service, Policy and Research Keynote Speaker: Cost-effective Analyses

Monday, Nov. 30 11:50AM - 12:00PM Location: S102D

Participants

Marta E. Heilbrun, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

ISP: Radiation Oncology (Pediatric Tumors, Lymphoma and Sarcoma)

Monday, Nov. 30 10:30AM - 12:00PM Location: S104A



AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: .50

Participants

Ralph P. Ermoian, MD, Seattle, WA (*Moderator*) Nothing to Disclose
David B. Mansur, MD, Cleveland, OH (*Moderator*) Nothing to Disclose

Sub-Events**SSC11-01 Radiation Oncology Keynote Speaker: Perspectives in Lymphoma**

Monday, Nov. 30 10:30AM - 10:40AM Location: S104A

Participants

Martin Colman, MD, Houston, TX (*Presenter*) Nothing to Disclose

SSC11-02 Dose Volume Dependent Lymphoid Depletion During Thoracic Radiation and Its Effect on Pediatric Patient Outcome

Monday, Nov. 30 10:40AM - 10:50AM Location: S104A

Participants

Wen Jiang, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Lymphoid cells, including mature lymphocytes and lymphocytic progenitors, are known to be extremely radiosensitive. Radiation-induced lymphocytopenia is a negative prognostic factor in adult cancer patients. Impact of radiotherapy (RT) on lymphocyte counts and outcome in pediatric population is unknown. We investigated association of lymphocyte depletion with radiation dose and volume and its effect on outcomes of pediatric cancer patients undergoing thoracic RT (TRT). **Materials/Methods:** Charts of 77 pediatric patients who received TRT at a single institution between 2005-2014 with complete blood analysis available were retrospectively reviewed on an Institutional Review Board-approved protocol. Lymphocyte, neutrophil and red blood cell (RBC) counts were measured pre- and post-RT to determine percent change from baseline (D%) and compared using Wilcoxon signed rank test. Association between lung dose-volume parameters and D% in absolute lymphocyte counts were correlated using Spearman correlation coefficients. Kaplan-Meier analysis was used to assess lymphocytic depletion effect on overall survival (OS) and compared using log-rank test. Multivariate regressions were conducted with linear and Cox regression analyses. All variables were analyzed as continuous, when possible. **Results:** The median age for our cohort was 14 years (range: 3-17). All patients received chemotherapy, either concurrently (76.5%) or prior to TRT (23.5%). Osteosarcoma was the most common tumor type (34.6%), followed by Ewing sarcoma (17.3%) and rhabdomyosarcoma (9.9%). TRT was associated with significant depletion in circulating lymphocytes (median D% = -56.0, pD% = 4.1, p=0.085) or RBC counts (median D% = -27.8, p=0.198). Extent of lymphocyte depletion correlated with RT dose and lung volume irradiated. Analyses of RT dose-volume distribution showed this correlation to be more significant at lower doses (lung V5: r=-0.778, p55%) showed worse OS (median OS 12.4 vs. 8.9 months, HR=1.84, 95% CI=1.02-3.34, p=0.043). This increased mortality risk remained significant after adjusting for covariates including age, chemotherapy schedule, and histology types on multivariate analysis (HR=2.03, 95% CI=1.07-3.85, p=0.031). **Conclusion:** Pediatric patients receiving TRT have significant lymphocytic depletion dependent both on total radiation dose and on lung volume irradiated. A strong correlation of lymphocyte drop was observed even with very low RT dose, confirming that these cells are highly radiosensitive. Increased lymphopenia is associated with worse survival in this young patient population.

SSC11-03 Peritransplant Radiation Therapy Among Patients with Relapsed or Refractory Hodgkin's Lymphoma: A Retrospective Analysis

Monday, Nov. 30 10:50AM - 11:00AM Location: S104A

Participants

Shekeab Jauhari, Oak Brook, IL (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): High-dose chemotherapy and autologous stem-cell transplantation (ASCT) remains the standard of care for relapsed / refractory Hodgkin's lymphoma (HL). Radiation therapy (RT) delivered in the peri-transplant setting is thought to optimize disease control, although timing and efficacy of use remain unclear. Our purpose is to compare outcomes among patients with and without peri-transplant RT. We hypothesize patients with peri-transplant RT have improved outcomes and limited toxicities. **Materials/Methods:** 31 patients with relapsed / refractory HL who received ASCTs at a single institution between 2008 and 2011 were included in the study. Patients ranged from 20 to 70 years and had minimum follow-up of 1 year following ASCT. Patient characteristics, clinical course and therapies were reviewed, including peri-transplant RT (defined as completing within 4 months of ASCT). Frequencies of second relapses (occurring after ASCT) were analyzed using Fisher's exact test. The Kaplan-Meier method and log rank test were used to analyze freedom from relapse. Disease-related mortality and radiation-associated toxicities were also evaluated. **Results:** 12 patients received RT in the peri-transplant setting at a median dose of 3540 cGy. All but one patient received RT after ASCT, completed at a median of 3.5 months. Primary sites of irradiation included mediastinum, axillae and periclavicular lymph nodes. Of patients receiving peri-transplant RT, 8/12 (67%) maintained CR through last follow-up (median = 51 months) while 4/12 (33%) had second relapses, of whom 2 died from HL. 1 patient developed grade 3 intermediate radiation pneumonitis. 19 patients did not receive peri-transplant RT. Of these, 9/19 (47%) maintained CR through last follow-up (median = 52 months). 6 of these 9 received RT prior to initial relapse. 10/19 (53%) had second relapses. 2 of these 10 received RT prior to initial relapse; in addition, 3 of these patients maintained CR following salvage RT and 4 died from HL. 2-year freedom from second relapse was 75% and 51% between groups with and without peri-transplant RT, respectively (p = 0.33). There was no significant

difference in the frequency of second relapses between both groups ($p = 0.46$). Conclusion: Patients receiving peri-transplant RT had a trend towards fewer relapses, but not disease-related mortality, and limited toxicities. These patients were also more likely to have chemotherapy-refractory disease prior to ASCT. Second relapses with sites of limited disease may be managed with reasonable success with RT. Our study is limited by small numbers and retrospective analysis but highlights the benefits of a combined modality approach in this population. Analyses of larger patient populations and prospective study are warranted.

SSC11-04 Proton Therapy for Pediatric Hodgkin Lymphoma

Monday, Nov. 30 11:00AM - 11:10AM Location: S104A

Participants

Justin Wray, MD, Gainesville, FL (*Presenter*) Nothing to Disclose

Bradford Hoppe, MD, Jacksonville Beach, FL (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The Children's Oncology Group upcoming protocol, AHOD1331, for pediatric high-risk Hodgkin lymphoma (HL) allows the use of proton therapy (PT). PT reduces the radiation dose to organs at risk, which should translate into fewer long term side effects, yet minimal data exist on the use of PT in HL. The purpose of this study is to determine whether PT is an effective and safe treatment for pediatric HL. Herein, we present our institutional experience treating pediatric HL with PT. **Materials/Methods:** Between 2010 and 2014, 17 patients ages 18 years and younger were treated with PT for HL and enrolled on a prospective institutional review board-approved outcomes tracking protocol. Age distribution was as follows: 6-8 years, 3 patients (18%); 12-15 years, 5 patients (29%), and 16-18 years, 9 patients (53%). Nine patients (53%) were male and 8 (47%) were female. Stage distribution was as follows: stage I, 0 patients; stage II, 4 patients (23%); stage III, 7 patients (41%); stage IV, 3 patients (18%); and relapsed, 3 patients (18%). Thirteen (76%) had bulky mediastinal disease (X). The median axial bulky disease was 9 cm and the median cranio-caudal bulky disease was 13 cm. Eleven patients (65%) had high-risk disease (stages IIBX, IIIB, IVA, or B). All patients were evaluated using the Childhood Hodgkin International Prognostic Score (CHIPS) class 0-4. The CHIPS score distribution consisted of 3 (18%) class 0, 4 (23%) class 1, 6 (35%) class 2, 3 (18%) class 3, and 1 (6%) class 4 patients. Total PT dose was a median of 21 Gy (RBE) (range, 15-36 Gy[RBE]), including 7 patients (41%) treated with a sequential boost. Of 14 de-novo patients, we obtained 11 PET and 12 CT images after 2 or 3 cycles of chemotherapy (mid-point). Seven patients (64%) had a partial response (PR) and 3 (36%) had a complete response (CR) on PET. Nine (75%) had a PR and 3 (25%) had CR on CT. Two of 3 (67%) recurrent patients achieved a PR on CT and PET and 1 patient achieved a CR before stem cell transplantation. Median follow-up for the cohort was 24 months (range, 4-52 months). **Results:** The 2-year overall survival rate was 93% and the progression-free survival rate was 80%. Three high risk patients recurred: 1 with an isolated in-field cervical lymph node and 2 recurred both in field and out of field. All recurrences were discovered within 5 months from completing PT. One patient with stage IVBX, CHIPS 4 died of a recurrence 7 months after treatment. The 2 other patients had stage IIBX and stage IVA disease, and both had mid-treatment PET-positive disease. No PT-related grade 3 or higher acute or late complications were observed according to CTCAEv4. **Conclusion:** Our results indicate that PT for pediatric HL is safe and effective in our generally unfavorable cohort of patients. In future studies, considerations will include increasing doses for patients with PET-positive disease at the midpoint of chemotherapy.

SSC11-05 Risk Factors and Patterns of Lymph Node Involvement in Gastric Large B Cell Lymphoma: Implications for Target Definition

Monday, Nov. 30 11:10AM - 11:20AM Location: S104A

Participants

Ximei Zhang, Oak Brook, IL (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To identify the appropriate radiation field in primary gastric diffuse large B-cell lymphoma (PG-DLBCL). **Materials/Methods:** The clinical and pathological findings of 48 PG-DLBCL patients treated with total gastrectomy and D2 lymphadenectomy were retrospectively analyzed. In addition, factors associated with lymph node involvement were also analyzed. **Results:** There were 26 patients with stage I disease, 14 patients with stage II and 8 patients with stage IIE disease. Lymph node involvement was identified in 37.5% of the whole series. Primary location, as well as the depth of invasion was significantly associated with lymph node involvement. The rate was rather low when gastric antrum was involved whereas when the whole stomach was involved, the rate could be as high as nearly 70%. The rate increased with the depth of invasion into stomach. Tumors invading into mucosa and submucosa, serosa and adjacent organs had a lymph node involvement rate of 0, 55.6% and 70%, respectively. When tumor was limited to the deep muscularis, the involved lymph nodes were all perigastric nodes. For tumors invaded upon muscularis, the involved lymph nodes were regional nodes. With a median follow up of 35 months, eight patients had developed progressive disease or a relapse, however, none of the patients who underwent adjuvant radiotherapy had disease progression or relapse. **Conclusion:** The radiation field for patients with PG-DLBCL is largely dependent on the primary location and depth of invasion. Large series as well as longer follow up are needed to further demonstrate the appropriateness of radiation volumes for PG-DLBCL.

SSC11-06 Hypofractionated Radiation Therapy in the Evolving Paradigm of Treating Nasal-Type Extranodal Natural Killer/T-CELL Lymphoma

Monday, Nov. 30 11:20AM - 11:30AM Location: S104A

Participants

Amandeep Taggar, Oak Brook, IL (*Presenter*) Nothing to Disclose

Douglas Stewart, MD, FRCPC, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose

Theresa Trotter, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose

Alexander G. Balogh, MD, MSc, London, ON (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Extranodal natural killer/T-cell lymphoma (ENKTL) is a rare and lethal malignancy with no consensus on its optimal management. External beam radiation (RT) is often used in its treatment with dosages of 45-50 Gy in 1.8-2.0Gy fractions delivered over 5 weeks. At our institution, a RT dose of 30 Gy in 3 Gy fractions over 2 weeks was introduced in 2006. Adjuvant therapies and autologous stem cell transplant (ASCT) were later introduced. It was hypothesized that this hypofractionated regimen would offer similar outcomes to the standard regimen, while shortening the duration of RT, because patients were

progressing while on or shortly after the 5-week regimen. We look to describe our results by reporting on disease/treatment characteristics and survival outcomes in a cohort of patients treated in the era of 45-50 Gy and then with 30 Gy. Materials/Methods: The clinical records of patients presenting with ENKTL at our tertiary institution between 1999 and 2013 were retrospectively reviewed. Demographics, vital statistics, tumour characteristics and treatment parameters were extracted from the medical records. Results were examined using SPSSv.22 for both the descriptive analysis and survival. Non-parametric approaches including the Mann-Whitney U test was used to compare differences in outcomes between both groups. Results: The records of n=19 with nasal-type ENKTL were identified. Median age was 58.7 years. Median follow-up was 10.8 months (range(R): 4.4-43.9 months). Stage at presentation: 14 - stage I/II, 2 - stage IV and 3 - stage unknown. The observed median survival was 10.8 months. 2 year overall survival was 36%. N=17 received RT; n=10 received 30Gy in 10 fractions, n=1 received 35 Gy in 20 fractions and n=6 received 45 Gy in 25 fractions (of which 2 patients did not complete due to disease progression, and received 41.4 Gy in 25 and 36 Gy in 18 fractions). Among those patients who died, median time to death (MTD) was 7.2 months (R:5.4-29.8 months) for patients receiving the 30 Gy regimen versus 1.5 months (R:0.4-6.9 months) for those receiving standard dose-fractionation (p=0.05). In total, 12 patients received chemotherapy and 4 out of 12 subsequently received ASCT. All patients who proceeded to ASCT were treated with hypofractionated regimen. All patients who treated with RT plus ASCT are alive at a median follow-up of 42.4 months. N=7 of those receiving adjuvant chemotherapy relapsed, of which 2 had "in-field" recurrences. Median time to relapse was 12.4 months (R:6.5-19.4m) from diagnosis and 8.9 months (R:5.4-16.8 m) from the date RT. Conclusion: Patients treated in the post 2006 era of our hypofractionated regimen with 30Gy/10 fractions had improved OS outcomes compared to traditional dose fractionations. There remains a role for dose escalation to minimize in-field recurrences and more effective systemic agents to further delay relapses.

SSC11-07 Prospective Absorbed Dose Based Combined Treatment Planning and Therapy Using 153Sm-EDTMP Radiopharmaceutical with External Beam Radiation Therapy in Metastatic Osteosarcoma Patients

Monday, Nov. 30 11:30AM - 11:40AM Location: S104A

Participants

Robert Hobbs, Baltimore, MD (*Presenter*) Nothing to Disclose

Anders Josefsson, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Metastatic osteosarcoma is a cancer of adolescents and young adults that has a very low survival rate. We present results and describe a methodology related to an ongoing trial designed to boost the radiation dose to lesions in cases where external beam radiation therapy (XRT) is limited by normal organ toxicity. We combine radiopharmaceutical therapy (RPT) using 153Sm-EDTMP, an FDA approved bone seeking calcium mimetic with XRT, and provide a treatment plan that incorporates the dose from both modalities. Materials/Methods: Three patients have been treated thus far under this protocol. The patients first underwent stem cell harvesting, then received a 1 mCi/kg pre-therapeutic dose of 153Sm-EDTMP and were imaged at 4, 24 and 48 h p.i. The in-house RPT treatment planning system, 3D-RD, was used to establish the maximum safe administered activity based on normal tissues absorbed dose (AD) constraints derived from RPT and the projected XRT treatment plan. One week after the pre-dose, a therapeutic dose, determined from the pre-therapeutic dosimetry and ranging from 10 - 15 mCi/kg of 153Sm-EDTMP was administered, and the patients imaged at 4, 24 and 48 h p.i. The images were reconstructed with an iterative algorithm including count-rate saturation corrections. AD-maps and DVHs were generated using 3D-RD for the RPT part of the treatment. These were entered into the XRT treatment planning system, which was used to create a renewed combined RPT/XRT treatment plan that incorporated the real Sm-153 dose deposition. Results: Results for three patients will be shown. As an example for a pelvic tumor in patient 2: the AD delivered to the tumor by RPT was 25.5 Gy. The XRT plan was created based on the RPT plan and another 51.3 Gy was delivered to the tumor by XRT, resulting in a total tumor AD of 76.8 Gy. The AD to adjacent spinal cord from the combined treatments was 30.9 Gy, lower than the maximum tolerable AD of 52 Gy; the threshold dose of 75 Gy would not have been possible with XRT alone. Conclusion: The treatment planning protocol combining RPT and XRT for metastatic osteosarcoma in pediatric patients showed potential to treat a highly aggressive disease, while limiting the AD to normal organs to below potentially toxic thresholds.

SSC11-08 Evaluation of the Response to Intratumor Implantation of Nanoparticles Activated by External Beam Radiation Therapy in Sarcoma by DCE-US and MRI: Radiologic-Pathology Correlation

Monday, Nov. 30 11:40AM - 11:50AM Location: S104A

Participants

Samy Ammari, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose

Laurent Derclé, MD, Villejuif, France (*Presenter*) Nothing to Disclose

Thierry Debaere, Villejuif, France (*Abstract Co-Author*) Consultant, Terumo Corporation; Speaker, Terumo Corporation; Consultant, Guerbet SA; Speaker, Guerbet SA; Consultant, General Electric Company; Speaker, General Electric Company; Proctor, Galil Medical Ltd

Sylvie Bonvalot, MD, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose

Jean-Charles Soria, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose

Nathalie B. Lassau, MD, PhD, Villejuif, France (*Abstract Co-Author*) Speaker, Toshiba Corporation; Speaker, Bracco Group; Speaker, Novartis AG; Speaker, Pfizer Inc; Speaker, F. Hoffmann-La Roche Ltd

PURPOSE

Nanoparticles activated by external beam radiation therapy (EBR) are new drugs tested in phase 1 trial in patients with soft tissue sarcoma of the extremity and trunk wall. Using current thresholds, there is a poor agreement between RECIST1.1 and the response to treatment. We aimed to determine the predictive value of biomarkers measured on MRI and Dynamic contrast-enhanced ultrasound (DCE-US).

METHOD AND MATERIALS

14 patients with a histological diagnosis of sarcoma received an injection of nanoparticles in a phase I study with NBTXR3. Once implanted in the tumor, they were activated by EBR (Day 2 until day 37). DCE-US and MRI (T1, T2, gadolinium) were performed at baseline and prior to the surgery (realized at 5 weeks). Biomarkers tested on MRI were: RECIST, WHO, Volumetric approach. Biomarkers tested on DCE-US were: Area Under Curve (AUC, quantitative) and DCE (Contrast enhancement in %, qualitative). A new biomarker: the percentage of tumor volume with increased T2-weighted signal (iT2%) or cystic on DCE-US was evaluated: Percentage of Cystic Volume (CV%). The reference standard for pathological response was based on the parameter of tumor cell viability expressed as a percentage of viable cells (PVC) in the global cell mass in the post-operative surgical specimen.

Furthermore, the percentage of necrosis was evaluated. A $p < .05$ was considered as statistically significant.

RESULTS

At baseline 14MRI and only 12 DCE-US were analyzed. The estimation of the tumor volume by US ($r=.85$) and MRI ($r=.75$) was significantly correlated with the pathology specimen. CV% was significantly correlated with the PVC ($r=.57$) and the percentage of necrosis ($r=.65$). RECIST and the relative variation of volume were correlated with the PVC: $r=.63$ and $.57$. The other biomarkers were not significantly correlated with the percentage of VC or of necrosis within the tumor volume.

CONCLUSION

The response to a treatment with nanoparticles activated by EBR lead to the apparition of a cystic portion within the overall tumor volume (CV%) that may be evaluated non-invasively by either MRI or US. and is a good predictor of the percentage of tumor necrosis and of viable cells. Changes in volume (US and MRI) are correlated with the PVC and it suggests that an adaptation of thresholds might be necessary.

CLINICAL RELEVANCE/APPLICATION

Nanoparticles activated by EBR are new drugs and RECIST1.1 is not a good predictor of the response to treatment. New biomarkers are needed.

SSC11-09 Outcomes of Adjuvant Radiation Therapy for Retroperitoneal Soft Tissue Sarcoma

Monday, Nov. 30 11:50AM - 12:00PM Location: S104A

Participants

Eric D. Miller, MD, PhD, Columbus, OH (*Presenter*) Nothing to Disclose

Nicole Andonian, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

Xiaokui Mo, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

Karl Haglund, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

John C. Grecula, MD, Columbus, OH (*Abstract Co-Author*) Research Grant, Teva Pharmaceutical Industries Ltd; Research Grant, Soligenix, Inc;

Douglas D. Martin, MD, Portsmouth, VA (*Abstract Co-Author*) Nothing to Disclose

Meng X. Welliver, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate outcomes of patients treated with adjuvant radiation therapy (RT) for retroperitoneal soft tissue sarcomas (RP STS) at our institution.

METHOD AND MATERIALS

The medical records of 34 consecutive patients with RP STS treated definitively between 1998-2013 were reviewed. Survival analyses were conducted using the Kaplan-Meier method and subsets of patients were compared using the log rank test.

RESULTS

Eighteen men and 16 women were included with a median age of 56 years (range 30-80). The most common histologies were liposarcoma (53%) and leiomyosarcoma (21%). The majority of patients had tumors >10 cm in size (53%). 26% of patients were stage III and 38% of patients were high grade. 21% of patients were treated for recurrent disease and 18% were treated for persistent disease after initial non-oncologic resection. All patients underwent resection and received RT as part of their treatment. 68% of patients had positive or close (<2 mm margins). 76% of patients completed external beam radiation therapy (EBRT). 62% of patients had RT delivered post-operatively with a median total dose of 45 Gy (range 39.5-54) and 38% of patients had pre-operative RT with a median total dose of 45 Gy (range 45-55). Intraoperative radiation therapy (IORT) was delivered in 82% of patients with 8 patients treated with IORT alone without EBRT. The median IORT dose was 12.5 Gy (range 10-15). At a median follow-up of 48 months (range 3-172), the 5-year LC, DFS, and OS rates were 62%, 50%, and 67%, respectively. 47% of patients ultimately failed with 35% failing locally, 15% failing distantly, and 3% failing both locally and distantly. RT timing delivered either pre- or post-operatively did not impact LC ($p=0.68$), DFS ($p=0.65$), or OS ($p=0.46$). Patients with recurrent disease had reduced LC ($p<0.0001$) and DFS ($p<0.0001$) but no effect on OS ($p=0.48$) was observed. There were no adverse effects on LC ($p=0.23$), DFS ($p=0.10$), or OS ($p=0.27$) in patients who were treated after initial non-oncologic resection as long as they received definitive treatment afterwards.

CONCLUSION

Patients with RP STS are most likely to fail locally. Based on our data, pre- vs. post-operative radiation and treatment following initial non-oncologic resection had no impact on outcomes. However, patients with recurrent disease were more likely to have a local or distant failure.

CLINICAL RELEVANCE/APPLICATION

Patients with RP STS fail locally with worse outcomes for recurrent disease.

SSC02

Cardiac (Viability and Ischemia)

Monday, Nov. 30 10:30AM - 12:00PM Location: S504AB



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

FDA Discussions may include off-label uses.

Participants

Jadranka Stojanovska, MD, MS, Northville, MI (*Moderator*) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (*Moderator*) Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Bayer AG; Departmental Research Grant, Guerbet SA; Departmental Research Grant, DAIICHI SANKYO Group; Departmental Research Grant, FUJIFILM Holdings Corporation; Departmental Research Grant, Nihon Medi-Physics Co, Ltd
Jacobo Kirsch, MD, Weston, FL (*Moderator*) Nothing to Disclose

Honored Educators

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

Jacobo Kirsch, MD - 2013 Honored Educator

Sub-Events

SSC02-01 Can Native T1 Mapping Distinguish between Infarct Area and Area-at-Risk in Patients between Acute ST-elevation Myocardial Infarction?

Monday, Nov. 30 10:30AM - 10:40AM Location: S504AB

Participants

Nicola Galea, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Pierpaolo Palumbo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Andrea Fiorelli, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Vincenzo Noce, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Franccone, MD, Rome, Italy (*Abstract Co-Author*) Speakers Bureau, Bracco Group
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Iacopo Carbone, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Cardiac Magnetic Resonance (CMR) has been established as the reference standard for in vivo identification and assessment of myocardial damage in acute myocardial infarction (AMI). Conventional CMR approach required a combined evaluation of myocardial edema and necrosis by using respectively T2-weighted sequences and late gadolinium enhanced (LGE) imaging. However the standard acquisition protocol for AMI is time-consuming (about 40-50 minutes), poorly tolerated by patients in inadequate clinical conditions and needs of the administration of contrast agent. Novel T1 mapping technique offers a pixel-by-pixel calculation of tissue T1 relaxation time determined by water content and cellularity. Our purpose was to investigate the capability of native T1 mapping to differentiate infarcted area, healthy myocardium and area-at-risk using conventional CMR sequences as reference in patients with AMI.

METHOD AND MATERIALS

Twenty consecutive patients performed CMR within the first 7 days following STEMI. CMR protocol included MOLLI, STIR T2w and cineMR sequences. IR-TSE T1w images were acquired for LGE after gadobenate dimeglumine (Gd-BOPTA, Bracco) administration. MOLLI images were analyzed with a dedicated software (Cvi42, Circle) by placing four ROIs within necrotic areas (LGE area, excluding microvascular obstruction area), area-at-risk (hyperintense area on STIR images without LGE) and in the remote myocardium. Acquisition time of each sequence was measured. Results are expressed on mean±SD and compared with Student's t test.

RESULTS

The mean T1 native value of all patients (age 54±9yrs, 68% male) was 1317±66ms in the necrotic area (LGE+/MVO-), 1149±57ms in the area-at-risk (LGE-/STIR+) and 952±76ms in remote myocardium (LGE-/STIR-). Significant differences were found in the comparison of t1 values between all regions (p<0.01 for all). Infarct size was 25±12% of left ventricular mass. Acquisition time of CMR protocol including only localizer, native MOLLI sequence and cineMR was 22.4±8.7min; acquisition time of standard CMR protocol (including localizer, STIR, cineMR and LGE) was 45.4±9.5min; p<0.01.

CONCLUSION

Native T1 mapping may reliably distinguish between necrotic area and area-at-risk after AMI.

CLINICAL RELEVANCE/APPLICATION

Native T1 mapping might offer a complete assessment of myocardial injury after AMI in shorter time and without contrast injection compared to conventional CMR approach.

SSC02-02 Subendocardium and Subepicardium Myocardial Blood Flow, Comparison in Normal and Ischemic Territories? A Dynamic CT Perfusion Study

Monday, Nov. 30 10:40AM - 10:50AM Location: S504AB

Participants

Adriaan Coenen, MD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose
Marisa M. Lubbers, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Raluca G. Saru, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Akira Kurata, PhD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi K. Kono, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Koen Nieman, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Toshiba Corporation Research Grant, Bayer AG Research Grant, General Electric Company
Alexia Rossi, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Marcel L. Dijkshoorn, RT, Rotterdam, Netherlands (*Abstract Co-Author*) Consultant, Siemens AG
Robert J. Van Geuns, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Speakers Bureau, Siemens AG

PURPOSE

Dynamic CT myocardial perfusion (CTP) uses a consecutive series of acquisitions in which the distribution of the contrast media over the myocardium is measured. By measuring time-attenuation curves and the arterial input function, the myocardial blood flow (MBF) can be computed. The examination is performed in a pharmacological hyperemic state. The subendocardium is known to be more susceptible for ischemia due to the wavefront phenomenon. One of the advantages of CTP compared with other modalities is the high spatial resolution, allowing for distinguishing the subendocardium and subepicardium. In this study the subendocardial and subepicardial perfusion are investigated for normal and ischemic territories, defined by invasive fractional flow reserve (FFR).

METHOD AND MATERIALS

For this study 43 patients, 94 vessels territories were analyzed. Short axis slices of MBF were reconstructed from dynamic CTP. Blinded to the invasive FFR outcomes the MBF was measured in the subendocardium and subepicardium within the suspected perfusion defect. Ischemic and normal territories were defined by invasive FFR, applying a threshold of ≤ 0.80 for ischemic territories.

RESULTS

Of the 94 vessels 48 were ischemic with an invasive FFR ≤ 0.80 . The mean subendocardium MBF was 67 ± 30 in the ischemic and 88 ± 38 ml/100ml/min in the normal territories. Compared with a subepicardium MBF of 80 ± 22 in the ischemic and 92 ± 29 ml/100ml/min in normal territories (figure 1). The area under the receiver operator curve for MBF as a diagnostic determinant for ischemia was larger for the subendocardium (0.71) compared with subepicardium (0.63).

CONCLUSION

Dynamic CT perfusion allows for measurement of the MBF in the subendocardium and subepicardium. The subendocardium is more susceptible for ischemia and MBF measurements in that region perform better for the detection of hemodynamically significant coronary artery disease.

CLINICAL RELEVANCE/APPLICATION

The susceptibility of the subendocardium for ischemia could be utilized by dynamic CT myocardial perfusion.

SSC02-03 Myocardium: Dynamic CT Perfusion Imaging: A Comparison to Coronary Angiography/FFR and to MR First Pass Perfusion Imaging

Monday, Nov. 30 10:50AM - 11:00AM Location: S504AB

Participants

Armin M. Huber, MD, Munchen, Germany (*Presenter*) Nothing to Disclose
Bettina M. Gramer, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Vivian Leber, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniela Muenzel, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander W. Leber, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Johannes Rieber, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Mani Vembar, MS, Cleveland, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ellen Hoffmann, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the diagnostic accuracy of dynamic computed tomographic (CTP) perfusion imaging of the myocardium for the detection of hemodynamically relevant coronary artery stenosis compared with the accuracy of coronary angiography and fractional flow reserve (FFR) measurement and with MR first pass perfusion imaging of the myocardium.

METHOD AND MATERIALS

This study was approved by the institutional review board and the Federal Radiation Safety Council (Bundesamt für Strahlenschutz). All patients provided written informed consent. Thirty-two consecutive patients in adenosine stress conditions underwent dynamic CT perfusion imaging (14 consecutive data sets) performed by using a 256-section scanner with an 8-cm detector and without table movement. Myocardial blood flow (MBF) was determined quantitatively. Results were compared with those of coronary angiography and FFR measurement by using a receiver operating characteristic (ROC) analysis. In addition results were compared to MR first pass perfusion imaging under adenosine and at rest. For evaluation of MR perfusion imaging the myocardial perfusion reserve index was calculated derived from the ratio of the parameter upslope determined under the stress and the rest conditions. In addition, threshold values based on the Youden index and sensitivity and specificity were calculated.

RESULTS

The comparison of CTP with the invasive reference method coronary angiography and FFR showed an area under the ROC curve, a

sensitivity, and a specificity of 0.86, 75.9% (95% CI: 56.5%, 89.7%), and 100% (95% CI: 94.6%, 100%) for the quantitative parameter MBF. The thresholds determined by using the Youden index was 1.64 mL/g/min. The comparison to MR perfusion imaging showed an area under the ROC curve, a sensitivity and a specificity of 0.90, 83.3 % (95% CI: 63.5%, 92.7%), 86.6 % (95% CI: 70.2 %, 93.2 %).

CONCLUSION

Dynamic CT perfusion imaging of the myocardium using the quantitative parameter MBF shows a similar diagnostic accuracy, when compared to the invasive reference methods coronary angiography and FFR and when compared to MR first pass perfusion imaging of the myocardium.

CLINICAL RELEVANCE/APPLICATION

Dynamic CT Perfusion imaging shows a high diagnostic accuracy and may be used in addition to CTA in order to improve the specificity and/or the positive predictive value in patients with a high pretest probability.

SSC02-04 Diffusion Weighted Images: New Application in the Evaluation of Myocardial Infarction and Microvascular Obstruction

Monday, Nov. 30 11:00AM - 11:10AM Location: S504AB

Participants

Giulia Benedetti, Milan, Italy (*Presenter*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonio Esposito, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Mariangela Cava, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo G. Camici, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CMR is one of the most accurate tool for myocardial damage evaluation after STEMI; LGE and STIR sequences are routinely used, even if STIR may suffer from some limitations. Aim of our study is to explore the potential role of Diffusion Weighted Imaging (DWI), in the detection of myocardial infarction and microvascular obstruction (MVO), in comparison with standard-reference sequences.

METHOD AND MATERIALS

STEMI patients underwent PCI and CMR within 5 days from the acute event with DWI (b= 0, 100, 300, 500), perfusion, LGE and STIR. Infarction walls involvement (apex, septal, anterior, lateral and inferior wall) and MVO presence were analyzed by two blinded observers; inter-observer reproducibility was assessed. DWI findings were compared to LGE as standard reference for the detection of the infarcted area, STIR for edema and perfusion for MVO. DWI sensitivity (Se) and specificity (Sp) in MVO detection were calculated; DWI-MVO was related with others CMR parameters.

RESULTS

51 pts were enrolled. Infarcted areas were hyperintense at DWI, and matched with hyperintensity at LGE and STIR, except for inferior and anterior walls infarctions, which couldn't be detected by axial DWI. Inter-observer reproducibilities for the detection of different walls infarctions were: septum k=0,75; apex k=0,90; lateral wall k=0,52. ADC maps showed different intensity between normal and infarcted myocardium: ADC Normal Myocardium = $2.96 \pm 0.78 \times 10^{-3} \text{ mm}^2/\text{sec}$, ADC Infarcted Myocardium = $4.75 \pm 0.76 \times 10^{-3} \text{ mm}^2/\text{sec}$ (p<0.001). Comparing DWI and LGE positive findings: septum 33vs34 pts; apex 35vs37; lateral wall 14vs13. Similarly, comparing DWI and STIR positive findings: septum 33vs38 pts; apex 35vs37; lateral wall 14vs14. 31 pts had perfusion-MVO, 28 showed corresponding hypointensity within the hyperintensity at DWI (p=0.005), with good inter-observer reproducibility (k=0,71), Se=0,80 and Sp=0,70. Pts with DWI-MVO had higher LGE MVO% (Early-MVO%: 5.39 vs 1.62, p=0.011; Late-MVO% : 3.04 vs 0.54, p=0.019), larger and more edematous infarctions (LGE%: 38.36 vs 21.42, p<0.001; Oedema%: 44.57 vs 29.92, p<0.001).

CONCLUSION

ADC is a sensible technique in revealing the presence of myocardial infarction. DWI may also detect MVO, when more represented.

CLINICAL RELEVANCE/APPLICATION

DWI is a promising CMR tool in pts with acute STEMI. DWI may become an alternative to traditional STIR, when Diffusion Imaging reliability will be confirmed on larger groups.

SSC02-05 Inversion Time Dependence of the Accuracy of Late Gadolinium Enhancement Quantification Using T1 Map Based Synthetic Inversion Recovery Imaging

Monday, Nov. 30 11:10AM - 11:20AM Location: S504AB

Participants

Akos Varga-Szemes, MD, PhD, Charleston, SC (*Presenter*) Nothing to Disclose
Rob J. van der Geest, PhD, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Muscogiuri, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ;
Bruce Spottiswoode, Chicago, IL (*Abstract Co-Author*) Employee, Siemens AG
Stefanie Mangold, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Rozemarijn Vliegenhart, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Pal Suranyi, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the influence of inversion time (TI) on the accuracy of myocardial late gadolinium enhancement (LGE) quantification using synthetic inversion-recovery (IR) imaging.

METHOD AND MATERIALS

Thirty-eight patients with suspected myocardial infarction underwent 1.5T MR imaging. Twelve minutes after the administration of 0.1mmol/kg gadobenate-dimeglumine, conventional single-shot magnitude and phase-sensitive inversion-recovery (MagIR, PSIR) LGE imaging and fast myocardial T1-mapping were performed in a single short axis plane. Based on the T1 maps, synthetic magnitude (MagIRsy) and PSIR (PSIRsy) images were calculated in a TI range of -100 and +150ms relative to the most optimal TI (TIO) with 5ms increments, using an in-house developed application integrated in the Research Mass Software. LGE was quantified using two binary methods: applying thresholds of 5 standard deviations (5SD) above the average signal of the normal myocardium, and using the lower threshold of the full width at half maximum (FWHM) of the signal of the infarcted myocardium. LGE area was compared within the TI range.

RESULTS

LGE was observed in 15 (39.4%) patients. LGE area quantified by 5SD thresholding in MagIRsy, PSIRsy (at TIO), and conventional MagIR, and PSIR techniques were 5.29 ± 1.39 , 4.44 ± 1.35 , 5.71 ± 1.88 , and $4.72 \pm 1.49 \text{cm}^2$, respectively, while the same parameter with FWHM was 3.46 ± 2.39 , 3.10 ± 1.18 , 4.01 ± 2.16 , and $3.32 \pm 1.43 \text{cm}^2$, respectively. LGE areas obtained by the synthetic and the conventional methods were in agreement at TIO. The 5SD method showed significantly larger infarct areas than FWHM ($P < 0.05$) in both synthetic and conventional images. LGE area was essentially constant over the TI range in the PSIRsy images. The MagIRsy technique provided accurate LGE area at TIs beyond TIO, while the accuracy was compromised for TIs below TIO.

CONCLUSION

The accuracy of LGE area quantification using MagIRsy images is constant over a wide TI range above TIO, while the accuracy using PSIRsy images is constant over the entire clinically relevant TI range (250-400ms).

CLINICAL RELEVANCE/APPLICATION

Synthetic T1-based IR images are reliable for infarct quantification and may provide a benefit over conventional LGE methods by eliminating the operator dependence (i.e. selection of optimal TI).

SSC02-06 Improved Detectability of Myocardial Delayed-Enhancement Using a Subtraction Myocardial Computed Tomography

Monday, Nov. 30 11:20AM - 11:30AM Location: S504AB

Participants

Takayoshi Yamaguchi, Sapporo, Japan (*Presenter*) Nothing to Disclose
Teppei Sugaya, MD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Jyungo Furuya, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiichi Igarashi, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuhiko Ichikawa, PhD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Subtraction coronary computed tomography (CT) angiography is effective for assessing calcified lesions in coronary arteries, enhancing visibilities of the enhanced coronaries. If this subtraction technique can be applied to delayed enhancement (DE) for assessing myocardial viability, the detectability of myocardial delayed enhancement might be improved. We propose the new subtraction technique, which removes coronary CTA images from DE CT images. The obtained images are similar to black blood delayed gadolinium enhancement images of magnetic resonance imaging (MRI). The purpose of this study is to evaluate the effectiveness of the subtraction myocardial CT (SMCT), compared with a myocardial MRI (MMRI).

METHOD AND MATERIALS

18 patients (mean age 62.6 ± 14.7 years) with suspected coronary artery disease underwent DE imaging with a 320-slice CT and a 1.5-T MRI. SMCT images were obtained using dedicated software. We assessed DE transmuralities per segment on a five-point scale (0 = 0%; 1 = 1-25%; 2 = 26-50%; 3 = 51-75% and 4 = 76-100% transmuralities), contrast-to-noise ratios (CNRs) in infarct and healthy myocardiums and left ventricular blood pools for MMRI, non-subtracted myocardial CT (NSMCT), and SMCT.

RESULTS

81/306 (26.5%) segments showed DE in MRI. Using MRI DE detection in the transmuralities scores as the reference standard, the kappa value of SMCT was higher than that of NSCT (0.775 vs. 0.646). CNRs at myocardiums for MRI, NSMCT and SMCT were 31.7 ± 18.2 , 3.15 ± 2.58 , and 5.15 ± 2.16 , respectively, while CNRs based on the blood pool were 11.9 ± 14.7 , -0.85 ± 1.77 , and 36.0 ± 11.4 , respectively.

CONCLUSION

DE imaging using SMCT technique showed better CNR compared with NSMCT, and comparably reasonable detectability of DE with MMRI.

CLINICAL RELEVANCE/APPLICATION

Conventional delayed enhanced CT imaging of myocardial infarction suffers from low contrast, especially between the area of infarction and the blood pool. The SMCT technique would contribute to improve the detectability of myocardial DE.

SSC02-07 Development of Infarct and Edema Size in the Course of the First 6 Months after Acute Myocardial Infarction Measured by LGE- and T2w-CMR Imaging

Monday, Nov. 30 11:30AM - 11:40AM Location: S504AB

Participants

Enver G. Tahir, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Martin Sinn, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Maxim Avanesov, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Dennis Saring, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Kai Muellerleile, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

Ulf K. Radunski, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gunnar K. Lund, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to serially analyze the development of infarct and edema size over 6 months after first acute myocardial infarction (AMI) using late gadolinium enhancement (LGE)- and T2-weighted (T2w)-CMR imaging, respectively.

METHOD AND MATERIALS

Consecutive baseline (BL) at 7 ± 4.9 days and follow-up (FU) imaging at 1.2 ± 0.3 months (FU1), 3.3 ± 0.6 months (FU2) and 6.3 ± 0.7 months (FU3) was performed on 25 patients with first-time AMI using a 1.5 Tesla MRI machine (Achieva, Philips). Short-axis LGE- and T2w-images of the entire left ventricle were acquired with a slice thickness of 8 mm and a gap of 2 mm. CMR studies were quantitatively evaluated by two experienced observers in respect to infarct and edema size using a threshold method with the dedicated HeAT-Software. Infarct and edema size were measured on LGE- und T2w-images as gram (g) of infarcted left ventricular myocardium. Statistical analysis was performed using GraphPad Prism 5 and Excel, Microsoft.

RESULTS

Mean size of infarcted myocardium was 26 ± 21.9 gram (gr) at BL and decreased on FU1 and FU2 to 20.7 ± 16.4 gram ($P < 0.04$) and 18.8 ± 14.6 gram ($P < 0.03$), respectively. FU3 did not show further decline in infarct size. Infarction was present in all 25 patients on BL and FU imaging, whereas edema was present in 88% of the patients at BL, in 72% of patients on FU1, in 32% of patients on FU2 and only in 8% of patients on FU3. Mean myocardial edema was 41 ± 28.3 gram at BL and decreased to 21 ± 16.2 gram ($P = 0.001$) on FU1 and 13.7 ± 13 gram ($P = 0.005$) on FU2, respectively. On FU3 edema was detected in two patients and measured 3.9 ± 2 gram.

CONCLUSION

After first AMI a continuous decrease in the size of gadolinium enhancing infarcted area is observed during the first 3.3 ± 0.6 months and remains constant afterwards, whereas main edema decrease occurs during the first 1.2 ± 0.3 months. Nevertheless, in 32% of patients edema is still present after 3.3 ± 0.6 months and can even persist in 8% after 6.3 ± 0.7 months.

CLINICAL RELEVANCE/APPLICATION

Infarct healing, defined as edema resorption, mainly occurs between 6 weeks and 3 months after AMI. However, in 1/3 of patients edema still persists after 3 months indicating prolonged infarct healing.

SSC02-08 Serial Native T1 and T2 Mapping for Quantitative Monitoring of Myocardial Edema Resorption after Acute Myocardial Infarction

Monday, Nov. 30 11:40AM - 11:50AM Location: S504AB

Participants

Enver G. Tahir, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Martin Sinn, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Maxim Avanesov, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Joshua Wien, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Dennis Saring, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Stehning, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ulf K. Radunski, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Kai Muellerleile, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gunnar K. Lund, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Currently, myocardial edema monitoring after acute myocardial infarction (AMI) is based on visualization of the region with increased signal-intensity on T2-weighted (T2w) images. Native T1 and T2 mapping are promising novel cardiac magnetic resonance imaging (CMR) techniques to quantitatively assess edema. The purpose of the study was to evaluate resorption of myocardial edema following AMI by native T1 and T2 mapping.

RESULTS

Edema size continuously decreased from BL with 29.9%LV to 19.6%LV at FU1, to 8.6%LV at FU2 and to 5.6%LV at FU3 using T2w-CMR. An identical decrease of edema size was observed using native T2 and T1 mapping. T2 times decreased between BL from 83 ± 8 ms to 76 ± 7 ms at FU1 ($P < 0.05$), but no further change was observed later with 73 ± 7 ms at FU2 and 72 ± 5 ms at FU3. The T2 times of remote normal myocardium were about 55 ± 3 ms at all times and significantly lower compared to the edema zone. Native T1 time within the edema was with 1253 ± 103 ms significantly increased compared to remote normal myocardium with 1018 ± 43 ms and remained constantly high in the edema zone throughout all follow-ups.

CONCLUSION

Edema size continuously decreased within the following months after AMI, but was still present at low levels after 6 months. Additionally, quantitative mapping showed increased T2 and T1 values within the edema zone indicating prolonged presence of edema up to 6 months after AMI.

CLINICAL RELEVANCE/APPLICATION

T2 and T1 mapping may improve the ability to differentiate edematous myocardium over T2w techniques allowing a more precise determination of area at risk after AMI.

SSC02-09 Integrating Anatomical and Functional Assessment of Coronary Artery Disease Using Single-scan Stress Computed Tomography Perfusion: A Comparison with Combined Invasive Coronary Angiography and Cardiac Magnetic Resonance Imaging

Participants

Sung Min Ko, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

This study was aimed to determine the diagnostic performance of single-scan stress computed tomography perfusion (CTP) for identifying hemodynamically significant coronary artery disease (CAD).

METHOD AND MATERIALS

Twenty-nine (21 men, 63.9±9.1 years) patients with suspected or known CAD underwent single-scan CTP, stress perfusion cardiovascular magnetic resonance (SP-CMR), and invasive coronary angiography (ICA). Dual-source CT was performed as follows: 1) coronary calcium scan: non-enhanced, prospectively ECG-triggered scan; 2) single-scan CTP for coronary artery anatomy (coronary CT angiography, CCTA) and inducible myocardial perfusion (CTP): contrast-enhanced, retrospectively ECG-gated scan during adenosine infusion; 3) delayed scan: acquired 5 min after single-scan CTP using prospectively ECG-triggered scan. Diagnostic values of CCTA for detecting hemodynamically significant stenosis were assessed before and after CTP on a per-vessel basis compared with combined ICA and SP-CMR as reference standard. A coronary vessel was considered to be significantly stenosed if there was at least 1 segment with ≥ 50% lumen reduction

RESULTS

By ICA, 26 (90%) patients had 57 (66%) significantly stenotic vessels. By SP-CMR, perfusion defects were noted in 23 (79%) patients with 48 (55%) vessel territories. Ten (34%) patients had old myocardial infarction. Combined ICA/SP-CMR showed hemodynamically significant stenoses in 23 (79%) patients with 47 (54%) vessel territories. The performance of single-scan CTP for detecting perfusion defects compared with SP-CMR on per-vessel (segment) basis was sensitivity, 88% (78%); specificity, 92% (84%); positive predictive value, 94% (76%); negative predictive value, 85% (86%). Compared to ICA/SP-CMR, per-vessel territory sensitivity, specificity, positive predictive value, and negative predictive value of CCTA were 75%, 93%, 96%, and 63%, respectively, those by using CTP were 86%, 92%, 94%, and 83%, respectively, and those by using single-scan CTP (CCTA and CTP) were 90%, 90%, 91%, and 88%, respectively. The area under the receiver operating characteristic curve increased from 0.79 to 0.90 (p=0.013) using single-scan CTP compared with CCTA.

CONCLUSION

Single-stress CTP allows for the detection of hemodynamically significant coronary stenosis.

CLINICAL RELEVANCE/APPLICATION

Single-stress CTP has the potential to become the preferred CT technique for identifying hemodynamically significant CAD at a single-examination.

MSCM22

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

Monday, Nov. 30 10:30AM - 12:00PM Location: S100AB

BR **CH** **HN** **NR** **MR**

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

Participants

John R. Leyendecker, MD, Dallas, TX (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of MRI in diagnosing abnormalities of the breast. 2) Be familiar with the MRI appearance of select cardiothoracic abnormalities. 3) Effectively use MRI to diagnose disorders of the head and neck. 4) Distinguish between a variety of brain lesions based on MRI appearance.

ABSTRACT

This session will help attendees recognize and manage select, commonly encountered breast, cardiothoracic, head and neck, and brain abnormalities based on their MRI appearances using a case-based, interactive format.

Sub-Events

MSCM22A Breast MRI

Participants

Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Presenter*) Medical Advisory Board, General Electric Company; Research Grant, GlaxoSmithKline plc; Research Grant, General Electric Company

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCM22B Cardiothoracic MRI

Participants

Suhny Abbara, MD, Dallas, TX (*Presenter*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Honored Educators

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

Suhny Abbara, MD - 2014 Honored Educator

MSCM22C Head and Neck MRI

Participants

Daniel W. Williams III, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCM22D Brain MRI

Participants

Mauricio Castillo, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the differential diagnosis and imaging features of intraventricular masses in children and adults. 2) Review the cerebral complications of treatment vascular malformations. 3) Review the differential diagnosis and imaging features of masses arising in the cerebello-pontine angle region. 4) Review the differential diagnosis of cerebral microbleeds.

IHE Clinical Solutions for Interoperability - Imaging and Beyond: IHE and HIE does the Order Matter?

Monday, Nov. 30 10:30AM - 12:00PM Location: S501ABC

INAMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**Participants**

David S. Mendelson, MD, Larchmont, NY (*Moderator*) Spouse, Employee, Novartis AG; Advisory Board, Nuance Communications, Inc; Advisory Board, General Electric Company; Advisory Board, Toshiba Corporation
David S. Mendelson, MD, Larchmont, NY (*Presenter*) Spouse, Employee, Novartis AG; Advisory Board, Nuance Communications, Inc; Advisory Board, General Electric Company; Advisory Board, Toshiba Corporation
Angela Lianos, MSc, Toronto, ON (*Presenter*) Nothing to Disclose
Mariann Yeager, MBA, Maclean, VA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the organization of IHE and the IHE profiles. 2) Understand the importance of interoperability in healthcare. 3) Learn about the various IHE profiles that address interoperability, including XDS. 4) Learn about how XDS-I and related profiles address interoperability for imaging. 5) Learn about real world implementations regarding interoperability and how IHE profiles have been employed to solve interoperability issues including: a. The RSNA Image Share b. Cleveland Clinic enterprise-wide multi-specialty imaging integration and implementation c. Canada Health Infoway: emphasis on the Province of Quebec Project d. Kaiser Permanente. 6) Understand the challenges in attaining safe, secure and transparent interoperability.

ABSTRACT

This course will focus on HIT interoperability and its importance in providing for the optimal care of patients. The session will start with a review of standards and the role of IHE. The discussion will then move to real world implementations at the Cleveland Clinic and in Canada where the Canada Health Infoway project is underway.

SSC01

Cardiac (Nonischemic Cardiomyopathies)

Monday, Nov. 30 10:30AM - 12:00PM Location: S502AB

CA MR

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

FDA Discussions may include off-label uses.

Participants

Konstantin Nikolaou, MD, Tuebingen, Germany (*Moderator*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Ella A. Kazerooni, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Vincent B. Ho, MD, MBA, Bethesda, MD (*Moderator*) In-kind support, General Electric Company

Honored Educators

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

Ella A. Kazerooni, MD - 2014 Honored Educator

Sub-Events

SSC01-01 Myocardial Hyperintensity on T2-weighted MRI of Hypertrophic Cardiomyopathy: Distribution and Clinical Significance Related to Phenotypes

Monday, Nov. 30 10:30AM - 10:40AM Location: S502AB

Participants

Shogo Imai, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Yasuo Amano, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Fumi Yamada, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kumiko Aita, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaki Tachi, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Makoto Obara, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichiro Kumita, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

T2-weighted magnetic resonance imaging (MRI) visualizes myocardial injuries that are different from late gadolinium enhancement (LGE). The aim of this study was to evaluate the distribution and clinical significance of myocardial hyperintensity on T2-weighted MRI (T2-high) in patients with two phenotypes of hypertrophic cardiomyopathy (HCM): asymmetrical septal HCM (ASH) and apical HCM (APH).

METHOD AND MATERIALS

Thirty-six ASH and 18 APH patients and their 864 myocardial segments based on the American Heart Association model were investigated using cardiac MRI. The two patient groups were age-matched. The distribution of T2-high was compared with that shown by LGE. The relationships between T2-high and the episode of unexpected syncope or nonsustained ventricular tachycardia and elevated troponin T levels were evaluated. In four patients with HCM, T2 values of the T2-high were quantitatively estimated with multi-echo spin-echo T2 mapping.

RESULTS

T2-high was observed in 18 segments (3.1%) in 13 ASH patients (36.1%) and in 12 segments (4.2%) in 8 APH patients (44.4%). One-third of T2-high was located outside LGE in ASH patients, and half of the T2-high was outside LGE in APH patients. The concordance of T2-high and LGE was moderate when analyzed on the per-patient basis ($k = 0.47$) and mild when analyzed on the per-segment basis ($k = 0.30$) in ASH. In APH, the concordance of T2-high and LGE was fair when analyzed on both the per-patient basis ($k = 0.05$) and per-segment basis ($k = 0.20$). In ASH patients, the presence of T2-high was significantly related to the episode of unexpected syncope ($P = 0.016$). T2-high had greater T2 values (mean, 61.1 ms) than the remote myocardium of HCM (mean, 47.3 ms) and the normal myocardium of 5 volunteers (mean, 47.4 ms).

CONCLUSION

T2-high reflects changes in myocardial water contents, which may be related to syncope associated with ASH. Because the T2-high is often localized outside the LGE area, T2-weighted MRI should be interpreted carefully in HCM.

CLINICAL RELEVANCE/APPLICATION

Myocardial hyperintensity on T2-weighted MRI, which may be related to syncope, should be investigated carefully in patients with hypertrophic cardiomyopathy.

SSC01-02 Comprehensive Cardiac Magnetic Resonance in Acute Myocarditis

Monday, Nov. 30 10:40AM - 10:50AM Location: S502AB

Participants

Julian A. Luetkens, Bonn, Germany (*Presenter*) Nothing to Disclose

Rami Homs, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Alois Martin Sprinkart, MSc, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Jonas Doerner, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Darius Dabir, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Kuetting, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
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Christian Stehning, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Rolf Fimmers, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Juergen Gieseke, DSc, Bonn, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Daniel K. Thomas, MD, PhD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Claas P. Naehle, MD, Bonn, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc

PURPOSE

Cardiac magnetic resonance (MR) can visualize inflammatory tissue changes in acute myocarditis. Several quantitative image-derived parameters have been described to enhance the diagnostic value of cardiac MR, but no direct comparison of all these techniques is available.

METHOD AND MATERIALS

34 patients with suspected acute myocarditis and 50 control subjects underwent cardiac MR. Cardiac MR protocol included quantitative assessment of T1 relaxation times using modified Look-Locker inversion recovery (MOLLI) and shortened MOLLI (ShMOLLI) acquisition schemes, extracellular volume fraction (ECV), T2 relaxation times, and longitudinal strain. Established Lake-Louise Criteria (LLC) consisting of T2-weighted signal intensity ratio (T2 ratio), early gadolinium enhancement ratio (EGEr) and late gadolinium enhancement (LGE) were assessed. Receiver operating characteristics analysis was performed to compare diagnostic performance.

RESULTS

Areas under the curve of native T1 (MOLLI: 0.95; ShMOLLI: 0.92) and T2 relaxation times (0.92) were higher compared to those of other cardiac MR parameters (T2 ratio: 0.71, EGEr: 0.71, LGE: 0.87, LLC: 0.89, ECV MOLLI: 0.77, ECV ShMOLLI: 0.80, longitudinal strain: 0.83). Combined with LGE each native mapping technique outperformed the diagnostic performance of LCC ($P < 0.01$ respectively). A combination of native parameters (T1, T2 and longitudinal strain) significantly increased the diagnostic performance of cardiac MR compared to LCC without the need of contrast media application (0.99 vs. 0.89; $P = 0.002$).

CONCLUSION

In patients suspected of having acute myocarditis, diagnostic performance of cardiac MR can be improved by implementation of quantitative cardiac MR parameters. Especially native mapping techniques have the potential to replace current LCC.

CLINICAL RELEVANCE/APPLICATION

Based on these study findings, an update to the Lake-Louise criteria with respect to quantitative CMR parameters may become necessary.

SSC01-03 Myocardial T1-mapping and T1-derived Extracellular Volume Fraction (ECV) in Patients with Chronic HIV Infection

Monday, Nov. 30 10:50AM - 11:00AM Location: S502AB

Participants

Julian A. Luetkens, Bonn, Germany (*Presenter*) Nothing to Disclose
Jonas Doerner, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Christoph Boesecke, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Jan-Christian Wasmuth, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Carolynne Schwarze-Zander, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Juergen Rockstroh, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Claas P. Naehle, MD, Bonn, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc

PURPOSE

Chronic HIV infection is associated with an increased risk for cardiovascular disease. Diffuse myocardial pathologies may noninvasively be assessed by quantitative cardiac magnetic resonance (CMR) using myocardial T1 mapping, and T1-derived extracellular volume fraction (ECV).

METHOD AND MATERIALS

The institutional review committee approved the study and all subjects gave informed consent prior to CMR. Patients with chronic HIV infection undergoing combination antiretroviral therapy and healthy controls were included in this study. All patients had no medical history of cardiac disease and no cardiac risk factors. CMR protocol at 3 Tesla (Ingenia, Philips Healthcare, The Netherlands) included common SSFP sequences, T2 STIR imaging, late gadolinium enhancement imaging, and a pre- and 10 minutes post-contrast 3-3-5 MOLLI scheme for myocardial T1 mapping. Hematocrit-corrected ECV was derived from the pre- and post-contrast T1 maps.

RESULTS

27 patients with HIV infection (age 49.1 ± 9.5 years) and 18 controls (age 40.6 ± 15.6 years) underwent CMR. Pre-contrast global T1 relaxations times were significantly prolonged in HIV patients compared to healthy controls (1116.1 ± 57.0 ms vs. 1075.1 ± 65.5 ms; $P = 0.033$). Post-contrast T1 relaxation times were decreased (405.0 ± 50.5 ms vs. 455.7 ± 77.5 ms, $P = 0.007$). ECV was higher in the HIV group compared to controls (25.8 ± 3.5 % vs. 22.4 ± 5.1 %, $P = 0.015$). Left ventricular ejection fraction was lower in the HIV group (60.3 ± 6.6 % vs. 64.4 ± 5.4 %; $P = 0.038$).

CONCLUSION

This study revealed signs of subtle myocardial disease (i.e. cardiac fibrosis) in asymptomatic HIV using quantitative myocardial T1 mapping analysis. Preclinical detection of myocardial involvement in HIV infection appears feasible and may allow for early risk factor modification.

CLINICAL RELEVANCE/APPLICATION

Myocardial T1 mapping might serve as a potential screening parameter for beginning cardiovascular disease in the course of HIV-infection.

SSC01-04 **Characteristics of Peak Systolic Longitudinal Strain Using Strain-encoded Magnetic Resonance in Patients with Hypertrophic Cardiomyopathy: Comparison with Healthy Subjects and Relationship with Late Gadolinium Enhancement and with Wall Thickness**

Monday, Nov. 30 11:00AM - 11:10AM Location: S502AB

Participants

Fumiko Kimura, MD, PhD, Hidaka-Shi, Japan (*Presenter*) Nothing to Disclose
Takatomo Nakajima, MD, Shinjuku-Ku, Japan (*Abstract Co-Author*) Nothing to Disclose
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Toshiko Hoshi, MD, Kumagaya, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigetoshi Nishimura, MD, PhD, Hidaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Nael Osman, Baltimore, MD (*Abstract Co-Author*) CEO, Diagnosoft, Inc

PURPOSE

To clarify characteristics of peak systolic longitudinal strain (PSLS) using strain-encoded cardiac magnetic resonance (SENC) in patients with hypertrophic cardiomyopathy (HCM) with normal left ventricular ejection fraction (LVEF)

METHOD AND MATERIALS

We retrospectively assessed 31 patients with HCM with LVEF \geq 55% (20 men, 11 women; mean age 62.6 ± 12.3 years; mean LVEF $68.7 \pm 8.6\%$) who underwent MR evaluation of late gadolinium enhancement (LGE) and PSLS using a 1.5 T-system in 2 hospitals between August 2012 and December 2014. For reference, we assessed the PSLS of 9 healthy control subjects. We compared the average segmental PSLS and the variability of segmental PSLS using 16-segment models between the HCM and control groups and then, in patients with HCM, directly correlated PSLS with corresponding myocardial wall thickness and compared PSLS with the percentage of area with LGE. We defined LGE as signal intensity (SI) 6 or more standard deviations (SDs) above the mean SI of normal myocardium, defined the normal range of segmental PSLS as the average segmental LS \pm 2 SD in controls, and used an expression of reduction of PSLS when the absolute value of PSLS was reduced more than 2 SD of that of controls.

RESULTS

The average segmental PSLS was significantly reduced (HCM, -14.8%; control, -19.5%; $P < 0.0001$) and significantly more inhomogeneous (SD of average PSLS: HCM, 6.2%; control, 3.3%; $P < 0.0001$) in the HCM group than controls. We identified LGE in 28 of 31 patients with HCM (90.3%) and 253 of 496 segments (51.0%). In HCM group, the PSLS correlated moderately with myocardial wall thickness ($R = 0.53$, $P < 0.0001$) and weakly with the percentage of area of LGE ($R = 0.30$, $P < 0.0001$). Defining the normal range of segmental PSLS as above, PSLS in the HCM group was reduced in segments with and without LGE (PSLS was reduced in 80 of 243 segments with no LGE).

CONCLUSION

The average PSLS was significantly reduced and inhomogeneous in those with HCM despite a normal LVEF. Segmental PSLS correlated moderately with wall thickness, and weak correlation with segmental LGE percentage was probably due to the presence of segments with reduced PSLS and no LGE.

CLINICAL RELEVANCE/APPLICATION

In patients with HCM and normal LVEF, peak systolic longitudinal strain was reduced and inhomogeneous compared to controls and reduced in thick myocardium and myocardium with and without LGE.

SSC01-05 **Relationship between Myocardial Markers and Myocardial Fibrosis of Hypertrophic Cardiomyopathy: Accessed by 3.0T Cardiac Magnetic Resonance**

Monday, Nov. 30 11:10AM - 11:20AM Location: S502AB

Participants

Huayan Xu, Chengdu, China (*Presenter*) Nothing to Disclose
Zhigang Yang SR, PhD, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Yingkun Guo, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To quantitatively detect myocardial fibrosis of hypertrophic cardiomyopathy (HCM) by 3.0 T cardiac magnetic resonance (CMR) Late gadolinium enhancement (LGE) technology, and get the relationship of LGE and myocardial markers, to investigate whether HCM patients' elevated myocardial markers are associated with myocardial fibrosis.

METHOD AND MATERIALS

34 HCM patients and 20 healthy volunteers were enrolled in this research. HCM patients and 20 healthy volunteers were underwent 3.0 T Cardiac Magnetic Resonance scanning, including short axis cine sequences and LGE sequences. Left ventricular function was obtained on short axis cine sequence. LGE parameters, including total LGE rate, total LGE volume and total LGE mass were detected on LGE sequences by commercial available software (cmr42, Circle Cardiovascular Imaging Inc., Calgary, Canada). Myocardial marker, including creatine kinase isoenzyme and troponin were detected. Independent sample t-test and Pearson correlation were used.

RESULTS

All myocardial markers of HCM patients were greater than clinical normal range. By LGE detection, LGE parameters of HCM group

All myocardial markers of HCM patients were greater than clinical normal range. By LGE detection, LGE parameters of HCM group, including total LGE rate, total LGE volume and total LGE mass, were greater than normal control group (18.95±9.87 vs. 50.82±14.18; 8.50±4.50 vs. 4.50±4.19; 9.00±4.80 vs. 90.58±44.11, all $P < 0.05$). Pearson correlation has been proved that creatine kinase isoenzyme of HCM patients were positively correlated to LGE rate and LGE volume ($r = 0.759$, $P = 0.000$; $r = 0.448$, $P = 0.008$). Troponin of HCM patients were also positively correlated to LGE rate and LGE volume ($r = 0.647$, $P = 0.000$; $r = 0.578$, $P = 0.000$).

CONCLUSION

Myocardial fibrosis of Hypertrophic Cardiomyopathy was quantitatively assessed by 3.0 T cardiac magnetic resonance late gadolinium enhancement technologies. Creatine kinase isoenzyme and troponin of HCM patients were positively correlated to LGE. Myocardial fibrosis may induce myocardial markers in the myocardial cells releasing, which affect the myocardial metabolic function further and induced heart function damage eventually.

CLINICAL RELEVANCE/APPLICATION

CMR-LGE is a well-established tool for the assessment of myocardium fibrosis in patients with HCM. Creatine kinase isoenzyme and troponin of HCM patients were positively correlated to LGE. Myocardial fibrosis may induce myocardial markers in the myocardial cells releasing, which affect the myocardial metabolic function further and induced heart function damage eventually.

SSC01-06 Magnetic Resonance Feature Tracking Derived Myocardial Strain Parameters: The Discriminative Power of Right Ventricular Strain Analysis in the Diagnosis of Acute Myocarditis

Monday, Nov. 30 11:20AM - 11:30AM Location: S502AB

Participants

Bettina Baessler, MD, Cologne, Germany (*Presenter*) Nothing to Disclose
Guido Michels, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank Schaarschmidt, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Anastasia Dick, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
David C. Maintz, MD, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander C. Bunck, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of cardiac magnetic resonance (CMR) feature tracking (FT) derived strain-analysis of the left and right ventricle in patients with CMR-proven acute myocarditis (ACM).

METHOD AND MATERIALS

CMR cine data of 34 patients with clinically suspected ACM and confirmation of diagnosis by CMR according to the Lake Louise criteria were retrospectively analyzed. 20 age-matched healthy volunteers (HV) served as a control. Analysis of global longitudinal, circumferential (circ.) and radial strain and strain rate (SR) of both ventricles was performed in one long-axis and three short-axis slices using a dedicated FT-software (TomTec). Statistical analysis was conducted using independent t-test, one-way ANOVA with tukey-type comparisons, multiple and multinomial logistic regression analyses, and ROC-analyses.

RESULTS

ACM patients showed significantly reduced LV longitudinal strain (-12.7 ± 1.1 vs. -16.8 ± 1.3 %, $p = .022$) and LV circ. strain (-22.9 ± 1.0 vs. -27.8 ± 1.0 %, $p = .001$) compared to HV. Conversely, they showed improved basal RV circ. SR (-0.70 ± 0.04 vs. -0.47 ± 0.07 s⁻¹, $p = .008$). In a multiple logistic regression model, LV circ. strain and RV basal circ. SR proved to be the best independent predictors of ACM with an AUC of 0.87 in ROC-analysis. In ACM patients with preserved LV ejection fraction (LV-EF), RV basal circ. SR (-0.76 ± 0.05 vs. -0.47 ± 0.07 s⁻¹, $p = .005$) was significantly increased compared to HV while LV strain parameters showed no significant differences between both groups. In multinomial logistic regression analysis, again LV circ. strain and RV basal circ. SR proved to be the best independent predictors of ACM when LV-EF is preserved with an AUC of 0.82 in ROC-analysis.

CONCLUSION

A combination of LV circ. strain and RV basal circ. SR is the best predictor for the presence of ACM, even in patients with preserved EF. Concurrently, the RV basal circ. SR appears to be particularly sensitive to alterations caused by ACM hinting at a potentially compensatory mechanism of basal RV hyperkinesia. Taken together, our results point to a discriminative power of RV strain analysis in the CMR-based diagnosis of ACM.

CLINICAL RELEVANCE/APPLICATION

ACM represents one of the most frequent causes of sudden cardiac death in young patients. Therefore, an improvement of the currently still challenging noninvasive diagnosis of ACM is highly desirable.

SSC01-07 Quantification of Myocardial Fibrosis by LGE, Pre- / Post-contrast T1 and ECV in Patients with Hypertrophic Cardiomyopathy Referenced to Normal Appearing Myocardium and Healthy Volunteers

Monday, Nov. 30 11:30AM - 11:40AM Location: S502AB

Participants

Maxim Avanesov, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Dennis Saring, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Enver G. Tahir, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Monica Patten, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Ulf K. Radunski, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Kai Muellerleile, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Stehning, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gunnar K. Lund, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Quantification of myocardial fibrosis by pre- and post-contrast T1 ECV as well as LGE in patients with hypertrophic cardiomyopathy

Quantification of myocardial necrosis by pre- and post-contrast T1, ECV as well as ESE in patients with hypertrophic cardiomyopathy (HCM) referenced to normal appearing myocardium and to normal values of healthy volunteers.

SSC12

Vascular/Interventional (Emerging Technology in Interventional Radiology)

Monday, Nov. 30 10:30AM - 12:00PM Location: E352

IR

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

FDA

Discussions may include off-label uses.

Participants

Ronald S. Arellano, MD, Boston, MA (*Moderator*) Nothing to Disclose
Jafar Golzarian, MD, Minneapolis, MN (*Moderator*) Chief Medical Officer, EmboMedics Inc

Sub-Events

SSC12-01 **Histological Evaluation of Intraarterial SN-38-incorporating Micellar Nanoparticle in a Rabbit Tumor Model**

Monday, Nov. 30 10:30AM - 10:40AM Location: E352

Participants

Hideyuki Nishiofuku, Kashihara, Japan (*Presenter*) Research funded, Nippon Kayaku Co, Ltd
Toshihiro Tanaka, MD, Kashihara, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasushi Fukuoka, Kashihara, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Sato, Kashihara, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Masada, Kashihara, Japan (*Abstract Co-Author*) Nothing to Disclose
Kimihiro Kichikawa, MD, Kashihara, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Micellar nanoparticle is an innovative drug delivery system, which can effectively accumulate in tumor tissue, due to enhanced permeability and retention effect. In addition, micellar nanoparticle can directly deliver SN-38 which is a biological active metabolite of irinotecan. The purpose of this study was to evaluate the histological findings after intraarterial SN-38-incorporating micellar nanoparticle injection compared with intravenous injection in a rabbit liver tumor model.

METHOD AND MATERIALS

Eighteen rabbits with VX2 liver tumors were divided into two groups, IA group (9 rabbits) and IV group (9 rabbits). Micellar nanoparticles incorporating SN-38 (30mg/kg) were intraarterially injected through the left hepatic artery in the IA group or intravenously injected in the IV group. Immuno-histochemical analysis using TUNEL staining was conducted at 2 hours to identify apoptotic cells. Coagulative necrosis was examined by Hematoxylin-Eosin stain at 24 hours. Further, SN-38 concentrations in the tumor tissues were measured within 24 hours.

RESULTS

Apoptotic cells had already been detected at 2 hours in the IA group, while no apoptotic cells were detected in the IV group. The mean tumor necrosis ratios were 80% in the IA group, while 50% in the IV group. The IA group showed significantly higher free SN-38 concentrations in tumor tissues at all measurement points (P=0.003 at 3 minutes, 0.012 at 2 hours and 0.048 at 24 hours).

CONCLUSION

Intraarterial SN-38-incorporating micellar nanoparticle can induce apoptosis of the tumor cells at 2 hours and achieve high tumor necrosis rate at 24 hours with high SN-38 concentration in the tumors.

CLINICAL RELEVANCE/APPLICATION

In this study an innovative drug delivery system was evaluated using a rabbit liver tumor model. Intraarterial SN-38-incorporating micellar nanoparticle can induce apoptosis of the tumor cells and achieve high tumor necrosis rate in the tumors.

SSC12-02 **EW-7197, a Novel ALK5 Kinase Inhibitor, Prevents Tissue Hyperplasia after Bare Metallic Stent Placement in a Urethra Rat Model**

Monday, Nov. 30 10:40AM - 10:50AM Location: E352

Participants

Eun Jung Jun, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ho-Young Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Wei-Zhong Zhou, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Jung-Hoon Park, MS, RT, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jiaywei Tsauo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the efficacy and safety of an activin receptor-like kinase 5 inhibitor, EW-7197, in the prohibition of granulation tissue hyperplasia after bare metallic stent placement in a rat urethral model.

METHOD AND MATERIALS

Twenty-four male Sprague-Dawley rats were randomly divided into four groups and underwent bare metallic stent placement in the urethra. Then, the rats were injected intraperitoneally per day with 0.3 ml of saline in group A and with EW-7197 at a dose of 5 mg/kg in group B, 10 mg/kg in group C, and 20 mg/kg in group D for 8 weeks. Retrograde urethrographies were performed at 4

weeks and 8 weeks after the stent placement. The body weight of each rat was measured and blood samples were obtained from the inferior vena cava for the evaluation of serum ALT and AST levels at 8 weeks. A histologic examination regarding the number of epithelial layers, percentage of granulation tissue area, thickness of submucosal fibrosis, and inflammatory cell infiltration grade was performed in each rat. We further investigated the reduction of transforming growth factor (TGF)- β .

RESULTS

The follow-up urethrographies performed at 4 and 8 weeks after stent placement shows the stented urethra in groups C and D had larger lumens than in the control group A ($p < 0.001$, $p < 0.05$). The average numbers of epithelial layers and the mean percentage of granulation tissue area in groups C and D were significantly lower than in control group A ($p < 0.001$). The average thickness of submucosal fibrosis was less in the 3 treated groups than in the control group A ($p < 0.001$). The mean percentage of granulation tissue was significantly lower in group C and D, when compared with the control group A ($p < 0.05$). The inflammatory cell infiltration was significantly higher in group C and D, when compared with the control group A ($p < 0.05$). However, there was no significant difference among the four groups in terms of body weight and liver enzymes ($p > 0.05$).

CONCLUSION

Intraperitoneally administration of EW-7197 was effective and safe for the prevention of granulation tissue hyperplasia after bare metallic stent placement in a rat's urethra. Our study provided a basis for future clinical studies of patients with restenosis.

CLINICAL RELEVANCE/APPLICATION

EW-7197 is effective for the prevention of granulation tissue formation after bare metallic stent placement in a rat urethral model.

SSC12-03 Electrolytic Electroporation - E2 — A New Tissue Ablation Technology; Early Results and Clinical Implications

Monday, Nov. 30 10:50AM - 11:00AM Location: E352

Participants

Michael K. Stehling, MD, PhD, Offenbach, Germany (*Presenter*) Nothing to Disclose
Enric Guenther, Dipl Phys, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Liel Rubinsky, PhD, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
Pedro Torrecillas, MD, Malaga, Spain (*Abstract Co-Author*) Nothing to Disclose
Franco Lugnani, MD, Trieste, Italy (*Abstract Co-Author*) Nothing to Disclose
Paul Mikus, DPhil, Coto De Caza, CA (*Abstract Co-Author*) Consultant, Interscience
Boris Rubinsky, PhD, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We explore the hypothesis that combining reversible electroporation (RE) to permeabilize the cell membrane with electrolysis to electrochemically produce compounds that destroy permeabilized cells (combination abbreviated as - E2) is an effective new tissue ablation technique with the ability to spare extracellular matrix and sensitive structures like irreversible electroporation (IRE) but with significantly lower energy and much larger maximum ablation volumes.

METHOD AND MATERIALS

E2 studies on nine pigs were done with open surgery under ultrasound (US) imaging, with and without paralyzing anesthetics. Delivered with two electrodes, we tested the effects of different electroporation parameters and various doses of electrolysis on cell death. Treatment was administered to the liver, gall bladder, kidney, rectum and nerves. HandE and Mason's trichromatic stained tissues were histologically examined.

RESULTS

E2 protocols produce a variety of cell death forms depending on dose and combination of electroporation and electrolysis parameters. For instance, the cell death modality at the anode is different from that at the cathode. We find that we could repeatedly ablate volumes of up to 200 cm³ with two electrodes with a treatment time of less than five minutes and no use of muscle relaxants. E2 ablation can be monitored with ultrasound. The signature of tissue affected by reversible electroporation is different from that ablated by electrolysis, hypoechoic and hyperechoic, respectively.

CONCLUSION

The combination of electrolysis with reversible electroporation is a highly flexible, cellular-level, low energy tissue ablation method suitable for the creation of large and reproducible ablation. Compared to electrolysis alone, it is faster and has lower toxicity. Compared to IRE, it affords larger ablation zones, has comparable toxicity and lower requirements for anesthesia and muscle relaxation. The initial animal studies confirmed the theoretical expectations. Obviously, the studies reported here are firsts of its kind and much research remains to be done.

CLINICAL RELEVANCE/APPLICATION

The combination of electrolysis with electroporation (E2) is a novel, low energy, tissue selective ablation method which provides larger tissue ablation zones than IRE with the same low toxicity.

SSC12-04 MRI Image Guided Nanocarbon-Assisted Microwave Therapy (NAMT) Causing Cytotoxic Thermal Ablation of MK1 Breast Tumor Cells in SCID Mice

Monday, Nov. 30 11:00AM - 11:10AM Location: E352

Participants

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Ana M. Franceschi, MD, New York, NY (*Presenter*) Nothing to Disclose
Wilbur B. Bowne, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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Atul Kumar, MD, Northport, NY (*Abstract Co-Author*) Nothing to Disclose

John A. Ferretti, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Caitlin Dolan, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluation of near real time MRI guided imaging of a spherical nanocarbon (Grafex) injected into MK1 breast carcinoma during microwave ablation. It is known that nanocarbon assisted microwave therapy (NAMT) increases the absorption of microwave energy, specifically into tumor cells. This study evaluated the use of MRI safe microwave probes and NAMT as primary treatment in MK1 breast tumor. Additionally, MRI near Real time imaging was performed during treatment.

METHOD AND MATERIALS

Severe combined immune deficient (SCID) isolated mice were injected with MK1 Breast carcinoma cells introduced into the dermis and allowed to grow to >1cm. In the 'treatment' group, nanocarbon and viscous carrier were injected into the tumors. Medwaves Avecure generators with MRI safe temperature sensing microwave probes were used for thermal ablation, with short cycle power using 15 watts at 20 sec as baseline settings. Target temperature within the tumor was 65°C. MRI imaging was simultaneously performed with a 0.6T Fonar MRI using T1, T2 and gradient sequences.

RESULTS

Spherical nanocarbon provides a non toxic method of thermally ablating the tumor utilizing MRI safe microwave probe while allowing for imaging during the treatment. Over 90% of the mice responded to the treatment without significant toxic effects of the retained carbon within the dermis.

CONCLUSION

MRI guided imaging provided continuous monitoring of thermal ablation zones using spherical nanocarbon , with the conversion of microwave energy causing thermal ablation of cancer cells. By using shorter treatment times and lower power output of the microwave generator, NAMT reduces heat sink effect and surrounding tissue damage. Grafex NAMT appears to be not only successful in treatment of breast carcinoma, but also nontoxic in this small animal study. A larger study is under way.

CLINICAL RELEVANCE/APPLICATION

MRI image guided Nanocarbon-assisted microwave therapy using MRI safe microwave probes provides near real time evaluation of ablation zone size, evaluation of contracted tissue, shorter treatment times and apparent non-toxic treatment of human breast tumor cells, and may represent a powerful new tool in cancer therapy with near real time imaging.

SSC12-05 Optical Imaging-Monitored Intra-Esophageal Radiofrequency Hyperthermia-Enhanced Local Chemotherapy of Esophageal Cancers

Monday, Nov. 30 11:10AM - 11:20AM Location: E352

Participants

Yaoping Shi, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Feng Zhang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jianfeng Wang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Zhibin Bai, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Longhua Qiu, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Yonggang Li, MD, Suzhou, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoming Yang, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the possibility of using bioluminescent optical imaging to monitor intra-esophagus radiofrequency hyperthermia (RFH)-enhanced local chemotherapy of rat models with orthotopic esophageal squamous cancers (ESCs)

METHOD AND MATERIALS

Human ESC cells were transduced with lentivirus/luciferase. Orthotopic ESC masses were established by inoculating luciferase-ESC cells into cervical esophagus walls of nude rats via a specifically designed transesophageal approach. Twenty four rats with ESC cancers were divided into four study groups (n=6/group) receiving various treatments: i) combination therapy of intraesophageal MR imaging-heating-guidewire (MRIHG)-mediated RFH (420C) plus local chemotherapy (cisplatin and 5-fluorouracil); ii) chemotherapy-only; iii) RFH-only; and (iv) phosphate-buffered saline (PBS). Bioluminescent optical imaging and transcutaneous ultrasound imaging were used to follow up bioluminescence signal and size changes of tumors among the groups over a time period of two weeks, which were correlated with subsequent histology.

RESULTS

Optical imaging demonstrated a significantly decreased bioluminescence signal in the combination therapy group, compared to those in three control groups (0.51±0.18 VS 1.6±0.4 VS 3.18±0.9 VS 3.5±0.96, p<0.05). Ultrasound imaging showed the smallest tumor volumes of the combination therapy group, in comparison to those of other control groups (0.62±0.16 VS 1.25±0.19 VS 2.28±0.25 VS 2.64±0.26, p<0.05). Both imaging findings were confirmed by histologic correlation (Figure).

CONCLUSION

Optical imaging is a useful tool for monitoring intra-esophageal RFH-enhanced chemotherapy of ESCs, which may provide a new opportunity for efficient management of esophageal malignancies.

CLINICAL RELEVANCE/APPLICATION

Intra-esophageal RFH-enhanced chemotherapy of ESCs may provide a new opportunity for efficient management of esophageal malignancies.

SSC12-06 Radiofrequency Hyperthermia-Enhanced Local Chemotherapy of Pancreatic Cancers: Monitored by Dual Modality Imaging

Monday, Nov. 30 11:20AM - 11:30AM Location: E352

Participants

Zhibin Bai, Seattle, WA (*Presenter*) Nothing to Disclose
Feng Zhang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Yaoping Shi, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jianfeng Wang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Longhua Qiu, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Gao-Jun Teng, MD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoming Yang, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the feasibility of using molecular optical imaging and ultrasound imaging to assess radiofrequency hyperthermia (RFH)-enhanced therapeutic effect of gemcitabine (Gem) on rat models with orthotopic pancreatic carcinomas.

METHOD AND MATERIALS

Lentivirus/luciferase-labeled rat pancreatic adenocarcinoma cells (DSL-6A/C1, 107) were subcutaneously inoculated into flanks of donor immunocompetent Lewis rats. We collected the subcutaneous tumor tissues from donor rats, and then transplanted the tissues into the pancreatic tails of recipient Lewis rats, to create orthotopic cancer models. Twenty-four rats with orthotopic pancreatic cancers were received various treatments in four groups: (i) combination therapy with intratumoral MR imaging-heating-guidewire (MRIHG)-mediated local RFH (420C) plus local chemotherapy (Gem); (ii) chemotherapy-only; (iii) RFH-only; and (iv) phosphate-buffered saline (PBS). Tumor sizes were followed-up by ultrasound imaging at days 0, 7 and 14 after the treatments. Bioluminescence signals of the tumors were measured via a laparotomy approach. Imaging results were correlated with subsequent histology analysis.

RESULTS

Ultrasound imaging showed the smallest relative tumor volume in the combination therapy group compared to those in three control groups (0.62 ± 0.18 VS 1.31 ± 0.30 , 1.61 ± 0.28 , 1.71 ± 0.29 , $p < 0.05$). Optical imaging demonstrated a decrease of bioluminescence signals of tumors in the combination therapy group, in comparison to those of three control groups (0.18 ± 0.06 VS 0.41 ± 0.12 VS 0.89 ± 0.26 VS 1.0 ± 0.32), which were well correlated with histologic confirmation (Figure).

CONCLUSION

Local radiofrequency hyperthermia can enhance the regional chemotherapeutic effect on orthotopic pancreatic carcinomas, which has established the groundwork to develop new interventional oncological techniques for effective management of human pancreatic malignancies.

CLINICAL RELEVANCE/APPLICATION

Local radiofrequency hyperthermia can enhance the regional chemotherapeutic effect on orthotopic pancreatic carcinomas, which has established the groundwork to develop new interventional oncological techniques for effective management of human pancreatic malignancies.

SSC12-07 In-Vitro and In-Vivo Feasibility Study of a Glassfiber-Based MR-Safe Guidewire

Monday, Nov. 30 11:30AM - 11:40AM Location: E352

Participants

Alexander Massmann, MD, Homburg/Saar, Germany (*Presenter*) Nothing to Disclose
Arno Buecker, MD, Homburg, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc Speaker, Medtronic, Inc Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG
Guenther K. Schneider, MD, PhD, Homburg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group;

PURPOSE

Evaluation of a dedicated MR-safe glass/aramidfiber-based guidewire.

METHOD AND MATERIALS

The MR-guidewires (GW) are composed of ultra-thin rod-shaped glass/aramid fibers embedded in epoxy-resin. MRI-visualization is ensured by metal-particles embedded in the epoxy-matrix. The shaft is covered by a PTFE-shrinktube, while the 10-cm flexible tip is coated with PEBAX and a hydrophilic surface. The tip is doped with tungsten-particles for X-ray visibility as a back-up option for conventional angiography. The standard/stiff GW measures 0.89 mm (0.035") in diameter and 260 cm in length. The micro-GW 0.36 mm (0.014") and 190 cm. After in-vitro testing in a synthetic abdominal aorta/visceral artery flow-model for visualization and handling, all GWs were used in 9 pigs (mean weight 65 +/- 5 kg). Catheterization of the iliac arteries, abdominal/thoracic aorta, visceral/renal arteries, iliac and inferior cava vein were performed in a clinical 1.5 T scanner using real-time interactive MR-imaging (temporal resolution 0.2 s; FOV 150 mm; matrix 128x128). MR-guided interventions included balloon-dilatation and arterial/venous stent-deployment via the GWs. Visualization, handling, and time for catheterization of the vessel regions were assessed.

RESULTS

Real-time interactive MRI allowed clear visualization of the GW characterized by a continuous artifact of about 2 mm in diameter along the shaft as well as a tip marker artifact of 4.5 mm. Suitable handling combined with sufficient stiffness, adequate transfer of traction and torsion allowed precise and exact navigation toward target vessels (mean time for abdominal/thoracic aorta 4 s; visceral/renal arteries 10 s, and contralateral iliac arteries 36 s). All procedures were technically successful. No GW-associated complications occurred, esp. no breakage, disruption or thrombosis. Handling regarding stiffness, flexibility and guidance were similar to usual standard angiographic GWs.

CONCLUSION

Initial in-vitro and in-vivo results of a new dedicated MR-safe guidewire are the basis for further clinical application for endovascular MRI-guided interventions in humans.

CLINICAL RELEVANCE/APPLICATION

Initial in-vitro und in-vivo results of a MR-safe guidewire showed the possibility for further clinical application for endovascular interventions in humans.

SSC12-08 Online Catheter Tracking using Magnetic Particle Imaging

Monday, Nov. 30 11:40AM - 11:50AM Location: E352

Participants

Johannes M. Salamon, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Martin Hofmann, Dipl Phys, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Caroline Jung, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael G. Kaul, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Harald Ittrich, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Tobias Knopp, DIPLENG, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Aim of this study was to establish an online reconstruction for real time Magnetic Particle Imaging (MPI) and test it ex-vivo on an angioplasty balloon catheter model. MPI is a new tomographic 4D imaging technique that allows to determine the spatial distribution of SPIOs at a time resolution of up to 46 Frames/s, technically allowing real time imaging. Therefore, in the future MPI might be a radiation free modality for catheter interventions. Until now, data could only be reconstructed and displayed after acquisition, limiting applications requiring direct feedback.

METHOD AND MATERIALS

Matrix compression techniques are used to reduce image reconstruction times on the available first commercial pre-clinical MPI scanner (Bruker) to achieve real time MP images. The compression level is tuned in such a way that the reconstruction and the data acquisition are in the same time order. Reconstruction is always performed on the latest captured frame during the measurement achieving direct feedback even if delays in the signal chain occur or if reconstruction times are slower. The online reconstruction framework was tested in a stenosis model with a 6/12 mm balloon catheter. In- and deflating rates were 1800, 900 and 450 ml/min using Resovist as contrast agent. For estimation of image quality DSA served as gold standard.

RESULTS

Using the developed online reconstruction framework reconstruction rates of more than 60 frames/s for 3D MPI sequences are achieved. As this is faster than the acquisition rate of 46 frames/s it is possible to follow the object in real time with a latency of about 1s due to a delay in the data acquisition hardware. Even though the overall image quality was better using DSA all relevant image information for balloon catheter intervention could be obtained from MPI data.

CONCLUSION

We demonstrate an online reconstruction framework for 4D MPI Data. Even though image quality was better using DSA, the new framework gives the basis for future radiation free 4D catheter intervention using a static 3D MRI for anatomic information and 4D MPI for intervention guidance.

CLINICAL RELEVANCE/APPLICATION

Magnetic particle imaging is an emerging radiation free method, that in future, might be used for 4D catheter interventions.

SSC12-09 Augmented Reality on a C-arm System: A Preclinical Validation for Percutaneous Interventions

Monday, Nov. 30 11:50AM - 12:00PM Location: E352

Participants

John M. Racadio, MD, Cincinnati, OH (*Presenter*) Research Consultant, Koninklijke Philips NV; Travel support, Koninklijke Philips NV
Rami Nachabe, PhD, Best, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Robert Homan, MSc, Best, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ross Schierling, BS, Cincinnati, OH (*Abstract Co-Author*) Research collaboration, Koninklijke Philips NV
Judy Racadio, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Drazenko Babic, MD, Best, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV

PURPOSE

To compare the navigational accuracy and radiation dose of image-guided percutaneous procedures performed with augmented reality (AR) with and without motion compensation (MC) versus cone beam CT with real-time fluoroscopy navigation (CBCTf) during needle localization of targets in a pig model.

METHOD AND MATERIALS

This was a prospective study in a pig model approved by the Institutional Animal Care and Use Committee. Three operators with different experience levels each localized 15 targets (bone fragments) approximately 7 cm deep in the paraspinal muscles of pigs using each of the 3 modalities. Accuracy (distance between needle tip and target) and radiation dose (DAP, Gy.cm²) were recorded for each procedure. Two-way analysis of variance (ANOVA) with interaction including Tukey's multiple comparison correction was used for differentiating accuracy and DAPs across navigation techniques and operator background. The AR system consisted of 4 small video cameras integrated within the frame of the X-ray detector of the C-arm (Philips Allura) as shown in the attached figure. The 4 cameras pointed towards the isocenter of the C-arm in a pyramidal fashion. The live video streams were augmented with X-ray and CBCT imaging as well as with virtual graphics depicting the planned needle path drawn by the operator. The video cameras were calibrated with respect to the geometrical specifications of the C-arm system so that the acquired CBCT and planned needle path were registered to the optical images. The visualization was displayed on a standard IR monitor.

RESULTS

There was no significant difference in accuracy between the three modalities (mean distance: 3.0±1.9 mm for CBCTf, 2.5±2.0 mm

for AR, and 3.2 ± 2.7 mm for AR with MC ($P=0.33$). There was, however, a significant difference in fluoroscopy radiation dose (2.3 ± 2.4 Gy.cm² for AR, 3.3 ± 4.6 Gy.cm² for AR with MC, and 10.4 ± 10.6 Gy.cm² for CBCTf ($P < 0.05$)) and therefore in total procedural radiation dose (12.6 ± 5.3 Gy.cm² for AR, 13.6 ± 7.4 Gy.cm² for AR with MC, and 20.5 ± 13.4 Gy.cm² for CBCTf ($P < 0.05$)).

CONCLUSION

Use of an AR system reduces radiation dose while maintaining navigational accuracy compared to CBCTf during image-guided percutaneous procedures in a pig model.

CLINICAL RELEVANCE/APPLICATION

Use of an augmented reality system reduces radiation dose while maintaining navigational accuracy compared to CBCT with real-time fluoroscopy guidance during image-guided percutaneous procedures in a pig model.

SSC03

ISP: Gastrointestinal (Dual Energy CT)

Monday, Nov. 30 10:30AM - 12:00PM Location: E353A



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

FDA Discussions may include off-label uses.

Participants

Benjamin M. Yeh, MD, San Francisco, CA (*Moderator*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextstrat, Inc;
Laura R. Carucci, MD, Midlothian, VA (*Moderator*) Nothing to Disclose
Meghan G. Lubner, MD, Madison, WI (*Moderator*) Grant, General Electric Company; Grant, NeuWave Medical, Inc; Grant, Koninklijke Philips NV

Honored Educators

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Meghan G. Lubner, MD - 2014 Honored Educator
Meghan G. Lubner, MD - 2015 Honored Educator

Sub-Events

SSC03-01 Gastrointestinal Keynote Speaker: Dual Energy CT-Principles and Implementations

Monday, Nov. 30 10:30AM - 10:40AM Location: E353A

Participants

Dushyant V. Sahani, MD, Boston, MA (*Presenter*) Research Grant, General Electric Company; Research Consultant, Allena Pharmaceuticals, Inc

Honored Educators

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

SSC03-02 Comparison of Iodine Quantification between Single-source and Dual-source DECT

Monday, Nov. 30 10:40AM - 10:50AM Location: E353A

Awards

Trainee Research Prize - Fellow

Participants

Diana Murcia, MD, Boston, MA (*Presenter*) Nothing to Disclose
Manuel Patino, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Andrea Prochowski Iamurri, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Farhad Mehrkhani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Canellas, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yasir Andrabi, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Consultant, Allena Pharmaceuticals, Inc

PURPOSE

Although Iodine quantification is possible on DECT scans, it remains unclear if the measurements are specific to scanners from different vendors. The purpose of our study is to compare the accuracy of Iodine quantification between single-source and dual-source DECT.

METHOD AND MATERIALS

An anthropomorphic CT colonography phantom with capacity for 500ml of fluid, and two iodinated solutions with known concentrations were used: 1) 9mg/ml, 2) 12mgI/ml. Each solution was diluted with water to obtain 75% (7 and 9mg/ml), 50% (4.5 and 6mg/ml), and 25% (2 and 3mg/ml) of the known concentration. The phantom was filled up serially with 400 ml of each dilution, from the lowest to the highest concentration, and scanned on DECT mode of ssDECT (Discovery CT750 HD, GE Healthcare) (140/80 kVp and tube current of 375 mA), and dsDECT (Somatom Definition Flash, Siemens Healthcare) (140/100 kVp and 180 Ref mA) scanners. MD-Iodine images were generated from the DECT scans in vendor specific workstations. A total of 16 datasets were obtained (4 for each solution on each scanner), 8 for ssDECT and 8 for dsDECT. Twenty regions of interest (ROIs) were placed at multiple levels of the gastrointestinal lumen. Iodine values (mg/ml) were measured and recorded for all the different dilutions. Iodine values were compared with the known concentration of iodine. Statistical analysis was conducted with t-test.

RESULTS

Spectrally calculated iodine concentration showed minimal discrepancy compared to the known iodine concentration on ssDECT and dsDECT scanners (± 0.4 and 0.6 mg/ml, respectively) ($p > 0.05$). The variability was the same for high and low iodine concentrations.

CONCLUSION

Despite the differences in approach for material separation between dsDECT (Image based) and ssDECT (raw data based) techniques, Iodine quantification is accurate, robust and reproducible for both scanners. Presence of image artifacts negatively impacts the iodine quantification.

CLINICAL RELEVANCE/APPLICATION

CT Attenuation values are used for clinical diagnosis and decision-making. The results of this study reassure the availability of an additional parameter (DECT-iodine quantification) for clinical use.

Honored Educators

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

Dushyant V. Sahani, MD - 2012 Honored Educator

Dushyant V. Sahani, MD - 2015 Honored Educator

SSC03-03 Evaluation of a Low Iodine Concentration Contrast Media in Abdominal Multiphasic Computed Tomography Examinations Using Spectral Imaging (SI): A Prospective Study on 300 Patients

Monday, Nov. 30 10:50AM - 11:00AM Location: E353A

Participants

Catherine Roy, MD, Strasbourg, France (*Presenter*) Nothing to Disclose

Francois Severac SR, MMedSc, DIPLPHYS, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

Mickael Ohana, MD, MSc, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

Isham Labani JR, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

Guillaume Aleman JR, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Demonstrate the non-inferiority of a low iodine concentrated contrast media for abdominal CT examinations acquired with Spectral Imaging in comparison with the usual single-energy injected CT examinations.

METHOD AND MATERIALS

300 patients (BMI < 35) with clinically indicated multiphasic abdominal CT were prospectively randomized in three groups of 100 patients. Examinations were performed on a single-source dual-energy CT (GE Discovery 750HD). Two reference groups underwent a conventional single-energy CT acquisition using 1.5 mL/kg of Iomeprol 400 mgI/ml and Iomeprol 350 mgI/ml, respectively. The study group was acquired with 1.5 mL/kg of Iobitridol 250 mgI/ml using Spectral acquisition with monochromatic images at 75 keV, 65 keV and 60 keV. Quantitative analysis was performed on arterial (30s) and portal phases (70s) by recording HU \pm SD values by mean of ROI in aorta, hepatic parenchyma, portal vein and muscle. Image quality was independently assessed by two radiologists on a four-point scale. Quantitative statistical analysis was performed using Bayesian method with a 95% credibility interval CI to assess for non-inferiority with an arbitrary HU thresholds set at 20% for the arterial phase and 10% for the portal phase of our reference groups. Radiation doses (DLP) were also recorded.

RESULTS

Spectral data revealed an excellent image quality (3.2 \pm 0.5). For quantitative evaluation, at 60 keV in aorta, arterial phase difference between Io350, Io400 and Io250 were estimated to -17.97 (CI=99.99%) and 36.5 (CI=99.06%), venous phase difference between Io350, Io400 and Io250 were estimated to -3.13 (CI=99.99%) and -11.87 (CI=99.99%). At 60 keV, at portal phase Io250 was superior to Io350 vs Io400 for hepatic parenchyma and portal vein, respectively. At 65 keV, Io250 revealed no significant differences with others contrast agents for all sites. At 75 keV, Io250 was inferior to others contrast agent for all sites. The radiation dose was increased at less than 10%; DLP: 489 mGy.cm (spectral) vs 513 mGy.cm (conventional).

CONCLUSION

Spectral imaging allows iodine dose reduction up to 37.5% for arterial and portal phase, better information at 60 keV, excellent image quality and no increased radiation dose.

CLINICAL RELEVANCE/APPLICATION

Iodine dose is reduced by using spectral CT imaging, with better results at 60 keV in terms of HU, without degradation of image quality or increased radiation dose for abdominal applications.

SSC03-04 Assessment of Radiation Dose, Image Quality and Accuracy of Virtual Non-Contrast Images in Thoracoabdominal CT Acquired with a Novel Single-source Dual-Energy Technique Using a Split Filter

Monday, Nov. 30 11:00AM - 11:10AM Location: E353A

Participants

Andre Euler, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose

Anna L. Falkowski, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Anushri Parakh, MBBS, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Sebastian Manneck, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

David Dashti, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Bernhard Krauss, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG; ;
Zsolt Szucs-Farkas, MD, PhD, Berne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Sebastian T. Schindera, MD, Basel, Switzerland (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Ulrich GmbH & Co KG; Research Grant, Bayer AG

PURPOSE

To assess the radiation dose, image quality and accuracy of virtual non-contrast images with a novel single-source dual-energy technique using a split filter (TwinBeam Dual-Energy, Siemens) compared with a single-energy CT scan.

METHOD AND MATERIALS

50 patients received a CT of the thorax and abdomen for oncologic staging on a single-source scanner (SOMATOM Edge, Siemens) either with (A) single-energy mode with automatic tube voltage modulation and 130 ref mAs or with (B) split filter dual-energy mode at AuSn120 kVp and 420 ref. mAs. Radiation dose was estimated by CTDIvol and DLP. Objective image quality was assessed by measuring image noise and calculating CNR. Subjective image quality was evaluated by three radiologists independently (one resident and two board-certified). The attenuation in the liver, spleen and muscle were measured on the true non-contrast premonitoring scan and at the same location on the virtual non-contrast image of protocol B. Descriptive statistics and Mann-Whitney-U-test were used.

RESULTS

The mean CTDIvol was 15% and the mean DLP was 20% lower with the dual-energy compared to the single-energy protocol (11.2 mGy (A) vs. 9.5 mGy (B) and 700 mGy*cm (A) vs. 558 mGy*cm (B)). No significant difference in objective image quality (image noise: 7.4HU (A) vs. 7.1HU (B); CNR: 29.2 (A) vs. 28.5 (B); $p=0.43$ and 0.88 , respectively) and subjective image quality was found between the two protocols. The mean error of measurement for the virtual non-contrast images was 6.2%, 12.7% and 16.3% for the liver, spleen and muscle, respectively.

CONCLUSION

Dose-neutral dual-energy CT scans are possible with a single-source CT scanner using a novel split filter technique compared to a single-energy mode with similar objective and subjective image quality. The dual-energy CT protocol also offers accurate attenuation measurements on the virtual non-contrast images.

CLINICAL RELEVANCE/APPLICATION

Since the split filter dual-energy technique on a single-source CT scanner benefits from the added information like virtual non-contrast, iodine quantification or stone characterization and the dose-neutral aspect, it can replace single-energy protocols in clinical routine.

SSC03-05 Differentiation of Mass Type Colorectal Adenocarcinoma from Colorectal Adenoma on Spectral CT: Preliminary Research

Monday, Nov. 30 11:10AM - 11:20AM Location: E353A

Participants

Xiaodong Liu, Dalian, China (*Presenter*) Nothing to Disclose
Ailian Liu, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Meiyu Sun, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Jinghong Liu, MD, PhD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Li Ye, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Chen Anliang, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Shifeng Tian, Dalian, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the value of spectral CT imaging in distinguishing mass type colorectal adenocarcinoma from colorectal adenoma.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board and informed consent was waived. Twenty-seven patients with colorectal masses were scanned with spectral CT scanner (GE Discovery HD 750) from January 2012 to April 2015, including 15 mass type colorectal adenocarcinomas and 12 colorectal adenomas proven by pathology. Bowel cleaning was performed until no excrement in 8-12h before examination including pre-contrast and three-phase dynamic enhancement. The mean CT value of 68 KVP images (mimic conventional polychromatic images) and monochromatic images (40-140) keV, effective atomic number(eff-Z) and iodine(water),fat(water) and the slope of spectral curve from 4 phases were measured using the GSI General MD analysis software equipped at an Advantage Workstation (ver.4.5, GE, USA). These parameters from mass type colorectal adenocarcinomas and adenomas were compared using the nonparametric rank sum test.

RESULTS

In the arterial phase of 68 KVP, the mean CT value was 88.45 ± 22.15 HU for adenocarcinoma group, and 61.03 ± 27.54 HU for the adenoma group. The mean CT value for adenocarcinoma was significantly higher than that of adenoma on 68 KVP images in arterial phase ($p < 0.05$). There were statistically significant differences of the CT value between two groups at low energy keV(40-90keV) in the arterial phase. The slope of spectral curve was -1.70 ± 0.62 for adenocarcinoma group and -1.03 ± 0.55 for the adenoma group in arterial phase. The mean slope of spectral curve of adenocarcinoma group was significantly steeper than that of adenoma group ($p < 0.05$). The mean CT value and slope of spectral curve in venous and delayed phases did not differ significantly between these two groups. The eff-Z and iodine(water),fat(water) were not significantly different between adenocarcinoma and adenoma groups.

CONCLUSION

The mean CT values and slope of spectral curve in arterial phase derived from spectral imaging is a potential quantitative parameters to distinguish mass type colorectal adenocarcinoma from adenoma. There was certain guiding significance in colorectal adenoma and mass type colorectal adenocarcinoma for spectral CT multi-parameter analysis.

CLINICAL RELEVANCE/APPLICATION

It's important to figure out the type of colorectal disease to provide more reference for clinical treatment.

SSC03-06 Noninvasive Liver Iron Content Quantification and Grading Based on Dual-Source Dual-Energy CT: An Iron Overload Rabbit Model Study

Monday, Nov. 30 11:20AM - 11:30AM Location: E353A

Participants

Xianfu Luo, Yangzhou, China (*Presenter*) Nothing to Disclose

Jingtao Wu, Yangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the accuracy of dual-source dual-energy (DSDE) CT in liver iron content (LIC) quantification and grading at different clinically significant LIC thresholds.

METHOD AND MATERIALS

Fifty-one rabbits of iron-loaded model were established by intravenous injection of iron dextran. DSDE CT was performed at 80 kVp and 140 kVp with tin filter. Hepatic attenuation difference (ΔH) between 80 kVp and 140 kVp was calculated. Postmortem assessments of LIC were conducted on inductively-coupled plasma (ICP) spectrometer. The correlation between ΔH and LIC was analyzed. Diagnostic performance of ΔH in discriminating different LIC thresholds was evaluated by receiver operating characteristic (ROC) analysis.

RESULTS

The LIC of our models was from 0.2 to 39.6 mg Fe/g measured by ICP. ΔH was highly correlated with LIC and the Spearman's coefficient was 0.975. For discriminating clinically significant LIC thresholds (1.8, 3.2, 7.0, 15.0 mg Fe/g dry tissue), ROC analysis revealed that the corresponding optimal cutoff value of ΔH was 13.1, 16.2, 23.1, 39.4 HU, respectively. For the lowest threshold of discriminating iron accumulation from normal storage, ΔH had a sensitivity of 86% and a specificity of 100%. With the cutoff value of $\Delta H = 39.3$ HU, the highest sensitivity (100%) and specificity (100%) were obtained at LIC threshold of 15.0 mg Fe/g dry tissue.

CONCLUSION

ΔH has a strong linear association with titrated LIC in the iron- overloaded rabbits. DSDE CT has the potential for liver iron content quantification and grading.

CLINICAL RELEVANCE/APPLICATION

DSDE CT has the potential to guide iron chelation therapy and to monitor chelation effect.

SSC03-07 Benefit of Iodine Maps to Reduce Out-of-Field Image Artifacts at Rapid kVp Switching Dual Energy CT

Monday, Nov. 30 11:30AM - 11:40AM Location: E353A

Participants

Brandan Dotson, BS, San Francisco, CA (*Presenter*) Nothing to Disclose

Jack Lambert, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

Zhen J. Wang, MD, Hillsborough, CA (*Abstract Co-Author*) Nothing to Disclose

Michael A. Ohliger, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

Sebastian Winkhofer, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;

PURPOSE

To evaluate the reduction of artifacts caused by body parts outside the field of view (out-of-field image artifacts) at rapid kVp switching dual energy CT (rsDECT).

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board and informed consent was not required. We retrospectively viewed 246 consecutive rsDECT thoracoabdominal scans to identify those with out-of-field image artifacts. The field of view, thickness and subjective severity of the out-of-field artifacts were recorded for the 40, 65 and 140 keV virtual monochromatic images and on the, iodine and water maps. Image artifact severity was rated on a 5 point scale from 0=not seen to 4=obscures all tissue detail. The thickness of artifacts and severity scores were compared between image reconstructions by t-test and Wilcoxon tests, respectively.

RESULTS

In 20 of 246 scans (8.1%), body parts extended past the CT's maximum field of view (FOV), 500 mm. The mean BMI of these 20 patients was 40 (range, 29 to 61), and out-of-field artifacts occurred for all 20. The mean maximal out-of-field artifact height was 167.4 mm. The mean artifact thickness was significantly less for iodine map (0.67 mm) than for the 65 keV and water map images (8.43 and 13.5 mm, respectively, $p < 0.001$ each comparison). The mean artifact severity score was significantly lower for iodine map (0.23) than for the 65 keV and water map images (2.3 and 2.7, respectively, $p < 0.001$).

CONCLUSION

Iodine maps substantially reduce out-of-field image artifact at rsDECT and may assist in the evaluation of peripheral tissues that extend beyond the maximal CT field of view in obese patients.

CLINICAL RELEVANCE/APPLICATION

Obese patients with concern for peripheral tissue injury may benefit from rsDECT iodine maps to minimize out-of-field image artifact.

SSC03-08 Can Dual Energy CT Predict the Need for Surgery in Crohn's Disease?

Monday, Nov. 30 11:40AM - 11:50AM Location: E353A

Participants

Naama R. Bogot, MD, Jerusalem, Israel (*Presenter*) Nothing to Disclose
Ruth Cytter-Kuint, MD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Tomer Adar, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Irith Hadas, MD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Dov Wengrower, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Roy Biron, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Eran Goldin, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Dual energy CT (DECT) is sensitive for detection and quantification of iodine in tissue. We aimed to evaluate the correlation between iodine uptake in the inflamed bowel wall in Crohn's disease (CD) and the need for surgery and create an inflammatory index

METHOD AND MATERIALS

IRB approved prospective double-blind study. 36 patients (mean age 38.6 years, 20 males) with Crohn's disease (CD) underwent a DECT (Somatom Flash) for acute abdominal symptoms. Study protocol: abdominal-pelvic CT using DE mode (100 and 140kV), IV contrast and negative oral contrast contrast. The DECT was interpreted by a radiologist blinded to the clinical outcome. The referring physicians were blinded to DECT interpretation. Studies were interpreted by a radiologist on a dedicated software (syngo.CT dual energy, singo.via). Enhancement (HU) was measured for each bowel lesion in both low and mixed images. Inflammatory enhancement index (IEI) was defined as the ratio between the inflamed segment and the stomach (HU on mixed images). Patients were followed for 3 months for an outcome of surgery

RESULTS

A total of 63 intestinal lesions were demonstrated (1-3 per patient). Eleven patients underwent surgery, 7 within 3 months after the CT and 4 within 1 month after the CT. Higher attenuation on 100kV and mixed images correlated with increased risk of surgery within 3 months: 92.2 vs. 66.6 for 100kV ($p=0.01$) 82.7 vs. 59.5 for mixed images ($p=0.01$) as well as for surgery within 1 month 105.2 vs. 67.04 ($p=0.05$) and 93.8 vs. 59.7 for the mixed images ($p<0.05$). AUROC analysis for the IEI achieved negative predictive value of 98% for the need for surgery.

CONCLUSION

DECT is a reliable tool in assessment of inflammation in patients with CD and can predict the need for surgery. The IEI has a high negative predictive value.

CLINICAL RELEVANCE/APPLICATION

Our study demonstrates that DECT is possible novel decision making tool (surgery vs. conservative surgery) applicable also to acute settings.

SSC03-09 Comparison between Spectral Imaging Scan Mode on Fast kVp-Switching Single-Source Dual-Energy Scan and Conventional Helical Scan Mode for CT Scan DOSE in 259 Abdomen Cases: Body Mass Index Factor

Monday, Nov. 30 11:50AM - 12:00PM Location: E353A

Participants

Tomokatsu Tsukamoto, RT, Onomichi, Japan (*Presenter*) Nothing to Disclose
Takashi Takahata, RT, Onomichi, Japan (*Abstract Co-Author*) Nothing to Disclose
Keisuke Nishihara, MD, Onomichi, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazunari Mesaki, MD, Onomichi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroki Mori, MD, Onomichi, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuhide Ito, MD, Onomichi, Japan (*Abstract Co-Author*) Nothing to Disclose
Huizhi Cao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaozhu Lin, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

On fast kVp-switching single-source dual-energy (ssDE) CT scan (gemstone spectral imaging: GSI), automatic exposure control (AEC) remains unavailable. The purpose of this paper is to compare DOSE between GSI scans and conventional helical scans about the DOSE and image quality in different body mass index (BMI) group.

RESULTS

CTDIvol (mGy) values between MONO mode and POLY mode at each BMI group were A: 13.4 ± 1.3 and 9.1 ± 2.5 ; B: 13.5 ± 1.0 and 11.2 ± 2.0 ; C: 14.3 ± 2.4 and 12.8 ± 2.9 ; D: 15.8 ± 2.6 and 15.6 ± 3.3 ; E: 18.3 ± 4.3 and 17.7 ± 4.3 ; F: 22.3 ± 5.6 and 21.3 ± 3.6 ; G: 29.1 ± 4.9 and 27.4 ± 2.1 , respectively. The CTDIvol with MONO scan mode was significantly higher than conventional POLY scan mode at each BMI group (A:55.6%, B:22.9%, C:14.2%, D:2.5%, E:4.9%, F:6.3% and G:8.8%), but the results were statistical significantly ($P < 0.05$) in A, B, C BMI group, and the results were not statistical significantly ($P > 0.05$) in D, E, F and G BMI group. The image quality with MONO scan mode (66keV) was significantly higher than FBP, similar to ASIR30%, poorer than ASIR50% with POLY-120kVp scan mode at gall bladder, muscular and liver.

CONCLUSION

From this study, we can conclude that GSI scan mode without automatic exposure control has similar DOSE level with normal helical (120kVp) scan mode in large BMI group ($BMI > 26$).

CLINICAL RELEVANCE/APPLICATION

In this study, we have demonstrated that GSI images reconstructed at MONO-66keV can achieve similar DOSE level as

conventional helical (120kVp) scan.

SSC04

Gastrointestinal (Multimodality)

Monday, Nov. 30 10:30AM - 12:00PM Location: E451A

CT **GI** **MR**

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

FDA Discussions may include off-label uses.

Participants

Alvin C. Silva, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose
Christine O. Menias, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose

Honored Educators

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Christine O. Menias, MD - 2013 Honored Educator
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Sub-Events

SSC04-01 The Incidental Splenic Lesion: Does It Need to be Worked Up?

Monday, Nov. 30 10:30AM - 10:40AM Location: E451A

Participants

Bettina Siewert, MD, Brookline, MA (*Presenter*) Nothing to Disclose
Noam Z. Millo, MD, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose
Kamaldeep Sahi, MD, BSc, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Robert G. Sheiman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Robert A. Kane, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Olga R. Brook, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Maryellen R. Sun, MD, Boston, MA (*Abstract Co-Author*) Research Grant, Glaxo SmithKline plc

PURPOSE

The purpose of this study is to evaluate whether an incidentally noted splenic lesion on abdominal computed tomography (CT) requires further imaging work-up.

METHOD AND MATERIALS

In this HIPAA compliant retrospective study, we performed a search of our CT database for patients with splenic lesions who underwent imaging from 2002 to 2008. Online medical records were reviewed for a history of malignancy and the indication for the CT examination. Patients were divided into 3 groups: 1. patients with a history of malignancy, 2. patients without a history of malignancy and no symptoms related to the left upper quadrant, 3. patients without a history of malignancy, but constitutional symptoms such as weight loss or fever or pain related to the left upper quadrant and epigastrium. Final diagnosis of the etiology of the lesion was confirmed by surgery, image guided biopsy or clinical and/or imaging follow-up. A lesion was considered benign on follow-up if it was stable by imaging for 2 years and by clinical follow-up for 5 years.

RESULTS

Our search revealed 525 patients, 57 patients needed to be excluded due to insufficient follow-up data. 468 patients were included in this study (294 women, 174 men, mean age = 58 years, age range 21-97 years). 154 of 468 (32.9%) patients had a history of malignancy (group 1), 279 of 468 (59.6%) patients had no history of malignancy and no symptoms related to the left upper quadrant (group 2). 35 of 468 (7.4%) patients had no history of malignancy, but constitutional symptoms or symptoms related to the left upper quadrant (group 3). The number of malignant lesions was as follows: group 1: 43 of 154 (27.9%), group 2: 2 of 305 (0.7%), group 3: 6 of 35 (17.1%). Patients with malignant lesions in group 2 consisted of new diagnoses of lymphoma (n=1) with extensive lymphadenopathy as well as metastatic ovarian carcinoma (n=1). Patients with malignant lesions in group 3 were diagnosed with lymphoma (n=6).

CONCLUSION

In a patient with no history of malignancy, no fever, weight loss or pain in the left upper quadrant or epigastrium, the likelihood of malignancy is very rare (0.7%). Patients who are diagnosed with a malignancy in this group have other lesions that allow for this diagnosis to be made. Therefore in patients with no evidence of previous or newly diagnosed malignancy, follow-up of splenic lesions may not be indicated.

CLINICAL RELEVANCE/APPLICATION

Follow-up of incidentally noted splenic lesions may not be indicated.

SSC04-02 CT Signs Predictive of Internal Hernia or Volvulus after Roux-en-Y Gastric Bypass in a Consecutive Surgical Cohort

Monday, Nov. 30 10:40AM - 10:50AM Location: E451A

Participants

Jennifer Y. Lee, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Peter S. Wang, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan L. Summerton, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Mindy M. Horrow, MD, Philadelphia, PA (*Abstract Co-Author*) Spouse, Director, Merck & Co, Inc

PURPOSE

To evaluate CT predictors of small bowel volvulus/internal hernia (VIH) after Roux-en-Y gastric bypass surgery (RYGB) in a consecutive, heterogeneous surgical cohort

METHOD AND MATERIALS

100 consecutive RYGB patients with abdominal pain and preoperative CT of abdomen/pelvis were retrospectively reviewed in consensus by 2 radiologists blinded to surgical outcomes for two 1^o signs of VIH: mesenteric swirl and shift of jejunal anastomosis and 7 2^o signs: dilated, ischemic or clustered small bowel; mesenteric edema; stretching of mesenteric vessels; SMA/SMV vascular narrowing; and mesenteric adenopathy. Alternative diagnoses, (related and unrelated to RYGB) and negative studies were tallied. Results included SEN, SPEC, PPV and NPV for VIH. Stepwise logistic regression analysis determined predictors of VIH amongst the 9 CT signs.

RESULTS

Patient age: 41 ± 12.6 (range 22-68) years), 85 females. 1 day (range 0-10) between CT and operation. Surgical results: 33 VIH (21 due to mesenteric defect and 12 to an adhesive band), 28 other diagnoses (intussusception, small bowel obstruction, adhesions) and 18 non-RYGB related diagnoses (acute cholecystitis, other hernias, cecal and sigmoid volvulus, perforated duodenal ulcer, ruptured ovarian cyst, appendicitis, omental infarct, PID). and 21 had no pathology. CT was 97% SEN, 78% SPEC for diagnosis of VIH with, NPV = 98%, PPV = 68 %. Presence of volvulus alone or IH alone on CT had numerically lower predictive value for surgical VIH than presence of either one: corresponding C-statistics 0.82, 0.75, 0.87. Of 9 predictors of VIH, only mesenteric swirl (odds ratio [95%CI] 7.46 (2.5-22.2) and vascular narrowing (12.0[2.3-62.5]) predicted VIH (p<.0001, C-statistic 0.843). Review of single FN showed subtle mesenteric swirl and 15 FPs showed 4 SBO and 1 adhesion all requiring surgery and 10 negative cases in which swirls were overcalled and other findings were minimal. CT correctly identified 83% of non-RYGB related operative diagnoses (missed 2 cholecystitis and 1 leaking ovarian cyst).

CONCLUSION

Mesenteric swirl and vascular narrowing on CT predict surgical VIH. FP cases occurred because SBO 2^o adhesions may appear similar to VIH and simple adhesions can cause appearance of a mesenteric swirl.

CLINICAL RELEVANCE/APPLICATION

CT can predict volvulus/internal hernia after RYGB amongst a cohort of all cases taken to surgery for abdominal pain.

Honored Educators

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Mindy M. Horrow, MD - 2013 Honored Educator

SSC04-03 An Assessment of Clinical History Quality and Its Effect on Acute Abdominal CT Diagnostic Accuracy

Monday, Nov. 30 10:50AM - 11:00AM Location: E451A

Participants

Wilfred Dang, BS, Ottawa, ON (*Presenter*) Nothing to Disclose
Pawel Stefanski, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Ania Z. Kielar, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Arash Jaber, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Mohamed A. el-Khodary, FRCR, PhD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Christian B. Van Der Pol, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Angel Y. Fu, BSC, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Matthew D. McInnes, MD, FRCPC, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT interpretation is integral in the management of emergency department (ER) patients. The clinical history provided on the ER CT requisition is variable in quality but often guides CT interpretation. The aim of this study is to evaluate the effect of CT requisition history quality on acute abdominal CT diagnostic accuracy and determine if more patient information would aid in study interpretation.

METHOD AND MATERIALS

335 abdominal CT scans at a tertiary care ER between September and October 2012 was retrospectively reviewed. The following data was collected: a) clinical history provided on CT requisition, b) lab work-up ordered prior to CT request, c) impression by ER CT radiologist, d) final disposition diagnosis by ER physician, and e) microbiology, surgical or pathology results. The quality of the clinical histories collected were evaluated by two blinded staff radiologists and two radiology residents. A 5-point Likert scale based on 4 categories of history criteria was used (presenting complaint, past medical history or symptom evolution, objective laboratory or prior examination results and differential diagnosis based on clinical evaluation). A composite CT diagnosis was created through: 1) Blinded double reading by two radiologists in consensus; 2) Patient laboratory data ordered by ER physician; 3) Surgical or

pathology confirmation; 4) Follow-up imaging confirming CT diagnosis. This combined composite was compared to the original CT diagnosis from the CT report.

RESULTS

14.9% (50/335) of ER CT diagnoses did not correlate with the final composite CT diagnosis. The usage of patient information (e.g. lab work, reports) in addition to CT requisition clinical history changed the radiological diagnosis for 8.0% (27/335) of cases. 8.4% (28/335) of cases had misleading history that could have led to interpretation error. No statistically significant correlation ($P=0.589$) was found between graded quality of the clinical history provided and CT diagnosis accuracy.

CONCLUSION

CT clinical history quality does not correlate with CT diagnosis accuracy. However, a misleading history could alter CT case interpretation. Increased access to ancillary patient information can improve interpretation accuracy.

CLINICAL RELEVANCE/APPLICATION

The results of our study could lead to greater live-access in electronic medical systems of more patient information and of increased quality for ER radiologists to improve interpretation accuracy.

SSC04-04 **Body Packing: Which Modality to Choose in the Initial Evaluation? A Comparative Study of X-ray versus CT**

Monday, Nov. 30 11:00AM - 11:10AM Location: E451A

Participants

Robin F. Gohmann, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Sebastian Reinartz, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to evaluate the diagnostic performance of plain film and CT in the detection of internally concealed drugs, frequently referred to as body packing.

METHOD AND MATERIALS

The study was approved by the local ethics committee and performed retrospectively. Between July 2009 and June 2013, 142 consecutive X-ray ($n=98$) and CT ($n=44$) examinations on medically asymptomatic suspects where included (107 men, 25 females, mean age 35 ± 8).

RESULTS

In a total of 40 cases (40 %) authorities ascertained intracorporally concealed drugs with a prevalence of 35 % in the group examined with X-ray and 14 % in the group examined with CT. In 85 % of those cases heroin was found. The rate of radiologically detected cases of body packing in either modality (X-ray: 79 %, CT: 82 %) did not vary statistically significantly ($p>0.05$). Both the NPV of X-ray (83 %) and CT (94 %) as well as the PPV of X-ray (68 %) and CT (40 %) were statistically equivalent ($p>0.05$).

CONCLUSION

As body packing is not limited to a single substance or mode of packaging and therefore presents with differing imaging characteristics, diagnostic performance of X-ray and CT may vary. Because CT and X-ray were statistically equivalent in our cohort, and body packing sometimes can be invisible on plain film and other times is very easily picked up we emphasise a stepwise approach with a careful interpretation of the CT-scout view and to only secondarily proceed to CT.

CLINICAL RELEVANCE/APPLICATION

Hard ray CT-scout view in body packing should be viewed as a diagnostic image with the potential of rendering the planned CT of the abdomen not necessary in selected cases.

SSC04-05 **Pelvic Artifacts in Material Decomposition Images from Dual Energy CT: A Phantom and Patient Study**

Monday, Nov. 30 11:10AM - 11:20AM Location: E451A

Participants

Sebastian Winkhofer, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Jack Lambert, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Yuxin Sun, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Zhen J. Wang, MD, Hillsborough, CA (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextst, Inc;

PURPOSE

Aim of the study was to describe the frequency, appearance and severity of pelvic beam hardening artifacts on material decomposition images from rapid-kV switching Dual-Energy Computed Tomography (rsDECT).

METHOD AND MATERIALS

Monochromatic (70keV, 52keV, 120keV) and material decomposition images (iodine(-water), water(-iodine)) reconstructed from pelvic rsDECT scans of 41 patients (22 male, mean age 57 ± 6 years, range 22-86 years) were retrospectively evaluated. We qualitatively analyzed the presence, type (hyperdense vs. hypodense) and severity of artifacts and the diagnostic capability of anatomic details (5-point scales). Quantitative measurements included CT numbers, iodine and water concentrations, grayscale values (GY), and standard deviations (SD) of the artifact-affected regions, compared with corresponding unaffected reference tissue. A pelvic phantom was constructed and scanned to validate the presence of artifacts. Wilcoxon signed-rank and paired t-tests were used to compare results between the different image reconstructions.

RESULTS

Beam hardening artifacts were seen in all 41 patients in all datasets. The median artifact severity score was higher in water(-iodine) and iodine(-water) images (3, each) compared to 70keV (1), 52keV (2), and 120keV (1) ($P < 0.001$, each). The diagnostic capability for pelvic organ depiction was lower ($P < 0.001$) in water(-iodine) and iodine(-water) images compared to monochromatic images. Higher SD values of CT number, concentrations, and GY value were revealed for areas affected by artifacts compared to reference tissues in all data sets (each $P < 0.001$). Similar results were seen in the phantom study.

CONCLUSION

Beam hardening artifacts are prevalent in pelvic material decomposition rsDECT images, show inverted high and low signal and should not be misinterpreted as disease in the pelvis.

CLINICAL RELEVANCE/APPLICATION

It is important for the radiologist to know that the accuracy of pelvic material decomposition images might be impaired by artifacts and that the diagnosis of frequently seen pathologies such as urinary bladder cancer or wall thickening, intravesicular calculi, enlargement of the prostate gland or ovarian cancer might be impeded.

SSC04-06 The Clinical Value of MR Gadolinium Colonic Transit Test in Patients with Constipation

Monday, Nov. 30 11:20AM - 11:30AM Location: E451A

Participants

Dan Liang, Guangzhou, China (*Presenter*) Nothing to Disclose
Wuteng Cao, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Mingyue Luo, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhiyang Zhou, PhD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To establish a new and non-invasive methodology of MR gadolinium transmission test and assess its clinical feasibility by comparing with conventional X-ray barium transmission test.

METHOD AND MATERIALS

According to Rome III clinical diagnostic criteria, eight patients, 1 male, 7 female, aged 15-48 with a mean of 34.3, with a history of functional constipation from 1 to 10 years, with a mean of 5.4 years were chosen to undergo both traditional barium X-ray and MR gadolinium colonic transit test at the same time. 20 barium tablets and 5 gadolinium grains were taken orally at the same time by each patient, then rechecked after 24h, 48h, 72h to count the residual barium tablet and gadolinium markers in X-ray and MRI respectively. The results, advantages and disadvantages of the two methods were compared.

RESULTS

All of the eight patients successfully underwent both X-ray and MR colonic transit tests. X-ray transmission test showed 5 cases residual barium strip markers $\geq 20\%$ (4 tablets) after 48h, 3 cases $\geq 20\%$ (4 tablets) after 72h; MR transmission test showed 5 cases residual gadolinium markers $\geq 20\%$ (1 grain) after 24h, 3 cases $\geq 20\%$ (1 grain) after 48h. The residual barium tablet markers $\geq 20\%$ (4 tablets) after 72h in X-ray test was set as a positive standard of slow colonic transit. All 3 positive patients in X-ray test showed residual gadolinium markers $\geq 20\%$ (1 grain) after 48h in MR colonic transit tests; All 5 negative patients in X-ray test showed no residual gadolinium grain after 48h in MR tests.

CONCLUSION

MR transmission test can clearly demonstrate the location and quantify the remaining markers in the colon with fast scan sequences. The exact location of the residual markers can be observed by using 2D combined with 3D technology. MR has no ionizing radiation which is very important for multiple follow-ups. Our preliminary results indicate that it is feasible to consider the residual marker $\geq 20\%$ (1 grain) in the colon after 48h as the diagnostic criteria of slow transit constipation time by MRI.

CLINICAL RELEVANCE/APPLICATION

It is expected that MR gadolinium transmission test to replace the X-ray colon transmission test due to its accurate positioning and without radiation.

SSC04-07 Quantification of Inflammation with Ultrasound Molecular Imaging Following Automated Imaging Fusion with CT/MRI: A Pilot Study in a Porcine Model of Acute Ileitis

Monday, Nov. 30 11:30AM - 11:40AM Location: E451A

Participants

Huajun Wang, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Stephen A. Felt, DVM, MPH, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Ismayil Guracar, Mountain View, CA (*Abstract Co-Author*) Employee, Siemens AG
Poonam Gwalani, MS, Mountain View, CA (*Abstract Co-Author*) Nothing to Disclose
Juergen K. Willmann, MD, Stanford, CA (*Abstract Co-Author*) Research Consultant, Bracco Group; Research Consultant, Triple Ring Technologies, Inc; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company

PURPOSE

Most patients with inflammatory bowel disease (IBD) undergo anatomical CT and MR imaging to assess the location and extent of inflammation as part of their routine clinical workup; however, both techniques are limited in terms of quantification of inflammation which is critically needed for proper patient management. Molecular imaging including ultrasound molecular imaging using targeted contrast agents is currently explored to quantify inflammation in IBD at the molecular level. However, localizing the inflamed bowel segment and imaging the entire bowel with ultrasound can be time consuming. The purpose of this study was to explore feasibility of real-time image fusion of CT and MRI data sets with ultrasound molecular imaging in an acute terminal ileitis model in pigs.

METHOD AND MATERIALS

An acute terminal ileitis model was established in 3 female pigs by intraluminal exposure of a segment of terminal ileum with 2,4,6-trinitrobenzene sulfonic acid (TNBS in ethanol). All pigs were imaged at 48 h after induction of acute ileitis. Pigs were either imaged with a clinical CT (Zeego, Siemens) or MR (Discovery MR750w; GE) enterography protocol and data sets were uploaded onto a clinical ultrasound machine (Acuson S3000; Siemens). Using an anatomical landmark-based approach, inflamed bowel segments were localized in real-time on subsequent ultrasound molecular imaging of the bowel using eSie Fusion auto registration software (Siemens). Inflammation of the bowel wall was quantified using dual P- and E-selectin-targeted ultrasound molecular imaging and compared with histology.

RESULTS

Real-time image fusion was successful in all 3 animals. Using anatomical CT and MR road mapping, the inflamed bowel segment could be identified quickly and inflammation of the bowel segment could be assessed within 10 minutes. Selectin-targeted ultrasound molecular imaging signal correlated well with the grade of inflammation on histology.

CONCLUSION

Automatic fusion of volumetric CT and MRI datasets with ultrasound imaging in real time is feasible and allows rapid anatomical localization of inflamed bowel segments for further quantification of inflammation using ultrasound molecular imaging.

CLINICAL RELEVANCE/APPLICATION

Anatomical road mapping by fusing volumetric CT or MRI data sets with ultrasound in real time improves the work flow of ultrasound molecular imaging for grading inflammation in IBD.

SSC04-08 CT after Pancreaticoduodenectomy with Portal Vein and/or Superior Mesenteric Vein Reconstruction: Review of Current Surgical Techniques and Associated Post Surgical Imaging Findings

Monday, Nov. 30 11:40AM - 11:50AM Location: E451A

Participants

Karen B. Bleich, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

Ammar Javed, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Fabio Bagante, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Christopher L. Wolfgang, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Elliot K. Fishman, MD, Owings Mills, MD (*Abstract Co-Author*) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

PURPOSE

To review the current range of PV-SMV reconstruction procedures that may be performed in conjunction with pancreaticoduodenectomy, and to establish patterns of imaging findings associated with these vascular procedures in order to more accurately distinguish post-surgical findings from recurrent malignancy, both of which can demonstrate venous attenuation and perivenous induration.

METHOD AND MATERIALS

We reviewed our database of patients who underwent PV-SMV reconstruction from 2004-2014 and identified patients who met the following criteria: 1. CT available within 60 days following surgery, 2. pathologic R0 or R1 resection. We restricted our analysis to cases with recent post-operative CT and complete surgical resection because recurrent malignancy is highly unusual in the immediate post-operative period in patients for whom a complete surgical resection has been achieved; therefore the observed CT findings could be attributed to post-surgical changes rather than to recurrent or residual disease. 71 patients in the database met the inclusion criteria. Two radiologists and two surgeons reviewed the CTs and the operative notes. The configuration and caliber of the post-reconstruction portal vein and SMV (referred to as the PV-SMV complex) were analyzed, and the perivenous tissue was characterized. The findings were correlated with the details of the type of venous reconstruction.

RESULTS

There are four patterns of the PV-SMV complex following reconstruction: concentric smooth narrowing, eccentric/irregular narrowing or defect, thrombosis, and changes in venous configuration without significant caliber change. There are two patterns of the perivenous tissue: soft tissue density thickening, and a range of low attenuation induration/inflammation/fluid. The post-operative imaging findings can be correlated with the type of venous reconstruction performed. Some of the post-operative imaging appearances overlap with findings considered suspicious for recurrent malignancy.

CONCLUSION

There are specific patterns of imaging findings after portal venous reconstruction. In some cases, the normal post-surgical findings mimic recurrent disease. Knowledge of the expected post-surgical appearances may allow for more accurate interpretation of follow-up CT.

CLINICAL RELEVANCE/APPLICATION

Recognition of the patterns of the PV-SMV complex after pancreaticoduodenectomy with venous reconstruction may prevent erroneous diagnosis of recurrent/residual disease.

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Elliot K. Fishman, MD - 2012 Honored Educator

Elliot K. Fishman, MD - 2014 Honored Educator

SSC04-09 Participants

Evaluation of Splenic Stiffness in Patients of Extrahepatic Portal Vein Obstruction Using Shear Wave Elastography: Comparison with Intra-Operative Portal Pressure

Monday, Nov. 30 11:50AM - 12:00PM Location: E451A

Madhusudhan Kumble Seetharama, MD, FRCR, New Delhi, India (*Presenter*) Nothing to Disclose
Raju Sharma, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ragini Kilambi, MS, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Peush Sahni, MBBS, MS, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Sujoy Pal, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Nihar R. Dash, MS, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Arun K. Gupta, MBBS, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare splenic stiffness (SS) measured by shear wave elastography (SWE) in patients of extrahepatic portal vein obstruction (EHPVO) with intra-operative portal system pressures (PP)

METHOD AND MATERIALS

21 patients (14 males; 7 females) of mean age 20.4 years (range: 13 - 34 years) with clinical and sonographic diagnosis of EHPVO were included in this prospective study after obtaining approval from institute ethics committee. Endoscopy for esophageal varices was done in all patients. Splenic stiffness was measured using shear wave elastography (SWE) on Aixplorer Supersonic Imagine ultrasonography scanner. Three values were taken three different region of interests drawn at different areas of spleen avoiding major vessels and mean was calculated. Intra-operative PP was measured from an omental vein in all these patients during proximal spleno-renal shunt surgery. The PP was compared and correlated with SS along with other parameters. A p-value of < 0.05 was considered significant.

RESULTS

The mean SS was 46.04 ± 8.0 kPa and the mean PP was 33.29 ± 4.1 mm of Hg. Although there was negative correlation between PP and SS (Pearson correlation coefficient: minus 0.119), this was not statistically significant ($p=0.607$). There was no significant correlation between grades of esophageal varices (EV) and SS ($p=0.375$) and between EV and PP (0.06). PP also did not show significant difference between patients with and without portal biliopathy ($p=0.14$).

CONCLUSION

There was no significant correlation between SS and PSP, EV grading and PSP, and EV grading and SS. Thus SS measured by SWE may not help in predicting gastrointestinal bleed in patients of EHPVO.

CLINICAL RELEVANCE/APPLICATION

Assessment of splenic stiffness by SWE is a simple technique giving absolute values of stiffness in kilopascals. Although, SS should indirectly reflect portal pressure, we did not find this in our study. The results of our study indicate that simple measurement of SS may not be sufficient to predict portal pressure and thus variceal bleeding.

SSC07

ISP: Musculoskeletal (Cartilage: Mechanics, Quantitative MRI and Repair)

Monday, Nov. 30 10:30AM - 12:00PM Location: E450B



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

Participants

Daniel B. Nissman, MD, MPH, Raleigh, NC (*Moderator*) Royalties, John Wiley & Sons, Inc
Michael P. Recht, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSC07-01 Musculoskeletal Keynote Speaker: Cartilage: Understanding Quantitative Evaluation through Structure and Biomechanics

Monday, Nov. 30 10:30AM - 10:50AM Location: E450B

Participants

Michael P. Recht, MD, New York, NY (*Presenter*) Nothing to Disclose

SSC07-03 Weight Loss Is Associated with Slower Cartilage Degeneration Over 48 Months in Obese and Overweight Subjects: Data from the Osteoarthritis Initiative

Monday, Nov. 30 10:50AM - 11:00AM Location: E450B

Participants

Alexandra S. Gersing, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Martin Solka, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Gabby B. Joseph, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Benedikt J. Schwaiger, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Ursula R. Heilmeyer, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Georg Feuerriegel, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
John Mbapte Wamba, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Charles E. McCulloch, San Francisco, CA (*Abstract Co-Author*) Instructor, F. Hoffmann-La Roche Ltd Expert Witness, Mallinckrodt plc Consultant, Mallinckrodt plc
Michael C. Nevitt, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Link, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Research funded, General Electric Company; Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

PURPOSE

To investigate the association of different degrees of weight loss with progression of knee cartilage degeneration in overweight and obese subjects.

METHOD AND MATERIALS

In this study, 290 subjects (age 61.7±9.1y; 171 females) with a BMI>25kg/m² from the Osteoarthritis Initiative (OAI) with risk factors for OA or radiographically mild to moderate OA were included. Subjects with weight loss were categorized into groups with a large (≥10%, n=36) or moderate amount of weight loss (5-10%, n=109) over 48 months, and were frequency matched to a group with stable weight (BMI change <3%, n=145). Changes of focal cartilage defects assessed with 3T MRI cartilage WORMS (Whole-Organ Magnetic Resonance Imaging Score) and T2 maps of the right knee for five cartilage compartments (patella, medial and lateral femur, medial and lateral tibia) including laminar and texture analysis, were analyzed using multivariate regression models adjusting for age, sex, baseline BMI and KL.

RESULTS

Overall cartilage WORMS showed significantly less progression in both weight loss groups compared to the stable weight group (5-10% weight loss, P=0.035; >10% weight loss, P<0.0001) over 48 months and changes were associated with changes of BMI (r=0.31, P=0.02). Subjects with >10% weight loss showed significantly less T2 value increase in the bone layer averaged over all compartments compared with stable weight subjects (mean diff. 1.0msec [95%CI 1.3, 0.6] P=0.01), suggesting slower cartilage deterioration, yet no significant change in T2 was found between 5-10% weight loss and stable weight group. In the medial compartment of the >10% weight loss group, overall T2 and cartilage WORMS changes were significantly less (P<0.0001, for each) and homogeneity was increased (P=0.004), compared to the group with stable weight.

CONCLUSION

While changes in cartilage defects were significantly associated with the amount of weight loss in all subjects, only subjects with >10% weight loss showed significantly reduced cartilage deterioration measured with T2. Our data show evidence that weight loss has a protective effect against cartilage degeneration and that a larger amount of weight loss is more beneficial.

CLINICAL RELEVANCE/APPLICATION

MR-based knee cartilage T2 measurements and semiquantitative grading allow monitoring of the protective effect of weight loss on joint health and are useful to determine which amount of weight loss is most beneficial in overweight and obese patients.

SSC07-04 The TEFr Field Study: Results of Continuous Biochemical and Morphological Cartilage Analysis of Hindfoot, Ankle, and Knee Joints in Course of a 4,500 km Ultramarathon Race throughout Whole Europe Using T2*-mapping on a Mobile MRI Truck Trailer

Awards

RSNA Country Presents Travel Award

Participants

Uwe H. Schuetz, MD, Ulm, Germany (*Presenter*) Nothing to Disclose
Christian Billich, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Jutta Ellermann, MD, PhD, Minneapolis, MN (*Abstract Co-Author*) Nothing to Disclose
Martin Ehrhardt, MD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Schoss, MD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Brix, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Siegfried Trattng, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Sabine Goed, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Antje Reiner, MD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Meinrad J. Beer, MD, Wuerzburg, Germany (*Abstract Co-Author*) Research Consultant, Shire plc

PURPOSE

We took advantage of the possibility for a continuous, mobile MR surveillance of cartilage integrity during a transcontinental ultramarathon over 4,486 km. Biochemical changes, thickness and focal lesions of the cartilage of knee, ankle, and hindfoot joints as well as muscle mass and respective relationships were presented.

METHOD AND MATERIALS

MRI data were acquired with a mobile 1.5T scanner travelling with 44 participants of the TransEurope FootRace (TEFR) for 64 days. Repeated follow-up scans were obtained using a T2* GRE-, a TIRM-, and a fat-saturated PD-sequence. T2* values were obtained from inline reconstructed T2* maps by using a pixelwise, monoexponential nonnegative least squares fit analysis. Statistical analyses regarding cartilage T2* and thickness changes and influencing factors were done on the finishers of the race.

RESULTS

With exception of the patellar joint, nearly all cartilage segments showed a significant initial mean T2* signal increase within the first 1500km run: ankle 25.6%, subtalar joint 20.9%, midtarsal joint 26.3%, femorotibial Joint (FTJ) 25.1 to 44.0%. Interestingly, an unexpected secondary T2* decrease was observed in ankle (-30.6%) and hindfoot joints (-28.5% and -16.0%), but not in the FTJ. A significant loss of cartilage thickness was detected in the FTJ, but not in the other joints. A side dependent, positive relationship between muscle volumes of the thigh and cartilage T2* at baseline could be found in the FTJ. Osteochondral lesions were detected, however all were already present at baseline and showed no changes throughout TEFR. Reasons for stopping the race were not associated with joint problems.

CONCLUSION

After initial significant intrachondral matrix changes, a subsequent T2* value recovery indicates the ability of the cartilage matrix to regenerate under ongoing running burden in ankle and hindfoot joints. In contrast, for the FTJ no T2* signal recovery could be observed accompanied by loss of cartilage thickness. No new lesions were observed during TEFR. Asymmetry of cartilage T2* behavior is in line with the hypothesis of the "breaking" limb and demonstrates leg-preference even in well-trained ultra-runners.

CLINICAL RELEVANCE/APPLICATION

The capability of most parts of human cartilage to recover in the presence of extreme physical stress has not been shown previously indicating a high regenerative potential of human joint cartilage.

SSC07-05 The Evaluation of Clinical Reliability and Speed of a Triple-echo Steady-state T2 Mapping for in Vivo Evaluation of Articular Cartilage in Comparison to Multi-echo Spin-echo Sequence

Monday, Nov. 30 11:10AM - 11:20AM Location: E450B

Participants

Vladimir Juras, BMedSc, PhD, Vienna, Austria (*Presenter*) Nothing to Disclose
Klaus Bohndorf, MD, Augsburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Claudia Kronnerwetter, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Pavol Szomolanyi, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Stefan Zbyn, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Siegfried Trattng, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the clinical relevance of T2 relaxation times, measured by 3D triple-echo steady-state (3D-TESS), in knee articular cartilage compared to conventional multi-echo spin-echo T2-mapping.

METHOD AND MATERIALS

Thirteen volunteers and ten patients with focal cartilage lesions were included in the study. All subjects underwent 3-Tesla MRI consisting of a multi-echo multi-slice spin echo sequence (CPMG) as a reference method for T2 mapping, and 3D TESS with the exact same geometry settings, but variable acquisition times: standard (TESSs 4:35 min) and quick (TESSq 2:05 min). T2 values were compared in six different regions in the femoral and tibial cartilage using a paired t-test and the Pearson correlation coefficient (r).

RESULTS

The mean quantitative T2 values measured by CPMG (mean: 46±9ms) in volunteers were significantly higher compared to those measured with TESS (mean: 31±5ms) in all regions. Both methods performed similarly in patients, but CPMG provided a slightly higher difference between lesions and native cartilage (CPMG: 90ms±61ms [31%], p=0.0125; TESS 32ms±24ms [24%], p=0.0839)..

CONCLUSION

This work compared a newly developed 3D-TESS sequence with a CPMG method to evaluate T2-mapping of human articular

cartilage. 3D-TESS provided results comparable to CPMG with a substantially shorter acquisition time. This novel sequence may replace the conventional approach with CPMG

CLINICAL RELEVANCE/APPLICATION

3D-TESS T2 mapping provides clinically comparable results to CPMG in shorter scan-time Cartilage loading studies might benefit from high temporal resolution of 3D-TESS. 3D-TESS T2 values are able to differentiate between healthy and damaged cartilage

SSC07-06 **A Comprehensive 7 Tesla Hip Cartilage Protocol Including Morphological and Quantitative MRI Techniques and Its Application in Patients after Acetabular Autologous Chondrocyte Transplantation**

Monday, Nov. 30 11:20AM - 11:30AM Location: E450B

Participants

Andrea Lazik, MD, Essen, Germany (*Presenter*) Nothing to Disclose
Oliver Kraff, MSc, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konrad Koersmeier, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Soren Johst, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christina Geis, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Harald H. Quick, PhD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Jens M. Theysohn, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate morphological and quantitative 7 Tesla MRI techniques for hip cartilage imaging in patients with acetabular cartilage lesions, treated by autologous chondrocyte transplantation (ACT).

METHOD AND MATERIALS

Hips of 11 healthy volunteers were examined to establish a 7T hip cartilage protocol including high-resolution DESS (0.7mm³ isotropic), T1 VIBE (0.4x0.4x0.8mm³) and PDw sequences (sagittal and coronal) for morphological imaging, multi-contrast sequences (5 echoes) for T2- and T2*-mapping and a dual flip angle technique for T1-mapping prior to and after contrast agent administration following a dGEMRIC-protocol. Accurate and reproducible scan-rescan conditions were monitored with a fast B1-mapping technique (DREAM). After reviewing image quality by means of acetabular and femoral cartilage delineation (4-point scale, 4 being best) and comparing relaxation times in correlating regions (Pearson's correlation) this protocol was applied in 9 patients treated by ACT. Here, over-all image quality, delineation of the cartilage transplants and their relaxation times were compared to 3T MRI.

RESULTS

Volunteer study: The delineation of acetabular and femoral cartilage was excellent in T2- (3.2±0.9) and T2*-maps (3.2±0.4). Gadolinium improved cartilage delineation in T1-maps (2.9±0.8 vs. 1.7±0.6) as well as in T1 VIBE (3.3±0.6 vs. 2.2±0.9). T1-, T2- and T2*-relaxation times showed a high correlation in unenhanced and contrast-enhanced sequences (all p<0.001) in volunteers with mean values of 931ms (T1 enhanced), 43ms (T2) and 15ms (T2*). Patient study: Compared to 3T, image quality at 7T was clearly superior in sagittal PDw, T1 VIBE, DESS and T1-mapping with enhanced delineation of the transplants. Mean relaxation times of the cartilage transplants were reduced at 7T compared to 3T for T1 (537 vs. 757ms), T2 (42 vs. 45ms) and T2* (11 vs. 14ms).

CONCLUSION

A comprehensive hip cartilage protocol after contrast agent administration was established at 7T MRI, including morphological sequences as well as T1-mapping for dGEMRIC, T2- and T2*-mapping. The application of this protocol in patients after ACT showed predominantly superior image quality with better evaluation of the cartilage transplants compared to 3T.

CLINICAL RELEVANCE/APPLICATION

7 Tesla can help to noninvasively follow up patients after acetabular cartilage transplantation, as imaging of the thin and spherical shaped hip cartilage remains challenging at lower field strengths.

SSC07-07 **Quantitative T2* Analysis of Articular Cartilage of the Tibiotalar Joint in Professional Soccer Players and Healthy Individuals at 3T MRI**

Monday, Nov. 30 11:30AM - 11:40AM Location: E450B

Participants

Marc Regier, Hamburg, Germany (*Presenter*) Nothing to Disclose
Cyrus Behzadi, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Azien Laqmani, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Chressen C. Remus, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael G. Kaul, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To quantitatively evaluate the tibiotalar cartilage of professional soccer players by T2* relaxation measurements in comparison to age-matched healthy volunteers.

METHOD AND MATERIALS

Using a 3T MRI system both ankles of 20 elite professional soccer players from the highest european level and 20 age-matched healthy individuals were investigated. After resting in supine position for 30 minutes, all individuals were examined applying multiplanar T1w and PDw sequences. For quantitative measurements a 3D T2* (24 echoes ranging from 4.6-52.9ms; image resolution 0.5x2x2mm) sequence was performed in sagittal orientation. Using a dedicated software tool (ImageJ) data were postprocessed and quantitative maps were generated. The articular cartilage was subdivided into 6 areas and regions-of-interest (ROI) were manually placed in all zones of the tibial and talar cartilage. For statistical workup Pearson product-moment correlation coefficients and confidence intervals were calculated.

RESULTS

In professional soccer players the T2* values were significantly higher in all tibial and talar compartments than those in healthy participants (mean, 21.36ms vs. 16.44ms; $p < 0.001$). This difference was most evident in the posterior zones of the tibiotalar cartilage. In the athletes, there was a trend towards higher T2* values at the anterior medial compartments of the articular cartilage, however, compared to the healthy control group this was not statistically significant ($p, 0.08$).

CONCLUSION

Based on these initial results, T2* values of the tibiotalar joint seem to be elevated in professional soccer players compared to an age-matched control group indicating cartilage degeneration. T2* measurements might potentially serve as a quantitative noninvasive tool for the detection of articular cartilage lesions at early stage.

CLINICAL RELEVANCE/APPLICATION

Quantitative MR imaging of tibiotalar articular cartilage using T2* measurements could serve as a complementary tool for early detection of subtle cartilage defects and further investigation should be encouraged.

SSC07-08 MRI-T2 Mapping Assessment after Treatment of Knee Osteoarthritis with Mesenchymal Stem Cells at One Year Follow-up

Monday, Nov. 30 11:40AM - 11:50AM Location: E450B

Participants

Joan C. Vilanova, MD, PhD, Girona, Spain (*Presenter*) Nothing to Disclose
Marina Huguet, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Lluís Orozco, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Robert Soler, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Anna Munar, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To confirm the feasibility of osteoarthritis treatment with mesenchymal stem cells (MSCs) in humans, and to demonstrate its efficacy on MRI and clinical outcome on a larger population with osteoarthritis of the knee

METHOD AND MATERIALS

Fifty patients with clinical and radiologic diagnosis of osteoarthritis of the knee (graded according to the ICRS (International Cartilage Repair Society)) were treated with autologous MSCs by intrarticular injection. Clinical outcomes were followed for 1 year (including pain, disability, and quality of life). Cartilage assessment was performed using MRI T2-mapping at 88 pre-determined anatomical regions previous to treatment at 12 months after treatment; by determining the T2 relaxation values (RV) in each region of the knee. Inter, intraobserver and equipment errors were calculated for reproducibility, and for the statistical analysis to determine significant differences on T2 RV's before and after treatment. Statistical analysis was performed by Students t-test or by one-way analysis of variance (ANOVA) and the corresponding non-parametric tests

RESULTS

The mean T2 RV's (ms) previous to treatment (mean±SD) (60.3 ± 6.1) was significantly higher than at 12 months (53.1 ± 6.2) ($p < 0.04$). A positive correlation was identified between the baseline mean average T2 RV's and the mean final average (ms) improvement T2 RV's score ($r = 0.38$; $p < 0.05$). T2 RV's decreased in 37 of 50 patients, 10 remained the same and 3 worsened between 7 and 10%. The median pain reduction was 60% for daily activities and 63% for sport activities. A good positive correlation was observed between the amount of clinical improvement and the initial score ($r = 0.49$), ($P < 0.001$)

CONCLUSION

Non-invasive technique MRI T2-mapping is a valuable tool to assess the follow up of cartilage after MSC therapy for knee osteoarthritis

CLINICAL RELEVANCE/APPLICATION

Stem cell therapy could be an effective, feasible and safe treatment for knee osteoarthritis; and MRI T2-mapping can be a useful imaging biomarker tool to correlate and assess the clinical outcome

SSC07-09 MRI and Clinical Outcomes of Hyaluronic Acid (HA) Injection Following Arthroscopic Microfracture for Osteochondral Lesions of the Talus

Monday, Nov. 30 11:50AM - 12:00PM Location: E450B

Participants

Hong Yue Tao, Shanghai, China (*Presenter*) Nothing to Disclose
Xiliang Shang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Shuang Chen, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to compare the magnetic resonance imaging (MRI) and clinical outcomes of arthroscopic microfracture surgery alone or in combination with hyaluronic acid (HA) injection in the treatment of osteochondral lesions of the talus.

METHOD AND MATERIALS

Thirty-five patients with osteochondral lesions of the talus who underwent arthroscopic microfracture were included and followed up for at least 9 months postoperatively. The patients were randomly divided into non-injection group ($n = 17$) who received treatment with microfracture surgery alone and injection group ($n = 18$) who also accepted intra-articular injection of HA postoperatively. Quantitative MRI was used to evaluate the cartilage repair after surgery. American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hind foot Scale scores and Visual Analogue Scale (VAS) scores were used to evaluate clinical outcomes.

RESULTS

After operation, the MRI outcomes showed that the thickness index was higher (0.8 ± 0.1 vs. 0.7 ± 0.1) and the T2 index was lower (1.2 ± 0.1 vs. 1.4 ± 0.1) in the injection group than in the non-injection group ($P < 0.01$). As for the volumes of subchondral bone marrow oedema, there are no significant differences between groups (n.s.). Compared with the non-injection group, the AOFAS score and the VAS score yielded a higher level of improvement in injection group at final follow-up post-operatively ($P < 0.05$).

CONCLUSION

Arthroscopic microfracture is a safe and effective procedure for osteochondral lesions of the talus. Intra-articular HA injection as an adjunct to arthroscopic microfracture might offer better functional recovery than microfracture alone.

CLINICAL RELEVANCE/APPLICATION

Quantitative MRI 3D-DESS, T2-mapping and T2-STIR can comprehensively evaluate the process of cartilage repair with respect to thickness and biochemical properties of repair tissue and subchondral bone marrow oedema.

SPCP21

Germany Presents: Population-based Imaging: How Broader Research Efforts Can Affect Everyday Care and Prevention

Monday, Nov. 30 10:30AM - 12:00PM Location: E353C



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

Discussions may include off-label uses.

Participants

Norbert Hosten, MD, Greifswald, Germany (*Moderator*) Institutional research agreement, Siemens AG; Institutional research agreement, Bayer AG; Stockholder, Siemens AG
Gabriele A. Krombach, MD, Aachen, Germany (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Appraise the contribution which Population-based Imaging can make to radiological knowledge. 2) Differentiate between classical, prospective double-blind studies and the epidemiological, non-interventional approach to generate radiological knowledge. 3) Assess information regarding normal findings, normal range and the like as generated by Population-based Imaging studies.

ABSTRACT

The „SHIP" (Study of health in Pomerania, Germany) has allowed to do more than 2000 whole-body MR scans in normal subjects in the setting of an on-going epidemiological study during several years. A body of knowledge regarding the organization of Population MR Imaging, the handling of incidental findings, the range of normal imaging findings and of imaging-related biomarkers has been generated. The course presents information about normal contrast enhancement patterns in the breast generated in a large group (> 500); about MR findings both pathological and non-pathological that may be made in individuals in the absence of disease; about the distribution of quantitative parameters in cardiac imaging (plain and enhanced) in subjects in the absence of overt heart disease. The success of the SHIP has encouraged to perform a similar, nation-wide study in Germany on an even larger scale. 5 centers have started to perform whole-body MRI in study participants. A large body of information on health status of the participants is generated by epidemiologists. Follow-up will be performed on a regular base in the frame of the so-called „National Cohort". Information on the value of radiological methods will be generated by epidemiological methods, namely long-time follow up.

URL

<http://www.medizin.uni-greifswald.de/cm/fv/ship.html>http://www.nationale-kohorte.de/index_en.html

Sub-Events

SPCP21A Opening Remarks

Participants

Ronald L. Arenson, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Norbert Hosten, MD, Greifswald, Germany (*Presenter*) Institutional research agreement, Siemens AG; Institutional research agreement, Bayer AG; Stockholder, Siemens AG

LEARNING OBJECTIVES

1) Appraise the contribution which Population-based Imaging can make to radiological knowledge. 2) Recommend Population based MR Imaging as a valuable part of Population based epidemiological studies.

ABSTRACT

"Population-based MR Imaging" was chosen as the topic for this year's RSNA "Germany presents:" session. In Germany, whole-body MRI is performed both in a regional study (Study of Health in Pomerania - "SHIP") and in the "National Cohort" which just started. The session explains (1) how normal ranges for contrast enhancement can be established in very large numbers of healthy subjects; (2) what "incidental" (or in the case of MRI patients) "unexpected" findings may be found on whole body MRI, (3) how whole-body MRI may be set up in epidemiological population-based studies.

SPCP21B Roentgen - An X-Ray Journey

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

SPCP21C What Is Normal? Reference Values Derived from Population-Imaging and Their Role in Clinical Practice

Participants

Katrin Hegenscheid, MD, Greifswald, Germany (*Presenter*) Research Grant, Bayer AG; Research Grant, Siemens AG; Research Grant, XERA 3 Deutschland GmbH

LEARNING OBJECTIVES

1) How population-based data are used to establish reference values for clinical diagnostics. 2) Which methods and procedures are

SPCP21G Discussion and Closing Remarks

Participants

Gabriele A. Krombach, MD, Aachen, Germany (*Presenter*) Nothing to Disclose

James P. Borgstede, MD, Colorado Springs, CO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI22

Molecular Imaging Symposium: Neurologic MI Applications

Monday, Nov. 30 10:30AM - 12:00PM Location: S405AB



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



Discussions may include off-label uses.

Participants

Satoshi Minoshima, MD, PhD, Salt Lake City, UT, (sminoshima@hsc.utah.edu) (*Moderator*) Royalties, General Electric Company; Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd; Research Grant, Astellas Group; Research Grant, Seattle Genetics, Inc;
Peter Herscovitch, MD, Bethesda, MD (*Moderator*) Nothing to Disclose

Sub-Events

MSMI22A Overview of MI in Neurology

Participants

Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Presenter*) Royalties, General Electric Company; Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd; Research Grant, Astellas Group; Research Grant, Seattle Genetics, Inc;

LEARNING OBJECTIVES

1) Learn recent development of molecular imaging in the field of neurosciences. 2) Understand technologies used in molecular brain imaging. 3) Discuss opportunities and challenges in molecular brain imaging.

MSMI22B MI in Dementia

Participants

Alexander Drzezga, MD, Cologne, Germany (*Presenter*) Research Grant, Eli Lilly and Company; Speakers Bureau, Siemens AG; Speakers Bureau, General Electric Company; Speakers Bureau, Piramal Enterprises Limited; Research Consultant, Eli Lilly and Company; Research Consultant, Piramal Enterprises Limited; ; ; ; ;

LEARNING OBJECTIVES

1) Gain overview on types of molecular neuropathology involved in the development of different forms of dementia and understand currently discussed disease concepts. 2) Learn about the currently available methods for imaging molecular pathology such as amyloid-deposition and tau-aggregation in dementia and their current status of validation. 3) Gain insights on the clinical value of the individual available methods and their combination with regard to earlier detection, more reliable diagnosis and therapy monitoring of disease.

MSMI22C MI in Movement Disorders

Participants

Kirk A. Frey, MD, PhD, Ann Arbor, MI (*Presenter*) Consultant, MIM Software Inc; Consultant, Siemens AG; Consultant, Eli Lilly and Company; Stockholder, General Electric Company; Stockholder, Novo Nordisk AS; Stockholder, Bristol-Myers Squibb Company; Stockholder, Merck & Co, Inc; Stockholder, Medtronic, Inc

MSMI22D Clinical Translation and Approval

Participants

Peter Herscovitch, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the FDA approval process for diagnostic radiopharmaceuticals Describe the current status of CMS coverage for diagnostic radiopharmaceuticals. 2) Describe the current status of CMS coverage for amyloid PET radiopharmaceuticals and coverage with evidence development (CED).

ABSTRACT

The final steps in clinical translation of molecular imaging radiopharmaceuticals for neurological studies are approval by the U.S. Food and Drug Administration (FDA) for marketing and by insurance carriers for reimbursement. Given the age of patients most likely to require brain imaging studies for neurodegenerative disorders, coverage approval by the U.S. Centers for Medicare and Medicaid ("Medicare") is crucial. This talk will discuss the steps required that lead to FDA approval of a radiopharmaceutical, including the IND process and Phase 1, 2, and 3 clinical trials. It should be noted that FDA approval does not necessarily lead to Medicare approval, especially for PET agents. The CMS approval process will be outlined, including the increasing need to demonstrate the ability of PET imaging to provide improved health outcomes. CMS coverage with evidence development (CED) of PET amyloid imaging agents will be described.

Participants

Jonathan E. McConathy, MD, PhD, Saint Louis, MO, (mccconathyj@mir.wustl.edu) (*Presenter*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) Participants will be familiar with newer molecular imaging approaches to dementia including tracers targeting tau, alpha-synuclein, and neuroinflammation as well as simultaneous PET/MRI which is particularly well-suited to neuroimaging.

ABSTRACT

Imaging biomarkers for Alzheimer's disease (AD) and other neurodegenerative diseases are playing increasingly important roles in both research and patient care. Many neurodegenerative diseases involve the deposition of characteristic proteins including amyloid, tau, and alpha-synuclein which are target for molecular neuroimaging and potentially for therapy. Additionally, processes such as neuroinflammation appear to contribute to the pathophysiology of many neurodegenerative diseases including AD. In this talk, these newer approaches to molecular neuroimaging in dementia will be discussed including their potential clinical applications in patients with cognitive impairment and dementia.

MSMC22

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

Monday, Nov. 30 10:30AM - 12:15PM Location: S406A



AMA PRA Category 1 Credits™: 1.75
ARRT Category A+ Credits: 2.00

Participants

Pamela K. Woodard, MD, Saint Louis, MO (*Director*) Research Consultant, Bristol-Myers Squibb Company; Research Grant, Astellas Group; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Bayer AG; Research agreement, Siemens AG; Research Grant, Actelion Ltd; Research Grant, Guerbet SA; ;
Geoffrey D. Rubin, MD, Durham, NC (*Moderator*) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company;
Arthur E. Stillman, MD, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

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

Sub-Events

MSMC22A Coronary Atherosclerosis I

Participants

Geoffrey D. Rubin, MD, Durham, NC (*Presenter*) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company;

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMC22B Coronary Atherosclerosis II

Participants

Smita Patel, MBBS, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

MSMC22C Valves and Cardiac Function

Participants

Andrew J. Bierhals, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Cardiac CT can provide information on valves and function when retrospective ECG gating is used in the acquisition. These studies require extensive image post-processing to accurately depict the moving structures. This presentation will highlight basic image acquisition as well as the evaluation of normal and abnormal patients.

Slicer: 3D Interactive Visualization of DICOM Images for Radiology Applications (Hands-on)

Monday, Nov. 30 10:30AM - 12:00PM Location: S401CD

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

Sonia M. Pujol, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Ron Kikinis, MD, Boston, MA (*Presenter*) Nothing to Disclose
Kitt Shaffer, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Facilitate interpretation of DICOM images through the use of computer-assisted 3D visualization. 2) Increase the understanding of the correlation of the three dimensional relationships of the segments of the liver and lung with the surrounding vascular anatomy. 3) Introduce cutting-edge open-source computer graphics applications for Radiology.

ABSTRACT

Three-dimensional visualization of anatomy is emerging as a vital component of clinical imaging through the combined development of technological breakthroughs in Radiology hardware and increasingly sophisticated software tools for medical image analysis. For the past 10 years, the National Alliance for Medical Image Computing (NA-MIC), one of the seven National Centers for Biomedical Computing part of the NIH Roadmap for medical research, has converted some of the major scientific advances made by the biomedical imaging community into open-source software tools, contributing to increase the deployment of cutting-edge visualization techniques on a national and international scale. As part of the NA-MIC toolkit, the 3D Slicer open-source software has been developed as a technology delivery platform for clinical researchers. 3D Slicer has evolved into a multi-institution effort to share the latest advances in image analysis with the scientific and clinical community. This course is an introduction to the basics of viewing and interacting in 3D with DICOM volumes and anatomical models using 3D Slicer. The course is divided into three sections: the first part introduces the concepts of 3D visualization through an hands-on training session using an MR DICOM dataset of the brain and 3D reconstructed models of cerebral structures; the second section presents 3D models of the segments of the liver reconstructed from three clinical cases; and the third section guides the user through the exploration of the bronchopulmonary segments of the lung reconstructed from DICOM images. Interactions with 3D anatomical models are fostered by a series of radiological tasks for participants to complete for each clinical case. Detailed answers to the tasks are provided during the workshop as the instructors guide the audience through the 3D visualization settings to enhance the understanding of the complexity of the anatomical structures involved.

URL

http://www.na-mic.org/Wiki/index.php/RSNA_3D_Visualization_Course

A Practical Introduction to Structured Reporting Tools and Resources

Monday, Nov. 30 10:30AM - 12:00PM Location: S401AB



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

Participants

Justin Kirby, Bethesda, MD (*Presenter*) Stockholder, Myriad Genetics, Inc
Pattanasak Mongkolwat, PhD, Bangkok, Thailand, (pmongkolwat@gmail.com) (*Presenter*) Nothing to Disclose
Daniel L. Rubin, MD, MS, Palo Alto, CA (*Presenter*) Nothing to Disclose
David A. Clunie, MBBS, Bangor, PA (*Presenter*) Owner, PixelMed Publishing LLC
Andriy Fedorov, PhD, Boston, MA, (andrey.fedorov@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the advantages of using structured data capture tools for research at your institution. 2) Learn how RSNA Radlex and other popular lexicons can help reduce ambiguity in your data. 3) Learn about tools leveraging the National Cancer Institute's Annotation Imaging and Markup (AIM) format for reporting radiologist observations and quantitative image analysis results. 4) Learn about tools leveraging DICOM for reporting quantitative image analysis results.

ABSTRACT

Institutions across the world are sitting on a potential gold mine of imaging-related information about their patients, but many are unable to make use of it. Structured reporting helps address this problem by leveraging standardized lexicons and case report forms to extract meaningful information from images and enable easy reuse of the resulting data. A number of initiatives have been developed by academic institutions, governments, and other organizations in order to help promote the broader use structured reporting in clinical imaging research. This course seeks to convey a basic understanding of structured reporting concepts and a summary of available tools and resources. Participants should leave the course with a knowledge of which tools/resources will best suit their needs and how to get started with using them.

Honored Educators

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

Daniel L. Rubin, MD, MS - 2012 Honored Educator
Daniel L. Rubin, MD, MS - 2013 Honored Educator

SSC08

Neuroradiology (Traumatic Brain Injury)

Monday, Nov. 30 10:30AM - 12:00PM Location: N226



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

 Discussions may include off-label uses.

Participants

Pratik Mukherjee, MD, PhD, San Francisco, CA (*Moderator*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company;
Michael M. Zeineh, PhD, MD, Stanford, CA (*Moderator*) Research funded, General Electric Company

Sub-Events

SSC08-01 The Association between Football Exposure, Position, and Concussion History on White Matter Integrity

Monday, Nov. 30 10:30AM - 10:40AM Location: N226

Participants

Allen A. Champagne, BS,BA, Chapel Hill, NC (*Presenter*) Nothing to Disclose
Michael D. Clark, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Feng Shi, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Dinggang Shen, PhD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Kevin Guskiewicz, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Diffusion tensor imaging has emerged as an important tool for quantitative analysis of white matter (WM) integrity following sport-related concussion. The primary purpose of this project was to investigate the variances in WM integrity in retired college and professional football athletes based on concussion history, duration of playing career, and playing position.

METHOD AND MATERIALS

32 former college and 31 former professional players were matched on age, concussion history, and playing position. All subjects were cognitively normal for age on a battery of neuropsychological tests. MRI scans were obtained and all diffusion-weighted images were analyzed using Tract Based Spatial Statistics. Our primary outcomes were fractional anisotropy (FA) and mean diffusivity (MD). A permuted, voxel-wise 3x2 ANOVA was performed on the WM skeleton to investigate the main and interaction effects of three fixed variables on WM integrity. These variables were concussion history (3+ vs. 0-1), football exposure (College vs. Professional), and playing position (Speed vs. Non-speed). Threshold-free cluster enhancement was used to identify clusters of significantly different FA or MD and post-hoc univariate analyses were used to determine the direction of interaction effects. Our a priori α was set at 0.05 after correction for multiple comparisons.

RESULTS

Three clusters in the forceps minor and genu of the corpus callosum were identified as having significant differences in FA for the concussion by position interaction. Post-hoc analysis of the peak voxels within each of the three clusters revealed consistently lower FA for non-speed players with 3+ concussions as compared to those with 0-1 concussions (Cohen's d : 0.89, 0.95, and 1.29; $P < 0.05$). No other main effects or interaction effects were observed for FA or MD.

CONCLUSION

Our results suggest a history of multiple concussions is associated with lower FA in former non-speed position players compared to speed players, particularly in frontal white matter tracts. Additionally, we did not observe main or interaction effects of football exposure, suggesting that without concussive injuries, added football exposure does not account for variances in FA or MD. A limitation of these results is the lack of a control group without history of football participation.

CLINICAL RELEVANCE/APPLICATION

Multiple concussions and playing a non-speed position are associated with lower FA in frontal white matter tracts.

SSC08-02 Reduced Cerebral Blood Flow Detected after Clinical Recovery in Acute Sports-related Concussion

Monday, Nov. 30 10:40AM - 10:50AM Location: N226

Participants

Yang Wang, MD, Milwaukee, WI (*Presenter*) Research Grant, Siemens AG; Research Grant, General Electric Company
Lindsay D. Nelson, PhD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Ashley A. LaRoche, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Adam Y. Pfaller, BS, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Andrew S. Nencka, PhD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Michael A. McCrea, PhD, Milwaukee, WI (*Abstract Co-Author*) Research Grant, General Electric Company

PURPOSE

Sport-related concussion (SRC) is a major health problem, affecting millions of people each year. While the clinical effects of SRC (e.g., symptoms and impairments in neuropsychological functioning) typically resolve within several days, increasing evidence suggests persistent neurophysiological abnormalities beyond the point of clinical recovery after injury. This study was aimed to evaluate cerebral blood flow (CBF) changes in acute SRC, as measured using advanced arterial spin labeling (ASL) MRI.

METHOD AND MATERIALS

We compared CBF maps assessed using 3D pCASL (pseudo continuous ASL) MRI in 18 concussed football players (age 17.8 ± 1.5 years) obtained within 24 hours and at 8 days after injury, in comparison to a control group of 19 matched non-concussed football players at the same interval. Clinical assessments including the Sport Concussion Assessment Tool 3 (SCAT3) and Standardized Assessment of Concussion (SAC) were obtained at each time point.

RESULTS

While the control group did not show any changes in CBF between the two time points, concussed athletes demonstrated a significant decrease in CBF at 8 days relative to 24 hours ($p < 0.01$, FWE corrected). Moreover, scores on the clinical symptom (SCAT3) and cognitive (SAC) measures demonstrated significant impairment (versus pre-season baseline levels) at 24 hours (SCAT $p < 0.0001$, SAC $p < 0.01$) but returned to baseline levels at 8 days.

CONCLUSION

Our preliminary results suggest that advanced ASL MRI method might be useful for detecting and tracking the longitudinal course of underlying neurophysiological recovery from concussive injury.

CLINICAL RELEVANCE/APPLICATION

Abnormal CBF was found using 3D pCASL MRI in acute concussed patients even after clinical recovery, which might have important implication for clinical decisions on return-to-play after concussion.

SSC08-03 Abnormal Radial Diffusivity Predicts Worse Cognitive Function One Year Following Concussion (Mild Traumatic Brain Injury)

Monday, Nov. 30 10:50AM - 11:00AM Location: N226

Participants

Sara B. Rosenbaum, MD, Bronx, NY (*Presenter*) Nothing to Disclose
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Margo Kahn, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Hannah Scholl, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Jennifer Provataris, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Craig A. Branch, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Abnormally low FA is related to worse cognitive outcomes in concussion (mild traumatic brain injury; mTBI). Some studies demonstrate that diffusion perpendicular to the principal direction of the diffusion tensor, or radial diffusivity (RD), may largely drive changes in FA, reflecting more severe transaxonal pathology such as axotomy. The purpose of this study is to examine the relationship between regional abnormalities of RD within 2 weeks of mTBI and cognitive function 1 year later.

METHOD AND MATERIALS

31 uncomplicated mTBI subjects were recruited from a local emergency center. 3T DTI was performed within 2 weeks of injury, and cognition was tested at 1 year post-injury. Voxelwise assessment was used to identify clusters of voxels demonstrating abnormally high RD ($p(\text{individual voxel}) < 0.05$, $p(\text{cluster size corrected for multiplicity}) < 0.01$) in each subject by comparing each subject to a cohort of 40 healthy controls. Each subject was then classified according to presence or absence of abnormally high RD within the following regions: left frontal, right frontal, left temporal, right temporal and corpus callosum. T-tests were used to compare cognitive outcomes between subjects with or without abnormally high RD in each region.

RESULTS

Subjects with abnormally high RD in the left temporal and right temporal lobe performed worse on tasks of executive function at 1 year ($t(18) = -2.607$, $p = 0.018$ and $t(18) = -2.495$, $p = 0.023$, respectively). There were no significant differences in cognitive function between those with and without abnormally high RD in the frontal lobes or corpus callosum.

CONCLUSION

Abnormally high RD in the temporal lobes within two weeks of injury is significantly associated with worse executive function 1 year following uncomplicated mTBI. RD, a putative imaging correlate for transaxonal injury, may reflect more severe early axonal or myelin pathology, which heralds persistent deficits in mTBI patients.

CLINICAL RELEVANCE/APPLICATION

These preliminary findings suggest that RD might provide an early imaging biomarker for worse long-term outcomes in mTBI, to guide patient management and inform treatment trials.

SSC08-04 Diffusion Tensor MRI Reveals Gender-based Risk for Traumatic Brain Injury in Soccer Players

Monday, Nov. 30 11:00AM - 11:10AM Location: N226

Participants

Eva Catenaccio, BA, Bronx, NY (*Presenter*) Nothing to Disclose
Roman Fleysher, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
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Liane Hunter, BA, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
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Walter Stewart, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Michael L. Lipton, MD, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Female athletes are thought to be at increased risk for sports-related mild traumatic brain injury (mTBI) and worse mTBI outcomes, relative to males. Heading in soccer represents a source of repetitive subconcussive head impacts. Previous research shows that heading exposure above a threshold of approximately 1000 headers/year is associated with microstructural brain damage (lower fractional anisotropy; FA) detectable on diffusion tensor imaging (DTI). This study assesses the role of gender as a predictor of mTBI-associated changes in white matter in a cohort of amateur soccer players.

METHOD AND MATERIALS

Forty-one females and 41 age- and education-matched males (ages 18-52) were drawn from an ongoing longitudinal study of mTBI in amateur soccer players. Number of prior concussions and frequency of heading in the prior 12 months was quantified. Subjects underwent 3.0T DTI. After registration to the Johns Hopkins University template, we analyzed the results with a voxelwise general linear model with 3 predictors of interest: (1) gender to assess baseline gender differences in FA, (2) reported heading to assess heading-related declines in FA and (3) a term representing the interaction of gender and heading to assess for gender-dependent sensitivity to heading. Nuisance covariates for the analysis included age, education, and number of prior concussions. Significance was determined by a statistical threshold of $p < 0.01$ and a cluster size of 100 voxels.

RESULTS

The analysis revealed regions showing statistically significant effects from all 3 predictors of interest in the bilateral corona radiata and right frontal lobe white matter, in which (1) women had lower baseline FA, (2) where both genders showed heading-related declines in FA and (3) where there was a differential gender-based sensitivity to heading-related changes in FA.

CONCLUSION

Our finding of significant overlapping changes in white matter abnormalities may indicate that baseline sexual dimorphisms in brain microstructure are the basis for a gender-specific response to repetitive trauma. Future work should focus on associating these imaging findings with gender-specific clinical outcomes.

CLINICAL RELEVANCE/APPLICATION

Gender-based vulnerability of amateur athletes to TBI pathology, revealed through DTI, may provide new bases for the development and implementation of preventive interventions.

SSC08-05 Quantitative Assessment of Optic Nerve Injury Longitudinally Using Manganese-enhanced MRI

Monday, Nov. 30 11:10AM - 11:20AM Location: N226

Participants

Jun Yang JR, BA, Kunming, China (*Presenter*) Nothing to Disclose
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qing q. Li, Kunming, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate manganese (Mn²⁺)-enhanced MRI (MEMRI) in a longitudinal quantitative study of rat optic nerve injury.

METHOD AND MATERIALS

Forty Sprague Dawley rats were divided into 3 groups: Group A / with manganese-enhanced MRI (n=15), Group B / with retrograde labeled fluoro-gold and pathology (n=15), and control group C (n=10). Group A and B were underwent left optic nerve crush (ONC) at 2mm back to the eyeball. Using fluoro-gold from superior colliculus and lateral geniculate nucleus to retrograde label RGCs was performed before ONC 7days. A total of 3 mL of 90 nmol MnCl₂ was unilaterally injected into the vitreous body 24h before MRI. MEMRI (group A) and retinal ganglia cells (RGCs) count (group B) were performed at 3, 7 and 14 day-post-lesion (dpl). Each 5 rats in group C were underwent the same process as group A and B respectively, but no ONC. The contrast-to-noise ratio (CNR) of retina and optic nerve, the results of RGCs count were compared between groups at different time points.

RESULTS

In the control groups, the intact visual pathway, from the retina to the contralateral superior colliculus, was visualized by MEMRI. The overall impression of ONC group at the different time point (3, 7, 14dpl) after the injury was that Mn²⁺ enhancement was seen in the retina and ON proximal to the lesion site. No Mn²⁺ enhancement was observed distal to the lesion site at 3, 7 and 14 dpl. The Mn²⁺ enhanced signal was reduced from 3dpl to 14dpl in the ON proximal to the lesion site. In the ONC group at 3dpl, there was an increased Mn²⁺ signal in the ON proximal to the lesion site compared to that seen in the control group ($P < 0.05$), while no signal was detected distal to the ONC. At 7 and 14dpl, the Mn²⁺-enhanced signal was decreased significantly in the ON proximal to the crush site, compared to the signal observed at 3dpl ($P < 0.05$). The RGCs drop rate was 6.84%, 45.31%, and 72.36% at 3dpl, 7dpl and 14dpl, respectively. The apoptosis of RGCs was most obvious after ONC at 14dpl.

CONCLUSION

MEMRI in the rat optic injury has a certain value in vivo experimental research, it can be used to observe the structure and function changes of optic nerve after injury. It is possible to detect the severity of the optic nerve by MEMRI examination.

CLINICAL RELEVANCE/APPLICATION

It is possible to use MEMRI to monitor the severity of the optic nerve injury in human by injecting micro-MnCl₂ in the future.

SSC08-06 'Black Dipole' or 'White Dipole': Using Susceptibility Phase Image to Differentiate Cerebral Microbleed from Intracranial Calcification

Monday, Nov. 30 11:20AM - 11:30AM Location: N226

Participants

Ying Jeng, MD, New Taipei City, Taiwan (*Presenter*) Nothing to Disclose
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Ying-Chi Tseng, MD, Kaohsiung, Taiwan (*Abstract Co-Author*) Nothing to Disclose
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David Y. Chen, MD, New Taipei City, Taiwan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of the study was to evaluate the role of susceptibility phase image in differentiation of cerebral microbleed (CMB) from intracranial calcification.

METHOD AND MATERIALS

The study was conducted upon 21 patients who received both brain CT and MRI within 3 days after acute infarct. MRI was performed in a 3T scanner, with susceptibility weighted angiography (SWAN) and susceptibility phase image generated from SWAN. Lesions that were 1) black, 2) round or ovoid, 3) less than 5 mm in SWAN were included. Two radiologists independently categorized each lesion, based on the SWAN phase image, into six axial patterns (1: total black, 2: total white 3: black with white core, 4: white with black core, 5: heterogenous black, 6: heterogenous white) and two coronal patterns (1: black dipole, 2: white dipole). Agreement of phase pattern was determined, including kappa statistics. Each lesion was interpreted as CMB or calcification based on coronal (pattern1 as CMB; 2 as calcification) and axial (pattern 1,3,5 as CMB; 2,4,6 as calcification) phase image respectively. In all the cases, CT was used as the gold standard for the presence/absence of calcification.

RESULTS

A total of 141 lesions were included. 60, 15, 17, 5, 32, 12 lesions were classified into axial phase pattern 1, 2, 3, 4, 5, 6, respectively, while 97 and 44 lesions into coronal phase pattern 1 and 2, respectively. The interobserver agreement was perfect ($\kappa = 1$) in coronal pattern, while moderate ($\kappa=0.73$; 95% CI, 0.65-0.81) in axial pattern. CT confirmed 97 lesions as CMBs and 44 as calcifications. The sensitivity and specificity for detecting calcification were 91.8% and 54.6% for axial phase image and 99.0% and 93.2% for coronal phase image. Among lesions < 2mm, the sensitivity and specificity for detecting calcification increased to 97.3% and 80.0% for axial phase image, while 88.3% and 47.1% among lesions > 2mm.

CONCLUSION

Coronal phase image better demonstrated the susceptibility property of the paramagnetic CMBs as black dipoles, which expanded along the direction of the main magnetic field, and the diamagnetic calcifications as white dipoles, with higher diagnostic accuracy than axial phase image.

CLINICAL RELEVANCE/APPLICATION

The ability of susceptibility phase image to differentiate cerebral microbleed from calcification in MRI study is gaining clinical importance, especially in patients with cerebrovascular disease.

SSC08-07 Correlation between Optic Nerve Sheath Diameter Measured Using Computed Tomography and Marshall's Scale in Adult Patients with Acute Traumatic Brain Injury

Monday, Nov. 30 11:30AM - 11:40AM Location: N226

Participants

Haider N. Al-Tameemi, MBBCh,MD, Al-Najaf, Iraq (*Presenter*) Nothing to Disclose
Sattar R. Al-Esawi, MBChB, PhD, Najaf, Iraq (*Abstract Co-Author*) Nothing to Disclose
Ali Alyassari, Al-Dywania, Iraq (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the correlation between ONSD measurements using CT scan with the severity of TBI according to Marshall's scoring system.

METHOD AND MATERIALS

A cross-sectional analytic study was conducted on 60 adult patients (52 males, 8 females) with acute TBI referred by the neurosurgeon for brain CT examination over period of 8 months between February 2014 and September 2014. Children (<18 years), patients with orbital pathology and orbital trauma were excluded. After initial general evaluation of brain CT images, the score of TBI was assessed according to Marshall's scale (I to VI). The transverse ONSD of both right and left sides was then manually measured on axial CT image at 3mm distance behind eye globe. Statistical analysis was done using scientific package of social statistics (SPSS) with the correlation was considered significant if P value less than 0.05. The Institutional Ethical Review Committee approved the study.

RESULTS

The means of all, right-sided and left-sided ONSD were 4.695mm, 4.606mm and 4.785mm respectively. There was statistically significant and a strongly positive linear correlation (p value <0.001, r = 0.662) between the mean of ONSD measured by CT scan and Marshall's score. When the ONSD measurements of the right and left sides were analyzed separately, the correlation was also significant and strongly positive (p value <0.001, r = 0.504 for the right side and p value <0.001, r = 0.699 for the left side). ONSD showed weakly negative and statistically not significant correlation (p value = 0.571, r = - 0.075) with the duration between onset of the trauma and time of CT examination. There was no significant difference between mean ONSD measurements when correlated with the laterality of TBI, age or gender (p values 0.392 0.328 and 0.462 respectively)..

CONCLUSION

ONSD measured on CT scan is strongly correlated with the severity of TBI as assessed by Marshall's scale. Because Marshall's scale has prognostic implication, ONSD may also have a prognostic value during assessment of patients with TBI.

CLINICAL RELEVANCE/APPLICATION

Measurement of ONSD using CT scan is correlated with higher scores of Marshall's classification of acute TBI and may be an indirect indicator of raised ICP. It is recommended to be included in the routine evaluation of patients with acute TBI.

SSC08-08 Cortical Thickness Analysis in Patients with Mild Traumatic Brain Injury

Monday, Nov. 30 11:40AM - 11:50AM Location: N226

Participants

Yadi Li, New York, NY (*Presenter*) Nothing to Disclose
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Thomas Thesen, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sohae Chung, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yvonne W. Lui, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It is known that brain atrophy can occur after traumatic brain injury (TBI) including changes in cross-sectional and longitudinal cortical thickness which have been documented in moderate to severe TBI patients. Alterations in cortical thickness after mild traumatic brain injury (mTBI) have not been previously examined. The purpose of this study is to investigate longitudinal changes in cortical thickness in mTBI patients from average 22 days to 1 year after injury and compare to controls.

METHOD AND MATERIALS

Sixteen patients with mTBI and 16 matched control subjects were enrolled. Longitudinal and cross-sectional cortical thickness group analysis was performed on T1WI-3D-MPRAGE images obtained at 3.0Tesla using Freesurfer. A statistical threshold of $p < 0.001$ was used following which clusterwise correction for multiple comparisons was applied. Z-score analyses were also done to assess individual differences in cortical thickness at both time-points.

RESULTS

The longitudinal analysis of mTBI subjects yielded a decrease in cortical thickness over the 1st year in the following areas: superior temporal gyrus, precentral gyrus, precuneus, etc. on the left; calcarine sulcus, parieto-occipital sulcus, inferior parietal lobule, middle occipital gyrus, etc. on the right. There was increased cortical thickness in the right temporal pole. The cross-sectional analysis showed greater cortical thickness in the mTBI group compared with normal controls at the 1st scanning in precentral gyrus, postcentral gyrus, supramarginal gyrus, paracentral gyrus, etc. bilaterally; superior temporal gyrus, middle temporal gyrus on the right; inferior temporal gyrus on the left. Right superior parietal gyrus demonstrated decrease in cortical thickness. None of these differences survive clusterwise multiple comparisons correction. Comparing to controls, Z-score analysis showed scattered differences in cortical thickness across individual patients at both 1st and 2nd scanning without definite consistent pattern.

CONCLUSION

The uncorrected pilot data suggest areas with predominantly decrease in cortical thickness of patients in the first year after mTBI; however, at the 1st scanning there is a trend towards areas of greater cortical thickness compared with controls. This could be due to a transient conformational change in regional thickness such as evolving gliosis or edema. There is, however, no clear pattern of cortical thickness change observed after multiple comparisons correction. Groupwise analysis insensitivity to morphometric alterations in this cohort may be due to heterogeneity of injury as is supported by variable differences seen after Z-score analysis.

CLINICAL RELEVANCE/APPLICATION

Cortical thickness analysis is helpful in detecting subtle morphometric changes of brain trauma.

SSC08-09 Small Traumatic Subarachnoid Hemorrhages: Is Routine ICU Admission Necessary?

Monday, Nov. 30 11:50AM - 12:00PM Location: N226

Participants

Paul J. Albertine, BA, MD, Washington, DC (*Presenter*) Nothing to Disclose
Samuel Borofsky, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Derek Brown, MS, Washington, AR (*Abstract Co-Author*) Nothing to Disclose
Smita Patel, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Woojin Lee, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Anthony Caputy, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
M. Reza Taheri, MD, PhD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Traumatic subarachnoid hemorrhages (tSAH) are a common type of intracranial hemorrhage that occurs in the setting of acute traumatic brain injury (TBI). It is estimated that more than 1.5 million Americans suffer from a TBI per year resulting in over 300,000 hospital admissions and an estimated financial cost of 17 billion dollars. In our current clinical setting, any form of intracranial hemorrhage requires both neurological consultation and mandatory observation in an intensive care unit for close neurological monitoring. It has been suggested that the clinical impact of these small subarachnoid hemorrhages may be minimal; however, few studies exist that compare the size of a subarachnoid hemorrhage with patient outcome and rates of medical and neurological decline.

METHOD AND MATERIALS

This retrospective cohort study is based on 63 patients evaluated between 2011-2014 who presented to a Level I trauma center emergency room for acute traumatic injuries that were found to have tSAH on CT examination. Results were obtained through medical records and imaging results. Blood volumes of the subarachnoid hemorrhages were evaluated using Fisher, Modified Fisher and Claassen classification systems. Data gathered on the hospital course included several neurological and medical complications that have been associated with tSAH. Information regarding patient outcomes was based chart review.

RESULTS

Of the 63 total patients, 33 (52%) patients had low-grade tSAH which were classified as Fisher grade ≤ 2 , 40(63%) Modified Fisher grade ≤ 2 , and 41(65%) Claassen grade ≤ 2 . None of these patients with low-grade tSAH demonstrated neurological decline, medical decline, or seizures while they were hospitalized (all findings are significantly lower [$p < .05$] when compared to the patients with higher grade tSAH). Patients with low grade tSAH had significantly shorter stays in the ICU ($p < .05$) and better clinical outcome

based on GOS compared to the other patients ($p < .01$).

CONCLUSION

In this study, none of the patients with small low-grade tSAH demonstrated neurological decline, seizures, or medical decline during their hospitalization. All of these patients spent significantly less time in the intensive care unit and had good clinical outcomes.

CLINICAL RELEVANCE/APPLICATION

Patients with small low-grade tSAH rarely experience medical decline, neurological decline or seizures as a result of their injuries and may not necessitate intensive care unit admission.

SSC06

Informatics (Image Processing and Analysis)

Monday, Nov. 30 10:30AM - 12:00PM Location: S402AB

IN

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

FDA

Discussions may include off-label uses.

Participants

Asim F. Choudhri, MD, Memphis, TN (*Moderator*) Nothing to Disclose
Sri Tridandapani, MD, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSC06-01 Radiogenomics Mapping of Non-Small Cell Lung Cancer Identifies Prognostic Relationships between Semantic Image Features and Metagenes Captured Using RNA Sequencing

Monday, Nov. 30 10:30AM - 10:40AM Location: S402AB

Participants

Olivier Gevaert, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Sandy Napel, PhD, Stanford, CA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc
Sebastian Echegaray, MS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Amanda Khuong, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Chuong D. Hoang, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
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Ann N. Leung, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To build a radiogenomic map linking RNA sequencing data with semantic image features for non-small cell lung cancer patients for non-invasive precision medicine.

METHOD AND MATERIALS

Under IRB approval, we studied 81 cases of NSCLC who had preoperative CT scans and tumor tissue collected between 4/7/2008 and 09/15/2014 at two medical centers. A radiologist annotated the CT of each tumor with semantic image features using a template with a controlled vocabulary. Next, total RNA was extracted from these tissue samples and converted into a library for paired-end RNA sequencing on Illumina HiSeq. The RNA sequencing data were summarized into 56 high quality metagenes and filtered for metagene homogeneity in five external gene expression cohorts totaling 1227 NSCLC patients. We built a radiogenomics map between metagenes and semantic image features by using Significance Analysis of Microarrays (SAM) analysis including multiple testing corrections using the False Discovery Rate (FDR). We correlated the metagenes with clinical outcome using Cox proportional hazards modeling in the five external cohorts to establish the prognostic relationship of each metagene.

RESULTS

We focused on the top ten metagenes with the highest cluster homogeneity in five external cohorts and correlated them with 89 semantic image features. We found 48 significant associations (Q-value <0.05) defining a radiogenomics map between semantic features and molecular pathways. These metagenes capture intriguing pathways including early and late cell cycle, the T-cell immune response and hypoxic inflammation and link these with semantic image features capturing emphysema severity. Similarly the LRRIG1-EGF pathway defines peripheral ground glass lesions that have a high proportion of airway abnormalities or an internal air bronchogram. Six of these metagenes are significantly correlated with prognosis in five external cohorts. The most prognostic metagene contains genes related to extra-cellular matrix processing and is significantly correlated with spiculated margins.

CONCLUSION

We defined ten high level metagenes capturing canonical pathways of NSCLC and linked them with a large collection of semantic image features realizing a radiogenomics map for NSCLC.

CLINICAL RELEVANCE/APPLICATION

Semantic image features mirror molecular properties of NSCLC with prognostic implications.

SSC06-02 Prenatal Computer-Aided Diagnosis of Craniosynostosis Using Shape Analysis

Monday, Nov. 30 10:40AM - 10:50AM Location: S402AB

Participants

Jie Ying Wu, Providence, RI (*Presenter*) Nothing to Disclose
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Stephen Carr, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Derek Merck, Barrington, RI (*Abstract Co-Author*) Nothing to Disclose
Margaret M. Byrne, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Olivia E. Linden, BA, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
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Helena O. Taylor, MD, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

Background

Craniosynostosis is the premature fusion of cranial sutures, affecting approximately 1/2500 births. Surgical correction within first year of life generally leads to the best outcomes, so early detection is helpful for treatment planning. It is typically diagnosed during post-natal clinical examination secondary to the abnormal head shape. Some studies show that craniosynostosis is detectable on prenatal ultrasound (US), but a systemic, clinical screening methodology remains elusive.

Evaluation

Our goal is to quantitatively evaluate prenatal US to determine whether children with craniosynostosis can be identified in utero. We collected prenatal US images from 22 children with a CT-confirmed post-natal diagnosis, as well as 22 age-matched controls. On the standard cross-sectional image used to measure biparietal diameter, we manually measured the vectors to the outer cortex at every 10°. We normalized the lengths to correct for overall skull size. Using principal component analysis, we found the 6 principal directions and discarded the rest to reduce measurement noise. We train two machine learning algorithms, support vector machine and random forest, with these 6 parameters and the known diagnosis. Testing with leave-one-out cross-validation, we obtained 89% and 84% accuracy, and 95% and 86% specificity respectively. Sensitivity was 82% for both. For comparison, two blinded craniofacial surgeons scored each image as normal, or synostotic.

Discussion

We present a reliable tool for quantitatively assessing prenatal US images for craniosynostosis. The surgeons' accuracies were 40-50%, compared to the program's 89%. Our program can identify suspected cases for more dedicated imaging, and prenatal counseling. Since we collected the images routinely, and reviewed them retrospectively, our methodology can easily be integrated into the current clinical pipeline.

Conclusion

Our results show that a formal shape analysis of prenatal US identifies craniosynostosis with high accuracy. With more training cases and further refinement of the procedure, we hope to include this as a standard routine in the clinic. Future work includes automatic detection of skull boundary and radii measurement.

SSC06-03 A Novel 3D User Interface with 6 Degrees of Freedom for Analysis of Volumetric Computed Tomographic Images: A Pilot Study Evaluating Feasibility and Efficiency in the Diagnosis of Pulmonary Embolism

Monday, Nov. 30 10:50AM - 11:00AM Location: S402AB

Participants

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Michael Teistler, PhD, Flensburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Pattanasak Mongkolwat, PhD, Bangkok, Thailand (*Abstract Co-Author*) Nothing to Disclose
Ian Murphy, MBBCh, MRCS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Jeremy D. Collins, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Background

The aim of this pilot study is to evaluate the clinical utility of a novel 3D user interface approach that provides 6 degrees of freedom (6 DOF) input with the help of a motion sensitive game controller for evaluation of pulmonary embolism at computed tomography angiography (CTA).

Evaluation

Retrospective analysis of 36 patients (13M,23F; mean age 53+/-13 yrs) referred for CTA to rule out PE over one year. 11 of 36 patients had PE. The 6DOF tool was used to create on-the-fly oblique reformations and compared to conventional Radiology PACS with multiplanar reformatted images (MPR) and advanced visualization workstation with real-time MPR manipulation capabilities (Vitrea, Vital Images, Minneapolis, MN). Time to diagnosis and diagnostic confidence were recorded separately for each interface by a single observer starting with the 6 DOF tool. A second observer used the 6 DOF tool on two occasions 3 weeks apart. The final radiologic report was considered the gold standard. Time to diagnosis was compared using a Wilcoxon rank sum test comparing the 6 DOF tool, PACS, and 3D post-processing software (Vitrea). A two-tailed t-test was used to compare times recorded by the second observer.

Discussion

The 6 DOF tool enabled review of all datasets and detection of all PE. There was a temporal advantage of the 3D tool (41.7+/-15.6 s) over standard PACS (83.9+/-30.7 sec, $p<0.05$) and 3D post-processing software (66.6+/-17.7 s, $p<0.05$). There was a significant reduction in time to diagnosis by the second reviewer upon second attempt (46.26+/-27.1 s, improving to 36.47+/-18.8 s, $p<0.05$). Diagnostic confidence was similar among the different viewing interfaces.

Conclusion

The novel 6DOF technology has the ability to save time in CT diagnosis of PE without compromising diagnostic confidence. Time to diagnosis is further improved with repeated use of the tool. Applications of the new 3D user interface tool are not limited to CT angiography and include any volumetric cross-sectional data sets. This may be useful in reducing the burden of reformats on PACS and improve clinical throughput. Potential applications include teaching anatomy, procedural planning, and interrogation of large time-resolved volumetric data.

SSC06-04 A New Saliency Metric for Precise Denoising PET Images for Better Visualization and Accurate Segmentation

Monday, Nov. 30 11:00AM - 11:10AM Location: S402AB

Participants

Nasim Souly, Orlando, FL (*Presenter*) Nothing to Disclose
Georgios Z. Papadakis, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Uygar Teomete, MD, Miami Beach, FL (*Abstract Co-Author*) Nothing to Disclose
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Background

Our purpose in this study is to design an automated, accurate, robust, and efficient image denoising and algorithm for PET images in diagnostic tasks. For this purpose, we define a new metric for saliency definition in PET imaging. Existing denoising methods take a few hours for a single PET volume if optimal results are desired. Briefly, saliency definition aims to detect the regions of an image that stands out from the rest of the image. Hence, those regions are considered redundant. First, we build pyramids of the image with different resolution and contrast map. Then, we use a sliding window across the image and compute the Euclidean distance of each pixel from its neighbor in the window. Next, for each pixel, by accumulating the distances to all pixels in the neighborhood, a contrast value is obtained. Finally, all contrast maps are combined to form the denoised images. We retrospectively analyzed 20 PET-CT images of NEMA phantoms where ground truths are available as CT correspondence.

Evaluation

We compared our method with the state of the art non-local means based denoising method and have observed that there is no statistically significant difference (via t-test) in terms of SNR, relative contrast ratio, and measured SUV levels. On average, more than 30% improvement was observed in SNR, and 100% of SUVmax was preserved at the end of denoising. While the state of the art method produces a denoised PET image within 3-4 hours on average, our method produces the same/similar quality images only in seconds. Figure 1 shows improvement of the PET images for a given phantom image.

Discussion

Confounding factors such as noise should be removed from the PET images for (1) better visualization and (2) more accurate quantification. Our proposed method removes noise from PET images and simplifies the segmentation and quantification of radiotracer uptake regions only within seconds as opposed to standard methods that may take hours.

Conclusion

The proposed comprehensive automated algorithm helps to achieve better quantification of PET images in an efficient and robust manner. It provides an effective tool (saliency metric) for PET image enhancement.

SSC06-05 Applying Deep Machine Learning Algorithms for Automated Detection of Abnormalities on Chest Radiographs

Monday, Nov. 30 11:10AM - 11:20AM Location: S402AB

Participants

Mark D. Cicero, Toronto, ON (*Presenter*) Co-founder, 3BC Inc
Taha Bandukwala, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Timothy R. Dowdell, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Joe J. Barfett, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Kuhan Perampaladas, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

Background

Since 2011, deep learning algorithms have been gaining more attention within the machine learning community, as their success rates on certain recognition tasks have been competitive with humans. In 2012, researchers from the University of Toronto trained a deep convolutional neural network (CNN) using the largest tagged dataset available, ImageNet, which consists of 15 million high-resolution images tagged in over 22,000 categories. They achieved object recognition top-1 and top-5 error rates of 37.5% and 15.3% respectively.

Evaluation

We trained a convolutional neural network with 10,000 chest radiographs which were tagged as either normal (absence of any clinically relevant pathology) or abnormal based on the final radiology report. This was performed using a single 2 GB nVidia GTX 770 graphics processing unit (GPU) and an open-source deep learning software package (convnet). The performance of the neural network was tested using an untrained dataset consisting of 500 radiographs and characterized using receiver-operating curve analysis at different output probability thresholds. It achieved a maximum sensitivity of 95% with a corresponding specificity of 85%.

Discussion

Advancements in machine learning have been possible due to improvements in computation power through the use of GPUs and the access to large quantities of data. The current success and future developments of these algorithms will have a profound effect on the interpretation of medical images. We have proven that with adequate data, these algorithms can be used to help automate and speed up medical diagnosis. With more data, we expect further improvement in performance. Furthermore, more experimentation is required to determine if diagnostic subcategories could be classified with this same approach.

Conclusion

Convolutional neural networks can be trained using a modestly sized medical dataset to screen chest radiographs as normal or abnormal. Deep learning will play an integral role in advancing computer-aided diagnosis which will enhance and speed up the workflow of the radiologist. Further experimentation is required using larger datasets as well as different types of imaging studies.

SSC06-06 Computer-aided Diagnosis of Ground Glass Opacity Lung Nodules: Quantitative Analysis of 248 Nodules

Monday, Nov. 30 11:20AM - 11:30AM Location: S402AB

Participants

Ming Li, MD, ShangHai, China (*Abstract Co-Author*) Nothing to Disclose
Vivek Narayan, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Maria F. Barile, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ritu R. Gill, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Raphael Bueno, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Clare M. Tempany-Afdhal, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jayender Jagadeesan, PHD, Boston, MA (*Presenter*) Research Grant, Siemens AG

Background

Lung adenocarcinoma's new classification is based on histologic criteria. There is a need to develop image-based classification of GGNs into AAH, AIS, MIA and IAC. We propose a Support Vector Machine (SVM) algorithm with input as tumor heterogeneity metrics obtained from CT images to predict the lesion type.

Evaluation

Non-contrast CT (NonC) images were obtained for 248 lung nodules and loaded in 3D Slicer software, along with the corresponding pathology reports. An experienced radiologist segmented the lesions on 3D Slicer. Thereafter, using the open-source HeterogeneityCAD module in 3D Slicer, 58 quantitative metrics that describe the distribution statistics, shape, morphology, Renyi dimensions, geometrical measure and texture were obtained for each segmented lesion on the NonC. Statistical correlation of the metrics with the four classes of GGOs, determined by pathology, was performed using the Kruskal-Wallis test. A SVM based algorithm was also developed to train the algorithm and predict the lesion type based on the quantitative metrics. The accuracy of prediction of the lesion type by the SVM algorithm was compared to the classification done by two fellowship trained thoracic radiologists (Manual-class). The accuracy of differentiating between AIS and MIA, and indolent (AAH and AIS) and invasive (MIA and IAC) was determined.

Discussion

All 58 metrics showed significant difference ($p < 0.05$) between the four groups on NonC. The accuracy of classifying AIS and MIA on NonC was: SVM = 88.24%, Manual-class = 38.07%, accuracy of classifying indolent and invasive lesions was: SVM = 90%, Manual-class = 64.75%, accuracy of classifying the lesions into the four groups was: SVM = 64%, Manual-class = 44.26%. The agreement between the two expert raters for classifying the lesions into the four categories was 38.52% with a kappa of 0.1376 corresponding to slight agreement.

Conclusion

In this preliminary study, the SVM based computerized algorithm appears to demonstrate significantly higher accuracy in classifying GGOs than manual classification. This may be a useful tool to determine the lesion type on CT images and could provide accurate guidance in determining the optimal therapeutic options.

SSC06-07 Automated Classification of Spectral Quality and Metabolic Abnormality in Volumetric MR Spectroscopic Imaging Using a Web-Based Evaluation Platform

Monday, Nov. 30 11:30AM - 11:40AM Location: S402AB

Awards

Trainee Research Prize - Medical Student

Participants

James S. Cordova, BS, Atlanta, GA (*Presenter*) Nothing to Disclose
Saumya Gurbani, MS, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Gaurav Verma, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Eduard Schreibmann, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Peter B. Barker, DPhil, Baltimore, MD (*Abstract Co-Author*) Research Consultant, Olea Medical
Harish Poptani, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Hui-Kuo G. Shu, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Chad A. Holder, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Andrew Maudsley, PhD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Hyunsuk Shim, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Lee Cooper, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

Background

MR spectroscopic imaging (MRSI) is able to assess treatment response in gliomas by imaging metabolites without exogenous tracer. Whole-brain volumes can be constructed using spectral components, including choline (Cho), creatine (Cr), and N-acetylaspartate (NAA) signal. Accuracy of these volumes depends on spectral quality (SQ) with poor SQ leading to erroneous volumetry. We developed an automated method for determining SQ based on curve-fitting metrics using machine-learning methods to create a data-driven model for SQ filtering.

Evaluation

A 3D MRSI sequence at 3T was used to generate whole-brain volumetric maps with 108 mm³ resolution. A spectral analysis tool was used to review and label each spectrum as having adequate (A) or inadequate (I) SQ. MRS curve-fitting measures describing 115 features (e.g. full-width, half max values) from each spectrum were used to train a random forest classifier to determine SQ and discriminate normal tissue vs. tumor in 6243 voxels (n=7 patients) as a pilot run by one reader. Strict cross-validation was performed by training a classifier on 6 patients and evaluating on the 7th in a rotating manner. Classifier performance was evaluated using ROC analysis and feature salience was evaluated by summing split criterion over all trees in each forest.

Discussion

Pilot-study area-under-the-curve (AUC) values for classifying SQ and tumor (in A voxels) were 0.94 and 0.79 respectively. The most salient features for SQ included the Cramer-Rao bounds for Cho peak frequency and area, and the Lorentzian and Gaussian components of the NAA peak. The most salient features for tumor classification included Cho/NAA, Cho/Cr, and NAA/Cr: ratios used for tumor evaluation clinically.

Conclusion

High AUCs for SQ and tumor classification suggests training random forests with curve-fit metrics results in an accurate classifier in a small sample. A web-based spectral evaluation tool to generate consensus measures between multiple experts (3 readers per spectrum) in a randomized, double-blinded fashion is currently being developed to mitigate bias in class labeling. We will report the outcomes using 20,000 voxels (n=20 patients) reviewed by ~ 10 MR spectroscopists and/or radiologists.

SSC06-08 Predictive Modeling of Microvascular Invasion Using Triphasic Quantitative Imaging of Hepatocellular Carcinoma

Monday, Nov. 30 11:40AM - 11:50AM Location: S402AB

Participants

Olivier Gevaert, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Sebastian Echegaray, MS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Sandy Napel, PhD, Stanford, CA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc
Nishita Kothary, MD, Stanford, CA (*Abstract Co-Author*) Scientific Advisor, Siemens AG Research Grant, Siemens AG Consultant, Cook Group Incorporated

PURPOSE

To predict microvascular invasion (mVI) in patients with HCC using quantitative image features extracted from contrast-enhanced, triphasic CTs.

METHOD AND MATERIALS

We selected 29 patients with HCC who underwent surgical resection, of which, 10 demonstrated microvascular invasion, undiagnosed on pre-operative cross-sectional imaging. All patients were chemo-naive and had no prior locoregional treatment. Four independent radiologists delineated tumor margins on each phase from which 470 computational features/phase were extracted including gray-value histogram statistics and textures, sharpness of lesion boundaries, and metrics of compactness and roughness. We also computed Delta features, i.e., the absolute difference and the ratio for each feature between all pairs of the three phases. We used concordance analysis to select only features robust to inter-reader variability using Lin's concordance correlation (LCC) coefficient with a correlation threshold of at least 0.8 between readers. We evaluated our model using a combined leave-one-reader and leave-one-patient out cross validation analysis (LOR-LOO-CV), whereby we train a model based on three readers on 28 patients and test on the fourth reader annotations of the left out patient. We used the area under the ROC curve (AUC) to evaluate our models.

RESULTS

170 arterial, 295 portal-venous and 135 delayed phase features were robust against inter-reader variability. 20-45 Delta features were similarly robust for all phase combinations. Texture features and gray-value histogram statistics provided the most robust features. LOR-LOO-CV analysis showed that delta features between the arterial and venous phase were sufficient and accurate predictors of mVI (AUC 0.77, std=0.05). The top features in this model were the absolute difference between two texture features and between two histogram intensity features.

CONCLUSION

Quantitative changes of texture and intensity features between the arterial and venous phases can be used to predict mVI in HCC.

CLINICAL RELEVANCE/APPLICATION

The presence of mVI, which indicates poor prognosis and survival for patients with HCC, is undetectable by the human eye on standard imaging, and hence only determined on pathological diagnosis. Quantitative image features could provide a non-invasive method of mVI detection.

SSC06-09 Identification of Molecular Phenotypes by Integrating Radiomics and Genomics

Monday, Nov. 30 11:50AM - 12:00PM Location: S402AB

Participants

Patrick Grossmann, Boston, MA (*Presenter*) Nothing to Disclose
Olya Grove, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Nehme El-Hachem, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
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Hugo Aerts, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To uncover the mechanistic connections between radiomic features, molecular pathways, and clinical outcomes, to develop radiomic based predictors of pathway activation states in individual patients, and to assess whether combining radiomic with clinical and genomic data improves prognostication.

METHOD AND MATERIALS

We analyzed two independent lung cancer cohorts totaling 351 patients, for whom diagnostic computed tomography (CT) scans, gene-expression profiles, and clinical outcomes were available. The tumor phenotype was characterized based on 636 radiomic features describing tumor intensity, texture, shape and size. We performed an integrative analysis by developing and independently validating association modules of coherently expressed radiomic features and molecular pathways. These modules were statistically tested for significant associations to overall survival (OS), TNM stage, and pathological histology.

RESULTS

We identified thirteen radiomic-pathway association modules ($p < 0.05$), the most prominent of which were associated with the immune system, p53 pathway, and other pathways involved in cell cycle regulation. Eleven modules were significantly associated with clinical outcomes ($p < 0.05$). Strong predictive power for pathway activation states in individual patients was observed using radiomics; the strongest per module predictions ranged from an intra-tumor heterogeneity feature predicting RNA III polymerase transcription (AUC 0.62, $p = 0.03$), to a tumor intensity dispersion feature predicting pyruvate metabolism and citric acid TCA cycle (AUC 0.72, $p < 1E-6$). Stepwise combinations of radiomic data with clinical outcomes and gene expression profiles resulted in consistent increases of prognostic power to predict OS (concordance index max = 0.73, $p < 1E-9$).

CONCLUSION

This study demonstrates that radiomic approaches permit a non-invasive assessment of molecular and clinical characteristics of

This study demonstrates that radiomic approaches permit a non-invasive assessment of molecular and clinical characteristics of tumors, and therefore have the unprecedented potential to cost-effectively advance clinical decision-making using routinely acquired, standard-of-care imaging data. We show that prognostic value complementary to clinical and genomic information can be obtained by radiomic strategies.

CLINICAL RELEVANCE/APPLICATION

Advance decision-making by radiomic predictions of tumor phenotype. These predictions are complementary to clinical and genomic data, and are generated based on existing standard-of-care images.

SSC09

Neuroradiology/Head and Neck (Thyroid and Parathyroid Imaging)

Monday, Nov. 30 10:30AM - 12:00PM Location: N229



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

FDA Discussions may include off-label uses.

Participants

Laurie A. Loevner, MD, Gladwyne, PA (*Moderator*) Stockholder, General Electric Company; Stockholder, Pfizer Inc; Stockholder, Merck & Co, Inc; Stockholder, Johnson & Johnson; Stockholder, Amgen Inc; Stockholder, GlaxoSmithKline plc
Mark E. Mullins, MD, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSC09-01 The Role of Core-Needle Biopsy as a First-line Diagnostic Tool for Initially Detected Thyroid Nodules

Monday, Nov. 30 10:30AM - 10:40AM Location: N229

Participants

Chong Hyun Suh, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jung Hwan Baek, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Jun Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Kyun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the role of core-needle biopsy (CNB) as a first-line diagnostic tool for initially detected thyroid nodules.

METHOD AND MATERIALS

This observational study was approved by the institutional review board and informed consent was obtained from all patients. From October 2008 to December 2011, we evaluated 632 initially detected thyroid nodules from 632 consecutive patients who underwent CNB. CNB readings were categorized into the same six categories of the Bethesda System. Final malignant results were diagnosed after surgery or CNB. Final benign results were diagnosed by surgery, twice of benign biopsy results, or benign cytology with a stable size at one year follow-up. The incidences of non-diagnostic, inconclusive results, diagnostic performance, unnecessary surgery, and complications were evaluated. Subgroup analysis according to nodule size was performed. The risk factors of inconclusive results were evaluated by multivariate logistic regression analysis.

RESULTS

CNB achieved 1.3% of non-diagnostic and 5.9% of inconclusive results. The diagnostic accuracy, sensitivity, specificity, positive predictive value and negative predictive value for diagnosis of malignancy were 97.6%, 90.5%, 100%, 100% and 92.7%, respectively. The unnecessary surgery was 0.6% and complication rate was 0.2%. Subgroup analysis showed that diagnostic performance was not significant according to nodule size. There were no independent risk factors associated with inconclusive results.

CONCLUSION

Our study demonstrated that CNB achieved low non-diagnostic, inconclusive results and high diagnostic accuracy for patients with initially detected thyroid nodules. CNB also minimize unnecessary surgery. Therefore, CNB seems to be a promising diagnostic tool for patients with initially detected thyroid nodules.

CLINICAL RELEVANCE/APPLICATION

CNB can be an alternative to FNA for patients with initially detected thyroid nodules to minimize non-diagnostic, inconclusive results and unnecessary surgery. CNB seems to be a promising diagnostic tool for patients with initially detected thyroid nodules.

SSC09-02 Optimal Follow-up Interval and Follow-up Management of Initial Non-diagnostic Thyroid Nodules 10 mm or Larger in Size

Monday, Nov. 30 10:40AM - 10:50AM Location: N229

Participants

Hee Jung Moon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jieun Koh, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Eun-Kyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Young Kwak, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Hyun Yoon, MD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the optimal follow-up interval in initial non-diagnostic thyroid nodules 10 mm or larger on ultrasonography-guided fine needle aspiration (US-FNA).

METHOD AND MATERIALS

This retrospective study was approved by the Institutional Review Board, and informed consent was waived. A total 228 nodules were classified into the 3, 6, and 12 months groups according to when the first follow-up US was performed or the length of the

US-FNA intervals, within 3 months, from 3 to 9 months, and 9 months after initial US-FNA. Nodules were classified according to size change. US features were reassessed using the Thyroid Imaging Reporting and Data System (TI RADS). Malignancy detection rate, malignancy risk, and clinico-pathological characteristics were compared among 3, 6, and 12 months groups and according to size change.

RESULTS

Seven (3.1%) were malignant. Malignancy detection rates, extrathyroidal extension and lymph node metastasis were not significantly different among the three groups. 13 (5.7%) of 228 showed increased size at least 10.7 months after initial US-FNA. One (7.7%) of the 13 was minimally invasive follicular carcinoma without lymph node metastasis found at 63.2 months. Of 177 without change, six papillary thyroid carcinomas less than 20 mm (3.4%) were found at a mean 10.4 months. The malignancy risks of 177 nodules with TI RADS category 3, 4a, 4b, and 4c were 1.7% , 0%, 3.3%, and 21.4%. None of the 38 nodules with decreased size were malignant. and 9 months after initial US-FNA.

CONCLUSION

The follow-up of initial non-diagnostic thyroid nodules 10 mm or larger in size can be performed around 12 months with US. The decision to perform repeat US-FNA can be made based on initial and follow-up US features.

CLINICAL RELEVANCE/APPLICATION

dealing with non-diagnostic thyroid nodules) 'The follow-up of initial non-diagnostic thyroid nodules 10 mm or larger in size can be performed around 12 months with US'

SSC09-03 Radiofrequency Ablation: New Perspectives in the Treatment of Malignant and Benign Thyroid Diseases

Monday, Nov. 30 10:50AM - 11:00AM Location: N229

Participants

Rosa Cervelli, Pisa, Italy (*Presenter*) Nothing to Disclose
Salvatore Mazzeo, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Valentina Battaglia JR, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Carla Cappelli, MD, PhD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Benedetta Pontillo Contillo, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Luigi De Napoli, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Bartolozzi, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Aim of this study was to evaluate the safety and the efficacy of ultrasound-guided percutaneous RFA in the treatment of benign thyroid nodules, and in selected cases of recurrent thyroid cancers (RTC).

METHOD AND MATERIALS

This study included 40 patients: 30/40 affected by nodular goiter contraindicated to surgery; 10/40 affected by RTC and excluded from surgery/ radiometabolic therapy. Pre treatment diagnostic protocol included a CT and US examinations performed within 1month, in order to evaluate lesions' volumes.All RFA procedures were performed under US guidance by using a 18-gauge electrode, with a single 1-cm active, internally cooled, tip.Response to therapy was evaluated by means of contrast enhanced ultrasound in benign goiters (follow-up ranging from 6 to 18 months) and by means of CT in RTCs (follow-up ranging from 3 to 12 months).Mean Volume Reduction Rate (MVRR) was evaluated in respect to the pre-treatment lesions' volumes.

RESULTS

RFA was well tolerated by all patients: significant complication (permanent, laryngeal nerve lesion) was observed only in one patientsMVRR in goiters at 6, 12 and 18 months resulted to be 71,9±13,3%, 75,8±14,3% and 83,0±6,5% respectively; RCTs' MRVV at 3, 6 and 12 months were 57,2±27,5%, 82,4±13,0%, and 75,4±6,6% respectively.

CONCLUSION

All multinodular goiters showed excellent volume reduction; all patients presented a reduction of the compression symptoms.The neoplastic lesions demonstrated a good therapeutic response with slowing of disease progression.

CLINICAL RELEVANCE/APPLICATION

RFA is a reliable alternative to surgery in patients affected by benign goiter; moreover RFA might be considered as a valid approach for the debulking of RTC in non surgical cases.

SSC09-04 Sonographic and Demographical Features Associated with BRAF and RAS Mutations in the Follicular Variant of Papillary Thyroid Carcinoma

Monday, Nov. 30 11:00AM - 11:10AM Location: N229

Participants

Luzeng Chen, Boston, MA (*Presenter*) Nothing to Disclose
Manish Dhyani, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Anthony E. Samir, MD, Boston, MA (*Abstract Co-Author*) Consultant, Pfizer Inc; Consultant, General Electric Company; Consultant, PAREXEL International Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, Toshiba Corporation; Research Grant, General Electric Company; Research Grant, Samsung Electronics Co, Ltd; Research Grant, Analogic Corporation; Research support, SuperSonic Imagine; Research support, Hitachi, Ltd

PURPOSE

The follicular variant of Papillary thyroid carcinoma (FVPTC) is the second common subtype of Papillary thyroid carcinoma. FVPTC harbors two common genetic mutations; BRAF and RAS, and nodules with BRAF mutations are more aggressive. The purpose of the study was to identify demographic and US features that might be useful for differentiating BRAF and RAS positive FVPTC's.

METHOD AND MATERIALS

The data of 61 patients with > 1 cm FVPTCs diagnosed between November 2000 and April 2011 were reviewed retrospectively. The patients were divided by mutation status into 3 groups: (1) BRAF positive group, (2) RAS positive group and (3) mutation negative group. Two radiologists with more than 10 years of thyroid sonography experience reviewed the sonographic characteristics of the FVPTC nodule while blinded to the results of the genetic analysis. Ultrasound features and patient demographics were compared.

RESULTS

The BRAF mutation was detected in 16 (26.2%) patients. The RAS mutation was detected in 25 (41%) patients. Patients with RAS positive FVPTC were significantly younger than patients in the BRAF mutation group ($p=0.022$) and the no mutation group ($p=0.034$). The nodule longest dimension of the BRAF group was smaller than the RAS group ($p=0.036$) and no mutation group ($p=0.002$). An indistinct nodule border was more common in the BRAF group than in the RAS group in both radiology assessments ($p=0.002$, $p=0.002$ respectively, Kappa value 0.610, $p=0.000$). An indistinct nodule border was more common in the BRAF group than in the no mutation group too ($p=0.030$, $p=0.030$ respectively, Kappa value 0.468 $p=0.005$). One of the two Radiologists found the BRAF group to appear spiculated more commonly than the other groups (BRAF group (6/16) vs. the RAS group (0/25) $p=0.002$; BRAF group (6/16) vs. no mutation group(0/20) $p=0.004$), and one of the two Radiologists found echogenicity to be significantly lower in the BRAF group (BRAF group vs. RAS group $p=0.000$; BRAF group vs. no mutation group $p=0.007$). No significant differences were found between gender, tall/wide, halo sign, heterogeneity, calcification in nodule, or vessel in and around the nodule.

CONCLUSION

An indistinct sonographic boundary is associated with the BRAF mutation, and larger nodule size is associated with the RAS mutation in FVPTCs.

CLINICAL RELEVANCE/APPLICATION

Demography and ultrasound features may be helpful to differentiate BRAF and RAS positive in FVPTC.

SSC09-05 Role of Screening Thyroid Ultrasonography in Healthy Population and Imaging Analysis of Screening-detected Thyroid Cancer

Monday, Nov. 30 11:10AM - 11:20AM Location: N229

Participants

Jeongin Yoo, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

Sung Hee Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Objective : To evaluate the role of screening ultrasonography (US) in healthy population and analyze the US features of screening-detected thyroid cancer (SDTC).

METHOD AND MATERIALS

A total of 1845 persons participated in the study among 1923 healthy population who underwent screening thyroid US from March through August 2012 at our screening center; those who were lost to follow up ($n=60$) and those who underwent the previous operation on thyroid ($n=18$) were excluded. We evaluated detection rate of thyroid cancer and the average cost for detecting each cancer patient. (Presumed cost: \$100 for thyroid US and \$150 for fine-needle aspiration). We also analyzed the US features of screening-detected thyroid cancer.

RESULTS

Among 1845 participants 973 had benign disease (52.74 %, 63 by FNA and 910 with no change in 2 year-follow-up); 29 had thyroid cancer (1.57 %, 27 proven by FNA and 2 by surgery); 28 had PTC and 1 had follicular carcinoma. The cancer patients were predominantly women (69.0 %) and the mean age was 50.9 ± 9.825 . Imaging features that significantly differentiated malignant nodules from benign nodules were solid composition (100 % in malignant nodules), hypoechogenicity (100 %), taller than wide axis (82.8 %) and indistinct margin (86.2 %). Among 18 patients who underwent thyroidectomy, 14 (77.8 %) had pathologic tumor staging of T1 and 12 (85.71 %) had nodal staging of N0. The estimated average cost for detecting each cancer patient was \$6,838.

CONCLUSION

Screening thyroid US enables detection of early stage thyroid cancer in asymptomatic healthy population. The majority of screening-detected thyroid cancer was micropapillary carcinoma and showed solid and hypoechoic nodule on US.

CLINICAL RELEVANCE/APPLICATION

The majority of screening-detected thyroid cancer was micropapillary carcinoma. Screening thyroid US enables detection of early stage thyroid cancer in asymptomatic healthy population.

SSC09-06 Malignant Thyroid Nodule with Chronic Lymphocytic Thyroiditis: The Value of Core-Needle Biopsy

Monday, Nov. 30 11:20AM - 11:30AM Location: N229

Participants

Eunchae Lee, MD, Seongnam-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose

Yeo Koon Kim, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Eun Ju Chun, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Sang Il Choi, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The detection and diagnosis of thyroid cancer can be more difficult in patients with chronic lymphocytic thyroiditis (CLT). The aim of this study is to compare the diagnostic accuracy of fine-needle aspiration biopsy (FNAB) and core-needle biopsy (CNB) for malignant thyroid nodule in CLT patients.

METHOD AND MATERIALS

Institutional review board approved and waived informed consent for this retrospective study. From January 2010 to April 2014, 1815 CLT patients (183 men, 1632 women; mean age, 53.6 years; age range, 11-87 years) who underwent ultrasound-guided FNAB (FNAB group, 993 nodules in 970 patients; 90 men, 880 women; mean age, 55.5 years; age range, 18-87 years) or CNB (CNB group, 912 nodules in 845 patients; 93 men, 752 women; mean age, 52.1 years; age range, 11-86 years) for thyroid nodule were included. Final diagnosis with surgical resection was obtained for 353 nodules. Chi-square test was used to compare the inconclusive results from both groups. Diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value for the diagnosis of thyroid cancer were calculated on the basis of binomial probabilities.

RESULTS

The rate of inconclusive results (nondiagnostic specimen or atypia of unknown significance) were significantly lower in CNB group (FNAB group, n=306 (30.8%); CNB group, n=33 (3.6%); $p < 0.001$). With correlation to final surgical pathology, the sensitivity and negative predictive value of FNAB were lower than CNB (49.5%, 18.9% vs. 83.5%, 63.6%)

CONCLUSION

Inconclusive results were significantly lower with CNB. CNB showed better diagnostic accuracy for thyroid cancer in patients with CLT.

CLINICAL RELEVANCE/APPLICATION

CNB can reduce the rate of inconclusive result in patients with CLT.

SSC09-07 Three-Dimensional Sonography more Accurately Localizes Preoperative Parathyroid Adenomas than Conventional 2D Sonography and Sestamibi

Monday, Nov. 30 11:30AM - 11:40AM Location: N229

Participants

Susan J. Frank, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Adam Goldman-Yassen, MD,MS, Bronx, NY (*Presenter*) Nothing to Disclose
Tova C. Koenigsberg, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Mordecai Koenigsberg, MD, Flushing, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Single parathyroid adenomas are the most common etiology of primary hyperthyroidism. If a single, enlarged parathyroid gland can be accurately identified before surgery, unilateral surgical dissection can be attempted, which has a lower morbidity than four-gland exploration. Two-dimensional ultrasound (2D US) and sestamibi scans are routinely used to evaluate patients with suspected primary hyperparathyroidism. Three-dimensional ultrasound (3D US) provides the surgeon with a coronal view, similar to a surgical perspective, and evaluates the typical vascularity of abnormal parathyroid glands. We compared the preoperative imaging of patients who underwent parathyroidectomy for primary hyperparathyroidism to determine the improvement of 3D US over 2D ultrasound and sestamibi for preoperative gland localization.

METHOD AND MATERIALS

We conducted a retrospective review of patients that underwent parathyroid surgery at our institution. We reviewed operative notes and pathology reports to identify final localization of abnormal parathyroid glands based on pathology and decrease in parathyroid hormone by 50% after gland excision in the OR. We evaluated preoperative ultrasound and sestamibi scan reports for gland localization.

RESULTS

118 patients underwent surgery for primary hyperthyroidism and underwent both preoperative ultrasound and sestamibi examinations at our institution between 2010 and 2014, 37 using 3D US. 3D US correctly identified the side of the abnormal parathyroid adenoma in 95% of cases (CI 81%-99%), compared with 57% of 2D US (CI 45%-68%), and the precise site of the abnormal gland in 81% of cases (CI 64%-92%), compared with 52% for 2D US (CI 40%-63%). Sestamibi scans correctly lateralized 82% of cases in our cohort (CI 73%-88%). 3D US and sestamibi concordantly lateralized the abnormal parathyroid in 92% of cases (CI 72%-96%), compared with 49% in 2D US cases (CI 38%-61%).

CONCLUSION

3D US is more sensitive than 2D US for correctly identifying the side and precise location of abnormal parathyroid glands in patients with primary hyperparathyroidism. 3D sonography may help provide more accurate gland localization before parathyroid surgery.

CLINICAL RELEVANCE/APPLICATION

Accurate localization of abnormal parathyroid glands before parathyroidectomy can reduce surgical morbidity and complications.

SSC09-08 Most Thyroid Cancers Lack Intranodular Vascularity on Color Doppler

Monday, Nov. 30 11:40AM - 11:50AM Location: N229

Participants

Grace C. Yang, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Karen O. Fried, MD, New York, NY (*Presenter*) Nothing to Disclose

PURPOSE

'Intranodular hypervascularity' has been reported to be associated with thyroid cancers in radiology literature. The aim of this study is to test this assumption with detailed pathology follow-up.

METHOD AND MATERIALS

Over a period of 8 years, 149 ultrasound-guided thyroid fine needle aspiration biopsies had both ultrasound images and histology

slides for review. Color Doppler images were reviewed and intranodular vascularity was graded from 0 to 3+ (0:no color). Recuts from index nodule were reviewed and divided into malignant and benign categories and tumor subtype recorded.

RESULTS

There were 99 thyroid cancers (size: 0.6-7 cm, mean 2.1, median 1.8), and 50 benign nodules (size 0.4-9 cm, mean 3.06, median 2.9). The malignant nodules from 22 males and 77 females included 78 papillary carcinomas (PTC), 6 medullary carcinomas (MTC), 6 Hürthle cell carcinomas (HTC), 5 follicular carcinomas (FTC), and 4 poorly differentiated thyroid carcinomas (PDTC). Benign nodules from 11 males and 39 females included 32 follicular adenoma/adenomatoid nodules (FA), 13 Hürthle cell adenoma/adenomatoid nodules (HA) and 5 hyalinizing trabecular adenomas (HHA). As shown in Table 1, there were 58 (93.5%) cancers (50 PTC, 5 MTC, 2 PDTC, 1 FTC) and 4 (6.5%) benign nodules (3 HA, 1 FA) with no intranodular vascularity; 15 (88.2%) cancers (9 PTC, 1 MTC, 4 HTC, 1 PDTC) and 2 (11.8%) benign nodules (2 HA) had 1+ intranodular vascularity; 14 (93.3%) cancers (10 PTC, 2 HTC, 2 FTC) and 1 (0.7%) benign nodules (1 HA) had 2+ intranodular vascularity; 12 (21.8%) cancers (9 PTC, 2 FTC, 1 PDTC) and 43 (78.2%) benign nodules (31 FA, 7 HA, 5 HHA) had 3+ intranodular vascularity.

CONCLUSION

Most thyroid cancers have no intranodular vascularity and most hypervascular thyroid nodules are benign. This finding is not surprising, since most thyroid cancers are PTC, which is a tumor rich in lymphatic vessels. Follicular tumors are rich in blood vessels, but FTC is much less common than PTC.

CLINICAL RELEVANCE/APPLICATION

'Absence of intranodular vascularity' is recommended as one of the suspicious features of thyroid ultrasound that include 'hypoechoic', 'taller than wide', 'blurred margins' and 'microcalcifications'

SSC09-09 Role Played by Elasticity Imaging in the Evaluation of the Thyroid Nodule

Monday, Nov. 30 11:50AM - 12:00PM Location: N229

Participants

Francisco J. Campoy-Balbontin, MD, PhD, Seville, Spain (*Presenter*) Nothing to Disclose
Carmen Jurado-Gomez, MD, Bellavista, Spain (*Abstract Co-Author*) Nothing to Disclose
Jose-Carlos Perez-Tejada, MD, PhD, Sevilla, Spain (*Abstract Co-Author*) Nothing to Disclose
Carmen Almeida, BMedSc, Seville, Spain (*Abstract Co-Author*) Nothing to Disclose
Rafael Aznar Mendez, Sevilla, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate conventional ultrasonography (US) including color doppler and elasticity imaging (EI) in thyroid nodule malignancy prediction.

METHOD AND MATERIALS

This prospective study included 399 patients (mean age, 51.9 years; range 13-83 years), 294 women (86.7%) and 45 men (13.3%). In 426 nodules (N) US, doppler color, EI and fine needle acquisition (FNA) were performed. The cytological results were classified according to the Bethesda System. No-apt sample and atypia or follicular proliferation of uncertain origin, were excluded (60N). 339 nodules in 335 patients were studied, divided in a non-surgical group (benign or T2, 292N) and a surgical group (follicular neoplasm-T4, 33N; suspicious for papillary carcinoma-T5, 9N; and Papillary carcinoma-T6, 5N). Comparison among US, vascularization, EI and cytology was performed, by using the χ^2 tests and the non-parametric Mann-Whitney U test, for categorical variables (statistical significance <0.05). Multivariate logistic regression analysis was performed to assess the independent variables for surgical group prediction.

RESULTS

Findings associated to surgical nodules are heterogeneity (24/51%; odds ratio (OR):2.584), very hypoechoic (4/8.5%; OR:5.195), Hypoechoic (24/51.1%; OR:4.160), increased vascularization (12/27.9%; OR:3.233), infiltrative margin (8/17%; OR:6.450), irregular border (5/10.6%; OR:4.211), hard in EI (19/40.4%; OR:2.073). Findings linked to benignity are to be isoechoic (197/67.5%) and spongiform (153/52.4%). In the multivariate regression analysis only very hypoechoic and hypoechoic are independent criteria related for the surgical group ($p < 0.05$), whereas spongiform is the only independent criteria associated to benignity.

CONCLUSION

EI could help in combination with the other US features to choose the nodule to perform FNA, but it does not seem to be independent criteria to indicate FNA

CLINICAL RELEVANCE/APPLICATION

EI properly used is a helpful tool, to be considered always in combination with US features, to indicate FNA.

3D Printing (Hands-on)

Monday, Nov. 30 12:30PM - 2:00PM Location: S401AB

IN

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

Participants

Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Moderator*) Research Grant, Toshiba Corporation;
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Presenter*) Research Grant, Toshiba Corporation;
Jane S. Matsumoto, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Andreas Giannopoulos, MD, Boston, MA, (agiannopoulos1@partners.org) (*Presenter*) Nothing to Disclose
Nicole Wake, MS, New York, NY (*Presenter*) Nothing to Disclose
Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Thomas A. Foley, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Kiaran P. McGee, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Michael W. Itagaki, MD, MBA, Seattle, WA (*Presenter*) Owner, Embodi3D, LLC
Shannon N. Zingula, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the Standard Tessellation Language (STL) file format that is used in 3D printing. 2) Be exposed to a software package to enable segmentation of DICOM images using semi-automated and manual segmentation algorithms, allowing the user to demarcate desired parts. The most commonly used tools are thresholding, region growing, and manual sculpting. 3) Learn refinement of an output STL output so that it can be optimized for accurate printing of the desired anatomy and pathology. This step uses Computer Aided Design (CAD) software is used to perform steps such as "wrapping" and "smoothing" to make the model more homogeneous.

ABSTRACT

"3D printing" refers to fabrication of a tangible object from a digital file by a 3D printer. Materials are deposited layer-by-layer and then fused to form the final object. There are several 3D printing technologies that share similarities but differ in speed, cost, and resolution of the product. Digital Imaging and Communications in Medicine (DICOM) image files cannot be used directly for 3D printing; further steps are necessary to make them readable by 3D printers. The purpose of this hands-on course is to convert a set of DICOM files into a 3D printed model through a series of simple steps. Some of the initial post-processing steps may be familiar to the radiologist, as they share common features with 3D visualization tools that are used for image post-processing tasks such as 3D volume rendering. However, some are relatively or completely new to radiologists, including the manipulation of files in Standard Tessellation Language (STL). It is the STL format that is read by the 3D printer and used to output the hand held part of the patient's anatomy. This 90 minute session will begin with a DICOM file and will proceed through the steps to create a printable STL file. An extensive training manual will be provided before the meeting. It is highly recommended that participants review the training manual to optimize the experience at the workstation.

URL

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

RCB23

Using Keynote: An Alternative to Power Point (Hands-on)

Monday, Nov. 30 12:30PM - 2:00PM Location: S401CD



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

Participants

Shawn D. Teague, MD, Indianapolis, IN (*Presenter*) Stockholder, Apple Inc

LEARNING OBJECTIVES

1. Modify the master slides used in a template. 2. Change the aspect ratio for a presentation from 4:3 to 16:9. 3. Utilize movies in a presentation. 4. Utilize the remote control feature in Keynote with a mobile device.

Structured Reporting and the RSNA Reporting Initiative

Monday, Nov. 30 12:30PM - 2:00PM Location: S501ABC



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

Participants

Sub-Events

RCC23A Herding the Cats: Successfully Implementing a Department-Wide Standardized Reporting Program

Participants

David B. Larson, MD, MBA, Los Altos, CA (*Presenter*) Intellectual property license agreement, Bayer AG; Potential royalties, Bayer AG

LEARNING OBJECTIVES

1) Understand critical interpersonal elements to consider in implementing and managing a department-wide standardized structured report program. 2) Understand the technical challenges associated with implementing and managing a department-wide standardized structured report program.

ABSTRACT

Modern voice recognition technology has made department-wide standardized structured reporting feasible. However, the most significant challenges often lie in the interpersonal and organizational aspects. The author will discuss his experience in implementing and maintaining department-wide standardized structured reporting programs at two academic institutions, highlighting critical steps, major pitfalls, and strategies for success. The session will focus on those who might wish to develop department-wide structured reporting programs at their own institutions.

Honored Educators

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

David B. Larson, MD, MBA - 2014 Honored Educator

RCC23B RSNA's Reporting Initiative: Recent Progress and New Directions

Participants

Charles E. Kahn JR, MD, MS, Philadelphia, PA, (charles.kahn@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the background and rationale for RSNA's reporting initiative. 2) Describe recent advances in the technologies for radiology reporting. 3) Explore how reporting can add augment radiology's value to the healthcare enterprise. 4) Envision the latest directions and opportunities for radiology reporting.

ABSTRACT

Since 2007, the RSNA has taken a leading role in developing tools and clinical content to help radiologists improve their reporting practices. RSNA's library of best-practice reporting templates (www.radreport.org) has seen more than 2 million views and downloads. The 'Management of Radiology Report Templates' (MRRT) profile and a DICOM standard for transmitting template-based reports into the electronic health record (EHR) have been recently developed. These standards, and a set of tools that use them, provide new opportunities for information from radiology reports to be integrated into the clinical enterprise. The 'Open Template Library' (open.radreport.org) allows any RSNA member to contribute report templates, and the open-source 'T-Rex' template editor simplifies the editing process. Through partnerships with other organizations, RSNA is seeking to improve and extend these approaches. This presentation will highlight recent advances and new directions in radiology reporting.

Honored Educators

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

Charles E. Kahn JR, MD, MS - 2012 Honored Educator

RCC23C radreport.org: Facing Challenges and Moving Forward

Participants

Marta E. Heilbrun, MD, Salt Lake City, UT, (marta.heilbrun@hsc.utah.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how to share templates on open.radreport.org Know how templates from open.radreport.org are promoted to

by understanding how to share templates on open.radreport.org with new templates from open.radreport.org are promised to radreport.org 2) Describe the active collaborations with the European Society of Radiology (ESR) and other societies with the RSNA structured reporting effort.

ABSTRACT

As a component of the RSNA structured reporting initiative a select template library was created and is available at www.radreport.org. In order to facilitate the exchange of templates and to identify best practices, a resource for hosting templates created by RSNA members and affiliated societies has been created at the www.open.radreport.org site. This presentation will walk the audience through the process for sharing templates on open.radreport.org and using the T-Rex editor to create MRRT templates. Additionally, the activities of the Template Library Advisory Panel (TLAP), a joint collaboration between the RSNA and the ESR will be described. The TLAP is responsible for promoting the crowd-sourced templates to the the select template library will be described.

MSCT21

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

Monday, Nov. 30 1:30PM - 3:00PM Location: S100AB

CH

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

Participants

Diana Litmanovich, MD, Haifa, Israel (*Director*) Nothing to Disclose

Sub-Events

MSCT21A Congenital Thoracic Pathology

Participants

Edward Y. Lee, MD, MPH, Boston, MA, (Edward.Lee@childrens.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the current imaging technique for evaluating congenital thoracic anomalies in infants and children. 2) Learn important clinical aspects and characteristic imaging features of various congenital thoracic anomalies in pediatric patients. 3) Discuss key imaging findings which allow differentiation among various congenital thoracic anomalies in infants and children.

MSCT21B Diffuse Lung Disease

Participants

Sujal R. Desai, MBBS, London, United Kingdom, (sujal.desai@nhs.net) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with the key patterns of diffuse interstitial lung diseases on chest radiography and HRCT. 2) To understand the relationships between HRCT signs and histopathologic changes. 3) To become familiar with some of the common types of diffuse interstitial lung diseases.

ABSTRACT

The diffuse lung diseases (DLDs) are an intriguing and challenging group of lung disorders in which a multidisciplinary approach to management is key. Imaging tests (and specifically, high-resolution computed tomography [HRCT]) are an important part of the evaluation of patients with suspected and established DLDs. A systematic approach to the diagnosis is important: an awareness of HRCT sign and the relationship between radiologic and histopathologic patterns is crucial. In addition to the differential diagnoses, this session will stress some of the important HRCT signs of DLDs and, where appropriate, the relationship with pathologic features.

MSCT21C Cystic Lung Disease

Participants

Andetta R. Hunsaker, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify dominant features in cystic lung disease and distinguish between their varied radiologic presentations. 2) Detect additional features in patients with cystic lung disease which will be helpful in diagnosis. 3) Differentiate between true cystic lung disease and mimickers such as bronchiectasis. 4) Recommend appropriate follow-up based on the diagnosis

ABSTRACT

Abstract not needed.

VSIO21

Interventional Oncology Series: Hepatocellular Carcinoma

Monday, Nov. 30 1:30PM - 6:00PM Location: S406B



AMA PRA Category 1 Credits™: 4.25
ARRT Category A+ Credits: 5.00

FDA Discussions may include off-label uses.

Participants

Riccardo A. Lencioni, MD, Pisa, Italy (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn the indications for image-guided ablation and transcatheter-based therapies for patients with HCC. 2) To understand the potential limitations, pitfalls, side effects and toxicities associated with ablative and transcatheter therapies for patients with HCC. 3) To know the results, imaging responses and survival benefit of various ablative and transcatheter therapies. 4) To know the future ablative and transcatheter therapies and understand their potential. 5) To learn the various combination therapies available and undergoing clinical evaluation for HCC.

ABSTRACT

Sub-Events

VSIO21-01 Epidemiology, Staging, and Medical Therapy

Monday, Nov. 30 1:30PM - 1:50PM Location: S406B

Participants

Ghassan K. Abou-Alfa, MD, New York, NY (*Presenter*) Research Grant, Abbott Laboratories; Research Grant, Amgen Inc; Research Grant, AstraZeneca PLC; Research Grant, Bayer AG; Research Grant, Eli Lilly and Company; Research Grant, Exelixis, Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Immunomedics, Inc; Research Grant, Incyte Corporation; Research Grant, Momenta Pharmaceuticals; Research Grant, Myriad Genetics, Inc; Research Grant, Novartis AG; Research Grant, OncoMed Pharmaceuticals, Inc; Research Grant, Polaris Group; Research Grant, Vicus Therapeutics, LLC; Consultant, Aduro BioTech, Inc; Consultant, Astellas Group; Consultant, Onxeo SA; Consultant, Boston Scientific Corporation; Consultant, Boston Therapeutics, Inc; Consultant, Bristol-Myers Squibb Company; Consultant, CASI Pharmaceuticals Inc; Consultant, Celgene Corporation; Consultant, Cipla Ltd; Consultant, Eli Lilly and Company; Consultant, Gilead Sciences, Inc; Consultant, IntegraGen SA; Consultant, AstraZeneca PLC; Consultant, Merrimack Pharmaceuticals, Inc; Consultant, Momenta Pharmaceuticals; Consultant, Novartis AG; Consultant, Onxeo SA; Consultant, AbbVie Inc; Consultant, sanofi-aventis Group; Consultant, Silenseed Ltd; Consultant, SillaJen, Inc; Consultant, Vicus Therapeutics, LLC

LEARNING OBJECTIVES

1) Recognize the increasing incidence of HCC in the Western Hemisphere. 2) Learn about scoring the cirrhosis and staging the cancer. 3) Identify sorafenib as the standard care treatment for advanced HCC.

VSIO21-02 Critical Evaluation and Validation of the 9-Stage Hong Kong Liver Cancer Staging System in North American Hepatocellular Carcinoma Patients Who Underwent TACE

Monday, Nov. 30 1:50PM - 2:00PM Location: S406B

Participants

Jae Ho Sohn, MD,MS, New Haven, CT (*Presenter*) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Julius Chapiro, MD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Yan Zhao, MS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Florian N. Fleckenstein, MS, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Sonia P. Sahu, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Howard Lee, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ruediger E. Schemthaner, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Li Zhao, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ming De Lin, PhD, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jean-Francois H. Geschwind, MD, Westport, CT (*Abstract Co-Author*) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

PURPOSE

The new Hong Kong Liver Cancer (HKLC) staging offers 9-stage and 5-stage classification for survival and treatment allocation for hepatocellular carcinoma (HCC), thought to be superior to the Barcelona Clinic Liver Cancer (BCLC) staging. A known limitation of the HKLC staging is the need for validation in non-HBV patient cohort. The purpose of this study is to compare the 9-stage HKLC against BCLC staging in a North American cohort and then identify any needs for improvement.

METHOD AND MATERIALS

968 HCC patients at a single institution who underwent TACE were retrospectively reviewed. 890 had sufficiently complete record to calculate the 9-stage HKLC and BCLC stages. Overall survival (OS) from date of first TACE to death or last note date was recorded. The performances of the HKLC and BCLC systems were compared through homogeneity, survival discrimination, monotonicity of gradients, and reduction in error of survival prediction. The staging systems were evaluated through Kaplan-Meier

(KM) estimate, Cox model's likelihood ratio (LHR), linear trend (LT), Harrell's C, Akaike's information criterion (AIC), and % error reduction in survival.

RESULTS

The HCC etiologies in this cohort included 132 (14.8%) hepatitis B, 427 (48.0%) hepatitis C, 254 (28.5%) alcoholic, 60 (7.8%) NASH, and 60 (6.7%) no identifiable cause (some patients with overlapping etiologies). Median OS in months for HKLC were I (62.6), IIa (35.8), IIb (24.3), IIIa(12.3), IIIb (10.9), IVa (11.0), IVb (4.3), Va (10.5), and Vb (2.7), notable for similarity in OS among a few stages. Median OS for BCLC were A (51.6), B (24.3), C (12.2), and D (4.3). The 9-stage HKLC performed better on all statistical measures. Better homogeneity was found for HKLC (LHR: 249) than BCLC (LHR: 119). Superior survival discrimination was shown for HKLC (C=0.72, AIC=6200) than BCLC (C=0.64, AIC=6320). Monotonicity was better in HKLC (LT: 261) than in BCLC (LT: 111). Reduction in error of prediction for HKLC was 15.9% while BCLC was 11.8%.

CONCLUSION

The 9-stage HKLC staging system outperformed the BCLC staging system as a prognostic classification system on overall statistical measures, but similarity in survival for stages IIIa/b, IVa, and Va should be further explored and addressed.

CLINICAL RELEVANCE/APPLICATION

The HKLC staging system may become the next HCC staging system of choice after addressing some of the identified issues and completing further validations.

VSIO21-03 TACE Techniques, Indications, and Results: Western Perspective

Monday, Nov. 30 2:00PM - 2:20PM Location: S406B

Participants

Jean-Francois H. Geschwind, MD, Westport, CT (*Presenter*) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

LEARNING OBJECTIVES

1) To understand the indications for TACE and describe the various technical issues and clinical results of TACE.

VSIO21-04 Does DEB-TACE Enhance the Local Effect of IRE? Imaging and Histopathological Evaluation in a Porcine Model

Monday, Nov. 30 2:20PM - 2:30PM Location: S406B

Participants

Peter Isfort, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
Philip Rauen, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Hong-Sik Na, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nobutake Ito, MD, Yokohama, Japan (*Abstract Co-Author*) Nothing to Disclose
Christoph Wilkmann, DIPL-ENG, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Bruners, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Irreversible electroporation (IRE) is associated with a hypervascular penumbra of vital temporarily damaged tissue due to reversible electroporation. Transarterial treatment of this penumbra could increase local efficacy of IRE. We conducted an in-vivo trial on swine to compare the ablation volumes of an IRE/DEB-TACE combination vs. IRE-only.

METHOD AND MATERIALS

Nine swine underwent IRE in one liver lobe and DEB-TACE immediately followed by IRE in a different liver lobe. For DEB-TACE, 100-300 µm beads (DC-Beads®) were loaded with 50mg doxorubicin. For IRE, the NanoKnife® was used with two IRE electrodes according to the vendor's recommended protocol. After one day (n=3), three days (n=3) and seven days (n=3) animals were sacrificed, and ablation volumes were evaluated histopathologically. Imaging follow-up was performed using contrast-enhanced CT and MRI. Lesion volumes were measured one day (n=9), three days (n=6) and 7 days (n=3) after the procedure.

RESULTS

Mean histopathological ablation volume of IRE/DEB-TACE combination lesions after one, three and seven days were 15.7 ± 11.1 ml, 11.8 ± 9.3 ml and 4.2 ± 1.4 ml. Mean histopathological ablation volumes of IRE-only lesions after one, three and seven days were 7.2 ± 4.5 ml, 4.0 ± 1.0 ml and 1.7 ± 1.5 ml. In intra-individual comparison the ablation volumes of the IRE/DEB-TACE combination group were on average 199.6 %, 163.4% and 98.5% larger than IRE-only lesions after one, three and seven days.

CONCLUSION

Combination of IRE followed by DEB-TACE resulted in larger ablation volumes compared to IRE alone suggesting that local efficacy of IRE can be enhanced by post-IRE DEB-TACE.

CLINICAL RELEVANCE/APPLICATION

Results suggest that local efficacy of IRE can be enhanced when additional DEB-TACE is performed in the target liver segment after ablation.

VSIO21-05 TACE Techniques, Indications, and Results: Eastern Perspective

Monday, Nov. 30 2:30PM - 2:50PM Location: S406B

Participants

Yasuaki Arai, Tokyo, Japan (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To describe the various techniques and approaches used in TACE treatment. 2) To understand the indications and results of TACE in the treatment of HCC. 3) To discuss differences and similarities between Eastern and Western approaches in TACE.

VSIO21-06 Anti-tumor Effects of TAE Administered in Combination with Sorafenib in a Rabbit VX2 Liver Tumor Model

Monday, Nov. 30 2:50PM - 3:00PM Location: S406B

Participants

Yuki Tomozawa, MD, Otsu, Japan (*Presenter*) Nothing to Disclose
Norihsa Nitta, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichi Ohta, MD, PhD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Shobu Watanabe, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Akinaga Sonoda, MD, PhD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Ayumi N. Seko, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiko Tsuchiya, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Kiyoshi Murata, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A number of studies have been reported that a combination of Sorafenib with TACE has been a more effective treatment than Sorafenib or TACE alone in addition to being tolerable. Using a VX2 liver tumor model, we investigated the most suitable timing parameters when using Sorafenib to enhance the anti-tumor effects of TAE.

METHOD AND MATERIALS

20 Japanese white rabbits were randomly assigned to four equal groups two weeks after of VX2 tumor transplantation to the liver. We then performed the combination treatment with Sorafenib and TAE on the four groups in the according ways; Group 1(TAE prior to administration of Sorafenib), Group 2(TAE on the second day after administration of Sorafenib), Group 3(TAE on the fourth day after administration of Sorafenib) and Group 4(TAE after the end of administrating Sorafenib). Sorafenib (40mg/day) was orally administrated for consecutive 7 days starting on the day two week after tumor implantation. The anti-tumor effects were assessed by comparing the pre- and post-treatment tumour volumes measured on a contrast-enhanced CT scans and by immuno-histochemical analysis of the number of intra-tumoral vessels two weeks after the treatment.

RESULTS

Among the four groups, the tumor growth rate tended to be lower in Group 1 and Group 2 than in Group 3 and Group 4. The difference between Group 1 and Group 3 was significant. The number of CD31-positive intra-tumor vessels in specimens tended to be higher in Group 3 than in the other groups, although there was no significant difference.

CONCLUSION

We suggest that the ideal time of TAE is prior to or early after commencement of administration Sorafenib.

CLINICAL RELEVANCE/APPLICATION

To date, limited data has focused on the timing parameters when Sorafenib is combined with TACE.

VSIO21-07 Y90 Radioembolization: What We Know, and What We Need to Know

Monday, Nov. 30 3:00PM - 3:20PM Location: S406B

Participants

Riad Salem, MD, MBA, Chicago, IL (*Presenter*) Research Consultant, BTG International Ltd; Research Grant, BTG International Ltd; ;

LEARNING OBJECTIVES

1) To describe techniques and approaches used for Y90 treatment of liver cancers. 2) To understand the available data for Y90 in the treatment of primary and metastatic liver tumors. 3) To discuss current gaps in knowledge and ongoing clinical studies.

VSIO21-08 Predicting the Hepato-pulmonary Shunt Fraction Using 3D Quantification of Tumor Enhancement on Contrast-enhanced CT Imaging in Patients with Hepatocellular Carcinoma before Y90 Radioembolization

Monday, Nov. 30 3:20PM - 3:30PM Location: S406B

Participants

Julius Chapiro, MD, Berlin, Germany (*Presenter*) Nothing to Disclose
David Wainstejn, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Duc Do Minh, BSc, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Christoph Erxleben, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Ming De Lin, PhD, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jean-Francois H. Geschwind, MD, Westport, CT (*Abstract Co-Author*) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation
Dirk Schnapauff, MD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernd K. Hamm III, MD, Berlin, Germany (*Abstract Co-Author*) Research Consultant, Toshiba Corporation; Stockholder, Siemens AG; Stockholder, General Electric Company; Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, General Electric Company; Research Grant, Elbit Imaging Ltd; Research Grant, Bayer AG; Research Grant, Guerbet SA; Research Grant, Bracco Group; Research Grant, B. Braun Melsungen AG; Research Grant, KRAUTH medical KG; Research Grant, Boston Scientific Corporation; Equipment support, Elbit Imaging Ltd; Investigator, CMC Contrast AB

Bernhard Gebauer, MD, Berlin, Germany (*Abstract Co-Author*) Research Consultant, C. R. Bard, Inc; Research Consultant, Sirtex Medical Ltd; Research Grant, C. R. Bard, Inc; Research Consultant, PAREXEL International Corporation; Federico Colletini, MD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study explored the ability of 3D quantitative CT image analysis to predict the hepato-pulmonary shunt fraction (HPSF) in patients with hepatocellular carcinoma (HCC) before Yttrium90 (Y90) radioembolization.

METHOD AND MATERIALS

This IRB-approved, retrospective analysis included a total of 26 patients with HCC, who underwent an evaluation study to calculate the HPSF from SPECT/CT after infusion of Tc-99m macroaggregated albumin into the proper hepatic artery. All patients underwent tri-phasic contrast-enhanced CT imaging within six weeks before the evaluation study. A semi-automatic, segmentation-based 3D quantification of the total tumor volume (TTV) was used to calculate the enhancing tumor volume (ETV), measured in cm³ and as a relative ratio (%; TTV/ETV). TTV as well as ETV were correlated with the HPSF for each patient. Statistical analysis included the One-way ANOVA test and linear regression analysis to calculate the R² values.

RESULTS

N=24 (92%) patients had preserved liver function (Child-Pugh A) and N=2 (8%) had Child-Pugh B. The mean HPSF was 13.5% (Range, 2.9-32.8; SD, 7.4) and the mean TTV was 569cm³ (Range, 18-2998; SD, 584). The mean absolute ETV was 120cm³ (Range, 7-431; SD, 116) and the mean relative ETV was 28% (Range, 6-60; SD, 19). A low correlation between TTV and the HPSF was observed (R²=0.29) and relative ETV (%) showed no correlation with the HPSF (R²<0.1). However, some correlation between the absolute ETV (cm³) and the HPSF was observed (R²=0.59). More importantly, patients with HPSF≤10% showed significantly lower mean ETVs as compared to patients with a HPSF≥10% (53cm³; Range, 7-96; SD, 21 vs. 187cm³, Range, 104-431; SD, 87, p<0.0001). No patient with HPSF≤10% exceeded the ETV of 100cm³. No statistically significant differences were observed for TTV and relative ETV (%).

CONCLUSION

The quantification of the absolute ETV (cm³) using semi-automatic 3D tools allows for an estimation of the HPSF in patients with HCC before Y90 Radioembolization. TTV and relative ETV (%) did not appear as reliable predictors of the HPSF.

CLINICAL RELEVANCE/APPLICATION

These preliminary results may introduce absolute ETV (cm³) as a new imaging biomarker for HPSF, potentially allowing to narrow down the selection of patients who will undergo shunt evaluation studies prior to Y90 radioembolization.

VSIO21-09 Response Assessment and the Concept of Treatment Failure

Monday, Nov. 30 3:30PM - 3:50PM Location: S406B

Participants
Riccardo A. Lencioni, MD, Pisa, Italy (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn the imaging criteria used for response assessment in patients with HCC. 2) To understand the limitations and the pitfalls associated with conventional response evaluation models. 3) To know the basic concepts of modified RECIST (mRECIST) criteria and how response predicts survival. 4) To understand the concept of treatment failure in patients undergoing loco-regional therapies. 5) To learn the novel volumetric response criteria currently undergoing clinical evaluation.

ABSTRACT

VSIO21-10 Which Response Criteria can Predict Early Tumor Progression in Hepatocellular Carcinoma Patients Treated with Conventional TACE: RECIST, mRECIST, EASL or qEASL?

Monday, Nov. 30 3:50PM - 4:00PM Location: S406B

Participants
Yan Zhao, MS, Baltimore, MD (*Presenter*) Nothing to Disclose
Sonia P. Sahu, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Wei Bai, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Zhanxin Yin, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Sohn, MD,MS, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ruediger E. Schernthaner, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Ming De Lin, PhD, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Guohong Han, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Jean-Francois H. Geschwind, MD, Westport, CT (*Abstract Co-Author*) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

PURPOSE

In this preliminary study, we compared the ability of RECIST, modified RECIST (mRECIST), EASL and quantitative EASL [(qEASL), a volumetric enhancement criterion] to assess early tumor progression after transarterial chemoembolization (TACE) in hepatocellular carcinoma (HCC) patients.

METHOD AND MATERIALS

A total of 53 consecutive patients (77.4% men; mean age, 51 years) with intermediate-stage HCC were included. All patients underwent conventional TACE and contrast-enhanced computed tomography (CT) scan at baseline and 1 month after TACE. Tumor response was determined by RECIST, mRECIST, EASL, and qEASL on CT. qEASL classifies progression as ≥73% increase in

enhancing tumor volume. The Kaplan-Meier method with the log-rank test was used to compare median overall survival (OS) between progression and non-progression.

RESULTS

Median follow-up period was 15.4 months (range 1.2-54.1). The mean value of enhancing tumor volume (qEASL) at baseline and post-treatment were 214 ± 263.5 cm³ and 58.5 ± 21.9 cm³, respectively. RECIST, mRECIST and EASL, identified progression in 2 (4%), 1 (2%) and 2 (4%) patients at 1 month after TACE treatment. Notably, qEASL had a higher sensitivity for early tumor progression and it identified 9 (17%) patients with progression. Too few patients showed progression to perform survival analysis for the RECIST, mRECIST, and EASL. However, the patients who experienced progression according to qEASL demonstrated a significantly shorter median OS than those with non-progression [6.5 months (95%CI 4.2-8.8) vs. 21.1 months (95%CI 14.1-28.1), $P < 0.001$].

CONCLUSION

qEASL is a more sensitive biomarker for tumor progression and survival than RECIST, mRECIST and EASL one month after TACE in hepatocellular carcinoma patients.

CLINICAL RELEVANCE/APPLICATION

Defining early tumor progression may help guide the decisions of further treatment. qEASL gave a better discrimination for early progression than other 1D or 2D criteria

VSI021-11 Panel Discussion: Management of Intermediate-Advanced HCC in 2015

Monday, Nov. 30 4:00PM - 4:20PM Location: S406B

Participants

VSI021-12 The Effect of Sociodemographic Determinants of Receipt of Cancer Directed Therapy on Survival and Therapeutic Efficacy in AJCC Stage I and II Unresectable Hepatocellular Carcinoma: A SEER-Medicare Population Study

Monday, Nov. 30 4:30PM - 4:40PM Location: S406B

Participants

Nima Kokabi, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Minzhi Xing, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Richard Duszak JR, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Kimberly E. Applegate, MD, MS, Zionsville, IN (*Abstract Co-Author*) Nothing to Disclose
Juan C. Camacho, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
David H. Howard, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Hyun S. Kim, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the socio-demographic determinants of receipt of HCC-directed locoregional therapies (LRT's) and comparative effectiveness of different therapies in American Joint Commission on Cancer (AJCC) Stage I and II unresectable hepatocellular carcinoma (HCC) using Surveillance Epidemiology and End Results (SEER) registries linked to Medicare database.

METHOD AND MATERIALS

Patients diagnosed with HCC during 2000 to 2010 were identified with unresectability defined using "no cancer-directed surgery recommended" and no HCC directed surgical claim. Patients were stratified by AJCC staging and the following therapies: ablation, trans-arterial chemoembolization (TACE), Yttrium-90 (Y90) radioembolization, sorafenib, systemic chemotherapy (CTX), external beam radiation (EBRT) or no cancer directed therapy (NCDT). Sociodemographic predictors of receipt of LRT's (i.e. TACE and Y-90) were evaluated by chi-square. Overall survival (OS) was estimated using Kaplan-Meier analysis.

RESULTS

Total of 9,169 patients with unresectable HCC were identified with the followings staging composition: I (25%), II (10%), III (13%), IV (17%), and unstaged (35%). All therapies demonstrated OS benefit compared to no therapy with the following median OS (months): ablation (30.8), Y90 (15.6), TACE (15.5), EBRT (7.6), Sorafenib (5.6), CTX (5.10), NCDT (3.7; $p < 0.001$). One year survival rate of stage I and II patients treated with TACE was 67% and 53% vs. 27% and 14% for NCDT respectively ($p < 0.001$). Overall, 38% of patients received any cancer directed therapy including TACE (18%), EBRT (8%), sorafenib (4%), ablation (3%), and Y-90 (2%) and CTX (1%). Specifically, 56% and 65% of stage I and II patients had NCDT respectively. There was no OS difference between TACE and Y90 group ($p = 0.31$). There was a significantly prolonged OS in LRT group vs. EBRT/CTX groups ($p < 0.001$) and the LRT vs. NCDT group ($p < 0.001$). The receipt of LRT significantly correlated with being married and of Asian decent, living on the pacific coast and in urban areas, being insured with higher income and education levels (p 's < 0.05).

CONCLUSION

Favorable sociodemographic factors were determinant of receipt of HCC directed LRT's. Less than 50% of of Stage I and II patients received LRT's. LRT's in Stage I and II significantly prolonged survivals over CTX/EBRT/NCDT.

CLINICAL RELEVANCE/APPLICATION

There is a national underutilization of effective HCC directed LRT's in patients with unresectable HCC.

VSI021-13 Image-guided Ablation: Does Novel Technology Mean Better Outcomes?

Monday, Nov. 30 4:40PM - 5:00PM Location: S406B

Participants

Stephen B. Solomon, MD, New York, NY (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

1) To describe techniques and approaches used for image-guided ablation. 2) To understand the available data for novel thermal and non-thermal technologies. 3) To discuss strategies to improve clinical outcomes.

VSIO21-14 Hepatocellular Ccrcinomas Treated with Percutaneous Ablation Using a High-power Microwave System with a Single Antenna: 5 Years' Experience

Monday, Nov. 30 5:00PM - 5:10PM Location: S406B

Participants

Giovanni Mauri, MD, San Donato Milanese, Italy (*Presenter*) Consultant, Esaote SpA
Luca Cova, MD, Busto Arsizio, Italy (*Abstract Co-Author*) Nothing to Disclose
Tiziana Ierace, MD, Busto Arsizio, Italy (*Abstract Co-Author*) Nothing to Disclose
S. Nahum Goldberg, MD, Ein Kerem, Israel (*Abstract Co-Author*) Consultant, AngioDynamics, Inc; Research support, AngioDynamics, Inc; Research support, Cosman Medical, Inc; Consultant, Cosman Medical, Inc;
Luigi Solbiati, MD, Busto Arsizio, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To report our 5 year experience treating hepatocellular carcinoma (HCC) using a third-generation high-power microwave system and a single antenna.

METHOD AND MATERIALS

From 2009, 223 HCCs (mean 2.2 cm, size range 0.7-5.5 cm) in 109 patients (mean age 67.7 ± 6.2 years) underwent US-guided ablation using a high-power (140 Watt, 2.45 GHz) microwave system (AMICA-Probe: Hospital Service, Aprilia, Italy) with a single insertion of an internally-cooled antenna. Power and time of energy application ranged between 45-100 Watts and 4-10 min, respectively. Follow-up from a minimum of 1 year to 6 years (mean: 2.2yr) was performed with contrast-enhanced CT at 4-6 months intervals. Results were classified according to index tumor size (<=2cm; 2.1-3 cm; > 3 cm). Chi Square test was used for comparison.

RESULTS

Immediate complete ablation (i.e. technical success) was achieved in 221/223 (99.1%) HCCs. Local tumor progression within 1 year from ablation occurred in 23/223 (10.3%) HCCs: 4/103 (3.9%) <= 2cm; 8/68 (11.8%) sized 2.1-3 cm; and 11/52 (21.2%) > 3 cm (p = 0.003). In 9/23 (39.1%) HCCs, local progression underwent successful re-treatment. Major complications occurred in 6/151 (4.0%) ablation sessions and only 2 required surgical repair. No deaths related to ablation were seen. In 29/109 (26.6%) patients, new HCCs were detected on follow-up.

CONCLUSION

With an affordable and efficient high-power microwave system, local control of HCCs can be safely achieved in the vast majority of cases with the simplest and fastest technique, i.e. single insertion of single antenna.

CLINICAL RELEVANCE/APPLICATION

Percutaneous ablation with a high-power, affordable microwave system allows successfully treatment for a large majority of HCCs using a simple technique of single insertion of a single antenna with a short energy deposition time.

VSIO21-15 TACE Segmentectomy for Small, Solitary HCC: Just for the Unfit for Resection and Ablation?

Monday, Nov. 30 5:10PM - 5:30PM Location: S406B

Participants

Jin Wook Chung, MD, Seoul, Korea, Republic Of (*Presenter*) Research Grant, BTG International Ltd

LEARNING OBJECTIVES

1) Describe the current role of TACE for small solitary HCC in the routine daily practice. 2) Explain the technical aspects of subsegmental or ultraselective TACE. 3) Estimate curative potential of subsegmental TACE for small solitary HCC. 4) Appraise the role of subsegmental TACE for small solitary HCC.

VSIO21-16 A Prospective Study of the Safety and Efficacy of Small Caliber Drug-Eluting Beads in TACE for the Treatment of Hepatocellular Carcinoma

Monday, Nov. 30 5:30PM - 5:40PM Location: S406B

Participants

Sonia P. Sahu, New Haven, CT (*Presenter*) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ruediger E. Schernthaner, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Yan Zhao, MS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Sohn, MD,MS, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ming De Lin, PhD, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jean-Francois H. Geschwind, MD, Westport, CT (*Abstract Co-Author*) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

PURPOSE

There has been a growing interest in smaller caliber beads which can penetrate deeper into tumors for transarterial chemoembolization (TACE). This prospective clinical trial examined the safety and efficacy of TACE using 70-150 µm doxorubicin-eluting beads (LC BeadM1, BTG, UK) in patients with hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

This single-center prospective study was HIPPA compliant and IRB approved. Patients with HCC who were locoregional therapy naïve, Eastern Cooperative Oncology Group performance status 0-2, Barcelona Clinic Liver Cancer stage A-C, and Child-Pugh A-B were eligible. Adverse events were graded by severity and in relationship to TACE using CTCAE V4.03. Tumor response at 1 month follow-up was assessed by modified RECIST (mRECIST), European Association for the Study of the Liver (EASL), and volumetric tumor enhancement [quantitative EASL (qEASL)] on T1-weighted contrast-enhanced MR. qEASL response was defined as $\geq 65\%$ decrease in volumetric tumor enhancement.

RESULTS

24 patients (men: 21, median age: 62 years) with a mean tumor size of 4.28 cm (range: 1.2 - 21.2) were enrolled and successfully treated with TACE. 2 serious adverse events unrelated to TACE occurred in 2 patients [upper GI bleed (n=1) and cardiac arrest (n=1)]. Possible to definitive device related toxicities were seen in 10 patients and were all grade 1-2 in severity [hypoalbuminemia (n=3), pain (n=3), elevated AP (n=2), headache (n=2), fatigue (n=2), leukopenia (n=1), anemia (n=1), anorexia (n=1), elevated AST (n=1), fever (n=1), flu-like symptoms (n=1), hyperbilirubinemia (n=1), weight loss (n=1)]. One month tumor response was assessed in 21 patients [died before follow-up (n=1), pending follow-up (n=2)]. 10 (45.5%) patients were classified as responders regardless of the criteria utilized.

CONCLUSION

TACE with 70-150 μm doxorubicin-eluting beads was well tolerated and had good tumor response after 1 month in patients with HCC.

CLINICAL RELEVANCE/APPLICATION

Smaller caliber 70-150 μm doxorubicin-eluting beads are a safe and promising alternative to the conventional sized 100-500 μm beads in TACE for patients with hepatocellular carcinoma

VSI021-17 HCC Tumor Board

Monday, Nov. 30 5:40PM - 6:00PM Location: S406B

Participants

MSAS23

Compassion Burnout (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Monday, Nov. 30 1:30PM - 3:00PM Location: S105AB

OT

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

Participants

David B. Nicholson, Charlottesville, VA (*Moderator*) Nothing to Disclose

Kathleen Kath, Livonia, MI (*Moderator*) Nothing to Disclose

Marcus Engel, Orlando, FL, (Marcus@MarcusEngel.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Convey the foundation of compassionate care: human presence Utilize "I'm Here" to offer security and empathy to vulnerable patients Recognize that many times, the healing power of human presence is the best (and sometimes only) thing a health care professional can do for a patient. 2) Demonstrate an understanding of individual patient and family needs in a clinical setting Effective communication requires using language and terminology that can be easily processed by the patient and family Interpret patient and family interactions with an understanding of individual backstories. 3) Implement best practices in patient communication Instill patient confidence by managing up (complimenting co-workers, sharing accolades of the institution, and positive reinforcement regarding excellence in PC.

ABSTRACT

Participants of the session will be reminded of the vital role they play in the healing process of patients. The lecture details the experience of a young patient during hospitalization, the care and compassion shown by health care professionals and the importance of health care professionals to be safe, secure, and appreciated in their role within this sacred field. Participants will also come away with an understanding of each patient and co-workers individuality, unique differences, and appreciation for the role every health care employee plays in the healing of patients and their families. The patient and family experience is absolutely vital in quality, competent, compassionate health care.

Physics Symposium: Best of the SRS/SBRT AAPM Summer School

Monday, Nov. 30 1:30PM - 5:45PM Location: S102C



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

Participants**LEARNING OBJECTIVES**

1) Identify critical anatomical features of major SRS/SBRT targets. 2) Learn techniques used in small field dosimetry and the order of magnitude of treatment uncertainties. 3) Learn essential treatment planning techniques, especially with regards to respiratory motion management. 4) Gain knowledge about treatment delivery devices for SRS/SBRT. 5) Understand resources and safety practices for SRS/SBRT.

ABSTRACT

This session summarizes the highlights of the 2014 AAPM Summer School on SRS/SBRT. The first speaker will highlight critical anatomical structures which physicists and treatment planners need to be aware of in SRS/SBRT. Contouring atlases specific to SRS/SBRT are discussed, e.g. the consensus guidelines published by the spine consortium. The second lecture focuses on the physics of small field dosimetry, which is a special skill set within the field of clinical medical physics. The state-of-the-art recommendation on detector selection and measurement techniques will be discussed, including current recommendations on the use of detector correction factors. The third speaker will summarize treatment planning approaches specific to classic SRS/SBRT targets in the brain, lung, GI and GU regions. The appropriate use of respiratory management techniques for SBRT in lung, liver and pancreas requires the careful and considerate application of complex technology. Current society recommendations and peer-reviewed literature on accepted approaches to respiratory motion management will be summarized. In the last decade, the selection of treatment machines capable of delivering SRS/SBRT treatments with the required spatial and dosimetric accuracy has increased significantly. The speaker will discuss the major technical components of each delivery device, highlighting strength and weaknesses of each system as they apply to SRS/SBRT. SRS/SBRT delivers a high dose with steep dose gradients in 1-5 fractions, using complex technology with image guidance. Both the risk of error and the impact of errors is amplified under these circumstances. The last speaker of this session will discuss selected case reports of errors, including a root cause analysis. Current safety initiatives and recommendations for improved safety practices will be introduced. Resources to guide safe and effective implementation of an SRS/SBRT program will be discussed and shared with the audience.

Sub-Events**SPPH22A Anatomy for SRS/SBRT**

Participants

Josh Y. Yamada, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

SPPH22B Small Field Dosimetry and Uncertainty

Participants

Sonja Dieterich, PhD, Sacramento, CA, (sdieterich@ucdavis.edu) (*Presenter*) Scientific Advisor, MGS Research, Inc

LEARNING OBJECTIVES

View learning objectives under the main course title.

ABSTRACT

This session summarizes the highlights of the 2014 AAPM Summer School on SRS/SBRT. The first speaker will highlight critical anatomical structures which physicists and treatment planners need to be aware of in SRS/SBRT. Contouring atlases specific to SRS/SBRT are discussed, e.g. the consensus guidelines published by the spine consortium. The second lecture focuses on the physics of small field dosimetry, which is a special skill set within the field of clinical medical physics. The state-of-the-art recommendation on detector selection and measurement techniques will be discussed, including current recommendations on the use of detector correction factors. The third speaker will summarize treatment planning approaches specific to classic SRS/SBRT targets in the brain, lung, GI and GU regions. The appropriate use of respiratory management techniques for SBRT in lung, liver and pancreas requires the careful and considerate application of complex technology. Current society recommendations and peer-reviewed literature on accepted approaches to respiratory motion management will be summarized. In the last decade, the selection of treatment machines capable of delivering SRS/SBRT treatments with the required spatial and dosimetric accuracy has increased significantly. The speaker will discuss the major technical components of each delivery device, highlighting strength and weaknesses of each system as they apply to SRS/SBRT. SRS/SBRT delivers a high dose with steep dose gradients in 1-5 fractions, using complex technology with image guidance. Both the risk of error and the impact of errors is amplified under these circumstances. The last speaker of this session will discuss selected case reports of errors, including a root cause analysis. Current safety initiatives and recommendations for improved safety practices will be introduced. Resources to guide safe and effective implementation of an SRS/SBRT program will be discussed and shared with the audience.

SPPH22C Treatment Planning and Respiratory Motion Management for SBRT

Participants

Kristi R. Hendrickson, PhD, Seattle, WA, (krgh@uw.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPPH22D SRS/SBRT Delivery Devices

Participants

Stanley Benedict, PhD, Sacramento, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPPH22E Safety and Quality for SRS/SBRT

Participants

James Gordon, PhD, Detroit, MI (*Presenter*) Departmental Research Grant, Varian Medical Systems, Inc; Departmental Research Grant, Koninklijke Philips NV

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMC23

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

Monday, Nov. 30 1:30PM - 3:00PM Location: S406A



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

FDA Discussions may include off-label uses.

Participants

Pamela K. Woodard, MD, Saint Louis, MO (*Director*) Research Consultant, Bristol-Myers Squibb Company; Research Grant, Astellas Group; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Bayer AG; Research agreement, Siemens AG; Research Grant, Actelion Ltd; Research Grant, Guerbet SA; ; ;
Harold I. Litt, MD, PhD, Philadelphia, PA (*Moderator*) Research Grant, Siemens AG ; Research Grant, Heartflow, Inc;
U. Joseph Schoepf, MD, Charleston, SC, (schoepf@musc.edu) (*Moderator*) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ; ;

LEARNING OBJECTIVES

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

Sub-Events

MSMC23A Pulmonary Veins and Pericardial Disease

Participants

Jacobo Kirsch, MD, Weston, FL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe normal versus anomalous pulmonary venous anatomy. 2) Understand the imaging findings of complications of ablation for atrial fibrillation. 3) Describe abnormalities of the pulmonary veins identifiable on routine CT. 4) Identify the most common pericardial abnormalities evaluated with CT.

Honored Educators

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Jacobo Kirsch, MD - 2013 Honored Educator

MSMC23B Coronary Atherosclerosis III

Participants

Elliot K. Fishman, MD, Owings Mills, MD (*Presenter*) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

The goal of this session is to learn how to interpret pathology involving the coronary arteries beyond the detection of coronary artery stenosis. Focus on exam acquisition protocols, study interpretation protocols, and minimizing radiation dose are addressed. Specific topics addressed will also include coronary artery aneurysm, myocardial bridging, anomalous coronary arteries as well as vasculitis. Potential pitfalls will be addressed and pearls for study optimization will also be discussed.

Honored Educators

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

Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator

MSMI23

Molecular Imaging Symposium: Oncologic MI Applications

Monday, Nov. 30 1:30PM - 3:00PM Location: S405AB



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

FDA Discussions may include off-label uses.

Participants

Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Moderator*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc
Umar Mahmood, MD, PhD, Charlestown, MA (*Moderator*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

LEARNING OBJECTIVES

1) To understand the role of molecular imaging in cancer therapy. 2) To understand the impact that new molecular imaging agents could have on drug development. 3) To understand the barriers facing the development of new molecular imaging agents.

ABSTRACT

Molecular Imaging is expanding in many new directions. Most research is being performed for PET and SPECT agents. However, optical and MRI agents are also being developed. Molecular Imaging can play a role in accelerating the development and approval of new cancer therapeutics by quantifying the impact drugs have in early Phase studies and by selecting the most appropriate patients for trials. Molecular Imaging agents can be useful in determining the utility and mechanism of actions of drugs that are already approved and may provide insights to oncologists regarding the best treatment combinations for individual patients. Molecular Imaging methods have already expanded our knowledge of cancer behavior and this will ultimately lead to new forms of the therapy that will one day cure this dreaded disease.

Sub-Events

MSMI23A Overview of MI in Oncology

Participants

Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Presenter*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To understand the broad spectrum of activities in molecular imaging including PET, SPECT, optical and MRI. 2) To understand the potential impact of Molecular Imaging on cancer treatment.

ABSTRACT

Molecular Imaging is expanding at a rapid rate. This overview will provide a panoramic view of the field of Molecular Imaging and major trends that are emerging among the different modalities, PET, SPECT, optical, ultrasound and MRI that constitute molecular imaging.

MSMI23B Hyperpolarized MRI of Prostate Cancer

Participants

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

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI23C Radiogenomics

Participants

Michael D. Kuo, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the principles behind radiogenomics and to highlight areas of clinical application and future development.

ABSTRACT

MSMI23D Somatostatin Receptor Imaging

Participants

Ronald C. Walker, MD, Nashville, TN, (ronald.walker@vanderbilt.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the principles behind somatostatin receptor imaging and to highlight areas of clinical application and future development.

1) Describe the advantages of ⁶⁸Ga-somatostatin PET/CT over ¹¹¹In-DTPA-octreotide imaging. 2) Detect patients likely to benefit from peptide receptor radiotherapy (PRRT).

ABSTRACT

⁶⁸Ga-labeled somatostatin analogs (DOTATATE, DOTATOC and DOTANOC) PET/CT imaging provides higher resolution scans than ¹¹¹In-DTPA-octreotide with less radiation, comparable cost, and imaging completion within 2 hours vs. 2-3 days. ⁶⁸Ga-somatostatin analogs have a higher impact on care than ¹¹¹In-DTPA-octreotide, including superior ability to identify patients likely to benefit from PRRT. This activity will provide results from the literature and the author's experience to illustrate the advantages of ⁶⁸Ga-based PET/CT imaging of neuroendocrine tumors.

MSMI23E Multimodal MI in Oncology

Participants

Umar Mahmood, MD, PhD, Charlestown, MA (*Presenter*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

LEARNING OBJECTIVES

1) To understand strengths of various imaging modalities for specific target/disease assessment.

ABSTRACT

Each imaging modality has a set of characteristics that helps define optimal use. These constraints include sensitivity, depth of imaging, integration time for signal, and radiation dose, among other factors. Understanding when each modality can be used and when combining the relative strengths of different modalities can be synergistic allows greater molecular information to be acquired.

AAPM/RSNA Basic Physics Lecture for the RT: Image Quality and Patient Dose in CT and Interventional Radiology

Monday, Nov. 30 1:30PM - 2:45PM Location: S402AB

PHAMA PRA Category 1 Credits™: 1.25
ARRT Category A+ Credits: 1.50**Participants**Scott J. Emerson, MS, Royal Oak, MI, (scott.emerson@beaumont.org) (*Moderator*) Nothing to DiscloseJerry A. Thomas, MS, Wichita, KS, (jerry.thomas@viachristi.org) (*Presenter*) Stockholder, General Electric Company; Stockholder, Hologic, Inc; Stockholder, Stryker Corporation; Speaker, Medical Technology Management Institute;**LEARNING OBJECTIVES**

1) Describe the technical factors which affect patient dose and image quality in CT and IR. 2) Fully participate in CT protocol review and development of new imaging protocols. 3) Describe radiation dose optimization techniques for adult and pediatric patients in CT and IR. 4) Recognize unsafe procedures and operation of CT scanners. 5) Develop methods for ensuring compliance with TJC Diagnostic Imaging Standards in CT which became effective on 01 July 2015.

ABSTRACT

Changes in TJC Diagnostic Imaging Standards and public concern with radiation dose have heightened the awareness and fear of dose in Computed Tomography (CT) and Interventional Radiography (IR). Unfortunately, as these changes have come into effect, the importance of image quality and its relationship to radiation dose may have been overlooked. This session will review technical factors which affect Image Quality and Patient Dose in CT and IR. Emphasis will be placed on practical methods which may be used to develop appropriate imaging protocols. Dose triggers in CT and IR fluoroscopy, the meaning of ALARA applied to staff with expected exposure levels, associated radiation safety design in imaging rooms and personnel training required to assure a culture of safety and imaging excellence will be examined. Finally, suggestions will be provided on how to meet and comply with the new TJC Diagnostic Imaging Services Standard effective July 01, 2015 and NEMA Standards XR-25, 27 and 29.

PS20

Monday Plenary Session

Monday, Nov. 30 1:30PM - 2:45PM Location: Arie Crown Theater

OT

CME credit is not available for this session.
ARRT Category A+ Credit: 0

Participants

Ronald L. Arenson, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

Sub-Events

PS20A Presentation of the Alexander R. Margulis Award for Scientific Excellence

Participants

PS20B Presentation of Honorary Membership

Participants

Lorenzo Bonomo, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Chamaree Chuapetcharasopon, MD, Bangkok, Thailand (*Presenter*) Nothing to Disclose
Jung-Gi Im, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PS20C Dedication of the New Horizons Lecture to the Memory of Ferenc A. Jolesz, MD (1946-2014)

Tuesday, Dec. 1 1:30PM - 2:45PM Location: Arie Crown Theater

Participants

PS20D New Horizons Lecture: Redefining Innovation

Participants

Jeffrey R. Immelt, Fairfield, CT (*Presenter*) Employee, General Electric Company
Ronald L. Arenson, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

Abstract

For the last hundred years innovation has been synonymous with technological advancements. In the healthcare space we saw innovation in the creation of the first x-ray machine, first multi-slice CT scanner and first silent MRI. Yet as the world becomes increasingly interconnected, innovation has begun to mean different things and seemingly simple things such as a low cost infant warmer have become the future of innovation. As we look towards the future, how will innovation change? We must be thoughtful about our investments and move away from creating technology just because we can. This is why it is critical for companies to work together with customers, governments, communities and NGOs, to innovate around what is needed to improve the health of millions around the world. GE and GE Healthcare are invested partners with our customers, working to innovate and drive the outcomes necessary for the future of healthcare. Together, we will continue to innovate and create the right technology that advances Radiology and healthcare for the next 100 years.

RCA24

National Library of Medicine: PubMed Tools: Save Searches and Create Personalized Search Options (Hands-on)

Monday, Nov. 30 2:30PM - 4:00PM Location: S401AB

IN

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

Participants

Wendy Wu, MS, Detroit, MI (*Presenter*) Nothing to Disclose

Holly Ann Burt, MLIS, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Personalize PubMed by saving search strategies and creating email alerts. 2) Use My NCBI filters to link to library full-text articles and to focus PubMed searches. 3) Save collections of citations including a personal bibliography.

ABSTRACT

In this hands-on workshop session, explore the free My NCBI tool in PubMed. Discover how to develop and save search strategies, create email alerts on your research topics, and build permanent online bibliographies. With your My NCBI account, add permanent library filters and evidence-based filters to PubMed, use My Bibliography to create an online list of personal publications, limit searches to high impact journals, and utilize the link between the NIH Manuscript Submission System and PubMed. The National Library of Medicine (NLM) provides free web access to nearly 25 million citations for biomedical and clinical medical articles through PubMed.gov; MEDLINE is a subset of PubMed.

3D Printing and 3D Modeling with Free and Open-Source Software (Hands-on)

Monday, Nov. 30 2:30PM - 4:00PM Location: S401CD



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

Participants

Michael W. Itagaki, MD, MBA, Seattle, WA (*Presenter*) Owner, Embodi3D, LLC
Tatiana Kelil, MD, Boston, MA (*Presenter*) Nothing to Disclose
Beth A. Ripley, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with the steps of converting a medical imaging scan in standard Digital Imaging and Communications in Medicine (DICOM) format into a 3D printable medical model. 2) to obtain hands-on experience using free, open-source software packages to perform each step.

ABSTRACT

This presentation will provide hands-on training for converting a medical imaging scan into a 3D printed medical model using free, open-source software. Participants will convert a real computed tomography image data set in Digital Imaging and Communications in Medicine (DICOM) format to stereolithography (STL) file format using the open-source software package 3D Slicer. Participants will then further manipulation the STL file in preparation for 3D printing using the open-source software package Blender. By the end of the session participants should have a medical model that is 3D printable. Additional free learning resources for more advanced medical 3D printing will be provided. Techniques and software packages discussed will work on Windows, Macintosh, and Linux platforms.

Overview of RSNA's Teaching File Software (MIRC®)

Monday, Nov. 30 2:30PM - 4:00PM Location: S501ABC

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

William J. Weadock, MD, Ann Arbor, MI (*Presenter*) Owner, Weadock Software, LLC
Stacy D. O'Connor, MD, Boston, MA (*Presenter*) Nothing to Disclose
Andre M. Pereira, MD, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the features of the RSNA's MIRC software for teaching files. 2) Learn how to download and install the software. 3) Learn to use the RSNA MIRC Wiki to obtain documentation on the software.

ABSTRACT

Background:MIRC (Medical Imaging Resource Center) or TFS (Teaching File System) is a component of RSNA's CTP (Clinical Trials Processor), a suite of tools developed by RSNA to optimize research in radiology mainly with emphasis on workflow and security of patient information. It is offered free of charge by RSNA. Simply put, MIRC can be used to build a radiology teaching file, be it for an individual or for an institution with many simultaneous users. Development started in 2000 and the project has been kept alive along the years, funded by RSNA, with great support both from RSNA and from the community of users. Installation is very streamlined and available for virtually all platforms and operational systems. All files necessary for installation are available at the download session of RSNA's own MIRC server (<http://mirc.rsna.org>). This course is aimed to cover the basics of installation and administration of MIRC and also basic and advanced authoring tools. After finishing this course the attendee will be proficient in authoring and uploading cases, and also be familiar with the resources for installation and administration of MIRC. Course outline: The following topics will be covered: 1) MIRC overview 2) Options of hardware 3) MIRC Installation 4) MIRC administration: setting up libraries. 5) MIRC administration: adding users 6) Authoring a case using the basic authoring tool. 7) Authoring a case using the advanced authoring tool. 8) Advanced authoring tools: image annotation, quizzes, adding documents. 9) Other user-level tools: conferences, migrating cases stored in local folders 10) Sending cases to MIRC straight from the Dicom viewer. The content related to MIRC administration and use will be delivered during a hands-on session with real time guidance by the presenter and IT personnel available in the room for personal assistance.

SSE04

Cardiac (Acute Chest Pain in the Emergency Department Patient)

Monday, Nov. 30 3:00PM - 4:00PM Location: S504AB



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

Participants

Karen G. Ordovas, MD, San Francisco, CA (*Moderator*) Nothing to Disclose
Travis S. Henry, MD, San Francisco, CA (*Moderator*) Spouse is a Senior Medical Science Director, Ophthalmology and Immunology, Genentech
Karin E. Dill, MD, Evanston, IL (*Moderator*) Nothing to Disclose

Sub-Events

SSE04-01 Added Value of the Triple-Rule-Out Study versus Dedicated Coronary CTA for the Evaluation of Chest Pain in the Emergency Department: Review of a 10-Year Experience

Monday, Nov. 30 3:00PM - 3:10PM Location: S504AB

Participants

Amelia Wnorowski, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Ethan J. Halpern, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Triple-rule-out (TRO) CT examines the coronaries, aorta and pulmonary arteries in a single scan. Compared to coronary CTA (cCTA), TRO CT includes anatomic structures above the carina and requires contrast opacification of both right and left sided circulations. The purpose of this study is to determine the added value of TRO CT for evaluation of chest pain in the emergency department.

METHOD AND MATERIALS

All TRO studies performed at our institution from 2006 to 2015 were reviewed. Scans were performed on a 256 slice iCT (Philips Medical Systems), using ECG-gating and a biphasic injection with 60 mL of Optiray 350 followed by 60 mL of a 1:1 mixture of contrast and saline. Scans extended from just above the aortic arch through the base of the heart. Reports were reviewed for diagnoses that could explain chest pain and significant incidental findings.

RESULTS

There were 1196 total cases. Four were excluded for inadequate image quality. 651 patients (54.6%) were female. Average age was 51 years. 81.4% of patients could be safely discharged without a significant coronary or non-coronary diagnosis. 139 patients (11.7%) had significant coronary artery disease (50% stenosis or greater) while 106 patients (8.9%) had a non-coronary diagnosis that could explain chest pain ($p < 0.02$), including pulmonary embolism (28 cases), aortic aneurysm (24) and other aortic pathology (10). 30 cases of pulmonary embolism and aortic pathology would not have been detected with cCTA because of unopacified right sided circulation or limited z-axis coverage. Even if cCTA opacified both right and left sided circulations, 4 patients had segmental upper lobe emboli alone, which would not have been included in the cCTA scan. 418 patients (35.1%) had a total of 528 incidental findings not felt to explain chest pain.

CONCLUSION

Although TRO CT identified a greater number of coronary versus non-coronary diagnoses to explain chest pain, 8.9% of patients had an unsuspected non-coronary explanation for chest pain, and 30/106 of these non-coronary diagnoses would have been missed on dedicated cCTA. Thus, TRO CT adds value in the evaluation of acute chest pain, particularly in the identification of significant non-coronary diagnoses.

CLINICAL RELEVANCE/APPLICATION

TRO CT can identify non-coronary diagnoses in acute chest pain patients and is appropriate when there is suspicion for acute coronary syndrome along with other diagnoses, such as pulmonary embolism.

SSE04-02 Incidence of ACS, MACE, and Positive ICA after Acute Chest Pain cCTA in Real World Clinical Practice-A Clinical Registry Comparison versus Published Trials

Monday, Nov. 30 3:10PM - 3:20PM Location: S504AB

Participants

Sumbal A. Janjua, MD, Boston, MA (*Presenter*) Nothing to Disclose
Pedro V. Staziaki, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Harshna V. Vadvala, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sean B. Singer, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Phillip Kim, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Tomas Neilan, MD, Boston, MA (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc
Udo Hoffmann, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Brian B. Ghoshhajra, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Multiple randomized controlled trials have established the safety and efficacy of coronary CT angiography (cCTA) in evaluating low-to intermediate risk emergency department (ED) patients with acute chest pain. However, concerns have been raised that results may vary outside the confines of a trial setting. We report our initial clinical experience at a large-volume tertiary center, and compare the results to published trials.

METHOD AND MATERIALS

We included all consecutive ED patients presenting with acute chest pain undergoing cCTA between October 2012 and July 2014. Medical records were reviewed and adjudicated for acute coronary syndrome (ACS) during index hospitalization and for major adverse cardiac events (MACE) at up to 60 days after discharge. ACS was defined as myocardial infarction (MI) and unstable angina pectoris requiring hospitalization (UAP) while MACE included MI, UAP and urgent coronary revascularization. We also determined the positive predictive value (PPV) of cCTA (defined as the rates of invasive coronary angiography (ICA) confirming >50% luminal narrowing). Results were compared with the published results of the ROMICAT II, ACRIN-PA and CT-STAT trials.

RESULTS

399 patients with a mean age of 51+/-11 years were included. The rate of ACS was 9.5% (n: 38/399), the rate of MI: 1% (n: 4/399) and UAP: 8.5(34/399). The rates of ACS were comparable to other published randomized trials. The rate of ICA was 6.2% (n: 25/399) with 92% (n: 23/25) of ICA confirming stenosis >50% by cCTA (PPVof cCTA) as compared to a PPV of 76.9% in CT-STAT, 76% in ACRIN PA and 78% in ROMICAT II. There were no undetected ACS and 60-day MACE rate after negative cCTA was 0%, with 0.25% MACE overall (n: 1/399; in a patient with severe stenosis managed medically), in keeping with other published trials.

CONCLUSION

Our unrestricted clinical registry confirmed similar rates of ACS and MACE to large randomized published trials. There were no undetected ACS nor MACE after negative cCTA. The positive predictive value of cCTA for ICA stenosis >50% was 92%, slightly higher than published randomized trials.

CLINICAL RELEVANCE/APPLICATION

An ED cCTA clinical registry confirms similar rates of ACS and MACE compared to large published trials, reinforcing the effectiveness of cCTA in an acute chest pain population.

Honored Educators

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

Udo Hoffmann, MD - 2015 Honored Educator

SSE04-03 Radiation Exposure of Acute Chest Pain Coronary CTA at a Tertiary Center Versus Recently Published Studies

Monday, Nov. 30 3:20PM - 3:30PM Location: S504AB

Participants

Pedro V. Staziaki, MD, Boston, MA (*Presenter*) Nothing to Disclose
Harshna V. Vadvala, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sean B. Singer, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Andy K. Chan, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Jonathan A. Scheske, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Nandini M. Meyersohn, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Udo Hoffmann, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Brian B. Ghoshhajra, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Coronary CT angiography (CCTA) accurately stratifies patients with acute chest pain into low or increased risk of infarction, allowing rapid disposition from the emergency department (ED). We report the radiation doses of emergency department (ED) CCTAs in a tertiary center and compare them with recent studies.

METHOD AND MATERIALS

We included all consecutive ED patients with acute chest pain that presented for CCTA between October 2012 and January 2015. We compared the mean estimated effective doses of our registry patients versus the published MonashHEART, San Antonio Military Medical Center, ROMICAT II, and CT-STAT studies.

RESULTS

Our registry comprised 629 patients. Prospective ECG-triggering utilized in 91% of cases; median tube potential was 100 kV (80-120 interquartile range); mean estimated effective dose was 4.5 ± 2.9 mSv; and median estimated effective dose was 3.7 (2.4-5.7) mSv. MonashHEART reported 585 patients with a mean estimated effective dose of 6.4 ± 2.8 mSv. San Antonio study reported median 6.7 (4.9-9.1) mSv. ROMICAT II reported 473 CCTA patients with a mean cumulative dose for all patients of 11.3 ± 5.3 mSv, whereas in the subset of 78 patients who underwent 128-slice dual source CCTA (identical to our site's equipment) dose was 6.2 ± 3.8 mSv. CT-STAT reported 361 patients, with a median cumulative estimated effective dose of 11.5 (6.8-16.8) mSv.

CONCLUSION

Radiation exposure at CCTA can be decreased in ED patients versus larger trials, with our site noting a median effective dose of 3.7 (2.4-5.7) mSv. This was likely due to increased use of prospective ECG-triggering and tube potential lowering.

CLINICAL RELEVANCE/APPLICATION

CCTA is reliable to assess coronary disease in the setting of acute chest pain. Efforts are made to decrease radiation exposure, including prospective ECG-triggering and tube potential lowering.

Honored Educators

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educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/>

Udo Hoffmann, MD - 2015 Honored Educator

SSE04-04 Discharge Times of Emergency Department Patients Evaluated with Coronary CT Angiography: Effect of Observation Unit Utilization and Hours of Scan Availability

Monday, Nov. 30 3:30PM - 3:40PM Location: S504AB

Participants

Nandini M. Meyersohn, MD, Boston, MA (*Presenter*) Nothing to Disclose
Pedro V. Staziaki, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Harshna V. Vadvala, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Thomas Mayrhofer, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
John T Nagurney, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Udo Hoffmann, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Brian B. Ghoshhajra, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recent trials have established that the use of coronary CT angiography (CCTA) to evaluate low- to intermediate risk emergency department (ED) patients with acute chest pain leads to shorter discharge times for those without significant coronary artery disease (CAD). Emergency departments are increasingly utilizing observation units (EDOUs) to address issues of health care cost and ED overcrowding. We evaluated the effect of hours of scan availability and utilization of an EDU on disposition times of patients without significant CAD.

METHOD AND MATERIALS

684 total ED patients were referred for CCTA between October 2012 and March 2015. 134 patients were excluded, 116 (17%) with significant CAD (>50% luminal stenosis) and 18 (3%) admitted as inpatients. The remaining 550 patients without significant CAD were subdivided into three groups. Group 1 included 301 patients scanned October 2012 - June 2014 with "banker's hours" of scan availability from 8am-3pm non-holiday weekdays only on a hospital-based scanner. Group 2 included 57 patients scanned July 2014 - September 2014 with "extended hours" of availability from 8am-7pm weekdays and 8am-12pm weekends and holidays on a hospital-based scanner. Group 3 included 192 patients scanned September 2014 - March 2015 with "extended hours" but on a scanner newly located physically in the ED. EDU utilization and time from triage to discharge was compared.

RESULTS

281 patients (51%) were discharged directly from the ED and 269 (49%) via an EDU. Statistical analysis was made using Wilcoxon rank sum test and reported as median values with interquartile range (Figure 1). Time to discharge did not increase significantly in either group with increased hours of scan availability. Discharge times for patients treated in an emergency department observation unit were significantly longer than those treated in the emergency department only.

CONCLUSION

Regardless of hours of scan availability or physical location of scanner, nearly all ED patients without significant CAD evaluated with CCTA were discharged within 24 hours of triage. Utilization of an ED observation unit, however, significantly increased time to discharge.

CLINICAL RELEVANCE/APPLICATION

Nearly all ED patients without significant CAD evaluated with CCTA are discharged within 24 hours of triage, although utilization of an ED observation unit significantly increases time to discharge.

Honored Educators

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Udo Hoffmann, MD - 2015 Honored Educator

SSE04-05 A System Dynamics Model Analysis to Assess the Impact of CCTA for Chest Pain Patients on Overall ED Performance

Monday, Nov. 30 3:40PM - 3:50PM Location: S504AB

Participants

Alexander Goehler, MD, PhD, New Haven, CT (*Presenter*) Nothing to Disclose
Steffen Huber, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Felix T. Nautsch, MS, BA, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
John T Nagurney, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
G. Scott Gazelle, MD, PhD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, Marval Biosciences Inc
Udo Hoffmann, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hannah J Wong, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Coronary computed tomographic angiography (CCTA) improves triage efficiency of patients with acute chest pain; however its impact on the Emergency Department (ED) performance for non-cardiac patients is unknown.

METHOD AND MATERIALS

We reviewed two consecutive years of ED visits at our tertiary care hospital to identify chest pain visits with chest pain suspicious for ACS but without known CAD who were suitable for CCTA. To determine the impact of CCTA on the ED, we identified our comparator group to be all non-cardiac patients who were placed in observation status. We developed a System Dynamics model to simulate patient flow through the ED, incorporating patient's characteristics, imaging use, and daily/hourly trends in ED visit volumes. The model considered two strategies (1) Standard of care as observed at our institution and (2) CCTA triage after 1st negative Troponin and discharge of patients without CAD on CCTA. Different CCTA availabilities were considered.

RESULTS

:Among 9,400 patients who received serial troponin measurements to assess chest pain in the ED, we identified 3,594 visits (38%) eligible for CCTA (age: 56±15 years, 52% male), accounting for 24% of all observation admissions. 3% of the patients were ultimately diagnosed with ACS. 52% of the patients with negative serial troponin had further CAD workup, among which 16% had obstructive CAD. The comparator cohort included 8,848 ED visits (age: 55±19 years, 47% male). 23% required cross-sectional CT imaging including head (37%), abdominal/pelvis (21%), and CTA-PE (8%). The model predicted well the length of stay (LOS) (model vs. observed in hours) for the current standard of care (target: 21 vs. 19, comparator: 22 vs. 25). The LOS was reduced to 14.8 hours (29%) when CCTA was available 24/7 and 10.8 (48%) when it was available M-F 7AM-4PM. At the same time, observation unit capacity for non-cardiac patients was increased by 7% and 11%, respectively

CONCLUSION

About one third of all ED visit for chest pain could benefit from a CCTA work up. This would not only reduce the length of stay for cardiac patients but also increase capacity for non-cardiac patients, improving overall ED performance.

CLINICAL RELEVANCE/APPLICATION

To our knowledge, this is the first study to assess CCTA in the broader ED context beyond the impact on cardiac patients.

Honored Educators

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Udo Hoffmann, MD - 2015 Honored Educator

SSE04-06 Culprit Lesions of Acute Coronary Syndrome are Characterized by the Presence of Stenosis and High-risk Plaque, But Not Higher Segmental Coronary Artery Calcium Score: Results from the ROMICAT II Trial

Monday, Nov. 30 3:50PM - 4:00PM Location: S504AB

Participants

Stefan Puchner, MD, Boston, MA (*Presenter*) Nothing to Disclose
Thomas Mayrhofer, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jakob Park, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael T. Lu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Pal Maurovich-Horvat, MD, PhD, Budapest, Hungary (*Abstract Co-Author*) Nothing to Disclose
Khristine Ghemigian, BA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jerome Fleg, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Udo Hoffmann, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Maros Ferencik, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The amount of coronary artery calcium (CAC) predicts cardiovascular events and correlates with plaque burden. However, CAC may represent advanced stage of atherosclerosis and is not directly related to high-risk plaque. We determined the association of stenosis, high-risk plaque and segmental CAC score with culprit lesions of ACS.

METHOD AND MATERIALS

We studied 501 patients with acute chest pain from the coronary CT angiography (CCTA) arm of the ROMICAT II trial. CCTA was assessed for the presence of $\geq 50\%$ stenosis and high-risk plaque (positive remodeling, low HU plaque, napkin-ring sign, spotty calcium) in all 17 coronary segments. Total and segmental CAC Agatston score was measured on non-contrast CT scans. Culprit lesions were determined in subjects with ACS by the review of available records.

RESULTS

Subjects with ACS (n=37) had higher prevalence of $\geq 50\%$ stenosis (78% vs. 7%, $p < 0.001$) and high-risk plaque (95% vs. 59%, $p < 0.001$), and higher total CAC score [median 229, 25th-75th percentile 75-517 vs. 27, 25th-75th percentile 0-99]. High-risk plaques were more frequent in segments with lower segmental CAC score (Figure, $p < 0.001$). In subjects with ACS, culprit (n=41) vs. non-culprit (n=200) plaques had higher prevalence of $\geq 50\%$ stenosis (81% vs. 11%, $p < 0.001$) and high-risk plaque (76% vs. 51%, $p = 0.005$), but not higher segmental CAC score (median 22, 25th-75th percentile 4-71 vs. 14, 25th-75th percentile 0-51; $p = 0.37$). In multivariable multilevel mixed-effects logistic regression, $\geq 50\%$ stenosis (OR 40.2, 95%CI 15.6-103.9, $p < 0.001$) and high-risk plaque (OR 3.4, 95%CI 1.3-9.1, $p = 0.02$), but not segmental CAC score (OR 1.0, 95%CI 1.0-1.0, $p = 0.47$) were associated with culprit lesions of ACS.

CONCLUSION

Prevalence of high-risk plaque is inversely related to segment amount of CAC. Culprit lesions of ACS are characterized by $\geq 50\%$ stenosis and high-risk plaque, but not by higher segmental CAC. These findings suggest that local advanced calcification may represent more stable stage of atherosclerosis, while the culprit lesions are characterized by smaller amounts of CAC.

CLINICAL RELEVANCE/APPLICATION

High calcium score indicates a higher risk for acute coronary syndrome, however the culprit lesions are characterized by smaller

amounts of coronary artery calcium.

Honored Educators

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Udo Hoffmann, MD - 2015 Honored Educator

SSE21

Physics (Nuclear Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: S403A



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

Discussions may include off-label uses.

Participants

Chien-Min Kao, PhD, Chicago, IL (*Moderator*) Stockholder, Walgreens Boots Alliance, Inc
Tinsu Pan, PhD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSE21-01 Algorithm-Enabled Reduction of Detector Crystals in Advanced PET System

Monday, Nov. 30 3:00PM - 3:10PM Location: S403A

Participants

Zheng Zhang, MA, BS, Chicago, IL (*Presenter*) Nothing to Disclose
Jinghan Ye, San Jose, CA (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Buxin Chen, MSc, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Amy Perkins, Philadelphia, PA (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Andreia Trindade, PhD, Eindhoven, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV
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Chien-Min Kao, PhD, Chicago, IL (*Abstract Co-Author*) Stockholder, Walgreens Boots Alliance, Inc
Emil Y. Sidky, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Xiaochuan Pan, PhD, Chicago, IL (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, Toshiba Corporation;

PURPOSE

As detector crystals constitute a large portion of a modern PET system cost, it is of significance to design a PET scanner with a reduced number of detectors without sacrificing the image quality. In this study, we investigate algorithm-enabled PET systems design with a 50% reduction of detector crystals.

METHOD AND MATERIALS

We employ a digital PET scanner to collect IEC phantom data with initial total activity of 53 MBq. The phantom contains 6 spheres of 10, 13, 17, 22, 28, and 37 mm diameter. The activity in the smallest four spheres is 4 times the background and zero in the other two. We design a sparse PET configuration with 50% of crystals, which is to remove odd-numbered tiles in the odd-numbered rings, and even-numbered tiles in the even-numbered rings. We use an iterative algorithm based on Chambolle-Pock framework to solve a constrained-TV-minimization problem. We reconstruct images from full data by using the row-action maximum likelihood algorithm (RAMLA) as references. Scatter and random corrections are applied in the reconstruction. Images are evaluated by use of contrast of 4 hot spheres with the instruction in NEMA NU 2-2012.

RESULTS

Reconstructions with the new algorithm from both full and sparse data exhibit lower background noise compared to the RAMLA result. The contrast of a hot sphere of size 22 mm is 71.7%, 66.7%, and 68.5% in the full-data TV image, the sparse-data TV image, and the full-data RAMLA result, respectively. In the same order, the contrasts of the hot sphere of size 17 mm is 63.2%, 60.8%, and 59.0%; of the hot sphere of size 13 mm is 58.4%, 54.1%, and 47.3%; and of the hot sphere of size 10 mm is 32.1%, 20.6%, and 17.5%.

CONCLUSION

Advanced algorithms can reconstruct PET images from full data with quality improved over the RAMLA results in terms of contrast and background noise, and can yield images from data with 50% crystal reduction with potential practical utility.

CLINICAL RELEVANCE/APPLICATION

This work suggests that PET images of practical utility may be obtained by use of advanced algorithms from sparse-crystal data, which can be exploited for enabling crystal/cost reduction.

SSE21-02 Respiratory Motion Compensation for Simultaneous PET/MR Based on Measurements of Strongly Undersampled Radial MR Data

Monday, Nov. 30 3:10PM - 3:20PM Location: S403A

Awards

RSNA Country Presents Travel Award

Participants

Christopher M. Rank, MSc, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Thorsten Heusser, Dipl Phys, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Wetscherek, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Marc Kachelriess, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We propose a new method for PET/MR respiratory motion compensation (MoCo), which employs strongly undersampled measured MR

data. These MR measurements can be interlaced with clinical MR sequences and can be acquired with measurement times as short as 30 s per bed position.

METHOD AND MATERIALS

MR data covering the thorax and abdomen of free-breathing volunteers were acquired with a Siemens Biograph mMR system. We applied a 3D encoded radial stack-of-stars sequence with a golden angle radial spacing. Two highly undersampled datasets consisting of 300 and 600 spokes were created corresponding to acquisition times of 30 s and 60 s, respectively. Respiratory motion amplitudes were derived from measured k-space centers allowing for a retrospective gating into 20 overlapping motion phase bins with a width of 10%. For all volunteers, MoCo 4D MR images and corresponding motion vector fields were generated for both highly undersampled datasets using our newly-developed method for joint motion estimation and iterative image reconstruction. Subsequently, 4D PET volumes of the volunteers with four artificial hot lesions (10 mm diameter) in the lungs and the abdomen were simulated. 3D PET and MoCo 4D PET images based on the two sets of motion vector fields derived from MR were reconstructed and compared to a reference gated 4D reconstruction with ten-fold PET acquisition time.

RESULTS

Compared to the 3D PET reconstructions, MoCo 4D PET reconstructions could reduce image blurring for both MR acquisition times. Due to its large motion amplitude, one lesion showed a double structure in the 3D reconstruction which could not be seen in the MoCo 4D reconstructions. For quantitative evaluation, SUVmean values were measured for all lesions in the end-exhale motion phases. In comparison to the reference, deviations of SUVmean were 36.7%, 24.5%, 21.5% on average for the 3D, MoCo 4D (30 s) and MoCo 4D (60 s) reconstructions, respectively.

CONCLUSION

It was demonstrated that motion compensation of PET images based on measurements of strongly undersampled radial MR data acquired during normal respiration could outperform 3D PET reconstructions in terms of image quality and quantification.

CLINICAL RELEVANCE/APPLICATION

The proposed method could be potentially integrated into clinical PET/MR to improve PET image quality and quantification, thus, increasing the diagnostic value of PET/MR.

SSE21-03 The Automated Determination of Universal Image Quality Indices for PET Scanners

Monday, Nov. 30 3:20PM - 3:30PM Location: S403A

Participants

Yaniv Rotem, BSc, MSc, Neshet, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
John A. Kennedy, PhD, Haifa, Israel (*Presenter*) Nothing to Disclose

Background

Evaluation of PET image quality phantom tests routinely requires deliberation and subjective decision-making. Commonly-used metrics of PET image quality do not always reflect perceptual quality differences. An automated method of measuring the structural similarity index (SSIM) reflecting known characteristics of the human visual system (HVS) has been developed to aid in the fast, objective evaluation of such tests.

Evaluation

Monthly image quality tests were performed (n=26) using an American College of Radiology (ACR) approved PET phantom (Esser flangeless) in a time-of-flight PET/CT. Scans comprised approximately 123e6 prompt counts and 19e6 random counts. An in-house MATLAB code analyzed 9.81 mm thick transaxial slices through the hot cylinders by comparing them with a digital model adjusted to known hot-to-background ratios. Registration of the digital model was performed using correlation of the outer phantom edges, and then rotating the images to maximize SSIM. In additional trials, SSIM was determined for a misregistered phantom (by 13 mm between CTAC and PET) exhibiting attenuation correction artifacts and for a list mode acquisition divided into 16 virtual acquisitions incrementing the scan time by 30 s to total of 8 minutes. SSIM was compared to a non-HVS metric, mean square error (MSE). Ideally, higher SSIM or lower MSE indicate superior image quality.

Discussion

Over approximately a two-year period, SSIM was 0.748 ± 0.007 (mean \pm S.D., n=26) on ACR-approved PET phantoms. All cold and hot features were evident but highest (0.764) and lowest (0.733) SSIM were the visually better and worse images respectively. For the 16 virtual acquisitions, SSIM increased (from 0.56 to 0.74) monotonically with scan time, a known determinant of image quality. The misregistered phantom was superior to the 90 s acquisition by visual assessment, which was reflected in the SSIM (0.68 vs. 0.65, respectively) but not in the MSE (0.072 vs 0.065).

Conclusion

Automated PET quality control using structural similarity to model the human visual system efficiently provides an objective index to reflect small perceptual quality differences among images and can be used to ensure diagnostic accuracy.

SSE21-04 Performance Evaluation of a Prone Dedicated Breast Ring PET Scanner Designed for Improved Visualization of Posterior Breast Tissue

Monday, Nov. 30 3:30PM - 3:40PM Location: S403A

Participants

Andrew Polemi, Charlottesville, VA (*Presenter*) Institutional research agreement, Hologic, Inc
Heather R. Peppard, MD, Charlottesville, VA (*Abstract Co-Author*) Consultant, Siemens AG; Research Grant, Hologic, Inc
Stan Majewski, MD, Morgantown, WV (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, ONCOVISION
Alexander Stolin, PhD, Morgantown, WV (*Abstract Co-Author*) Nothing to Disclose
Patrice K. Rehm, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Mark B. Williams, PhD, Charlottesville, VA (*Abstract Co-Author*) Institutional research agreement, Hologic, Inc.

PURPOSE

To report the design and performance of a novel dedicated breast ring positron emission tomography (BRPET) system measured using a modified NEMA NU4-2008 protocol.

METHOD AND MATERIALS

The BRPET scanner consists of a ring of 12 detector modules. Each detector consists of a pixelated LYSO crystal connected to a position sensitive photomultiplier tube using a fiber optic light guide. The detector ring is mounted below a modified Lorad prone breast biopsy table for pendant geometry imaging. The detector light guides extend from the photomultiplier tubes at an angle to permit closer crystal access to posterior breast tissue near the patient's chest wall. Performance metrics evaluated include spatial resolution, sensitivity, and noise equivalent count rate. These tests were adapted from the National Electrical Manufacturers Association (NEMA) NU4-2008 protocol. Two additional phantom tests were performed to assess the amount of posterior breast tissue that cannot be imaged by the scanner due to the thickness of the table.

RESULTS

Spatial resolutions of 1.8, 1.6, and 1.9 mm FWHM were measured at the center of the field of view in the axial, radial, and tangential directions, respectively. The peak absolute system sensitivity was 13.2% and scatter fraction of 25.4% using an energy window of 420 - 600 keV. The peak noise equivalent counting rate and peak true rates at 3.86 MBq were 0.75 kcps and 1.23 kcps, respectively. The scanner can image to within 6.25mm of the plane defined by the top surface of the table and has the capability to scan a total of 19 cm along the central axis of a pendant breast.

CONCLUSION

The BRPET system can produce high-resolution PET images at clinically relevant count rates. Compared to other prone breast PET systems it has superior coverage of the posterior breast.

CLINICAL RELEVANCE/APPLICATION

Novel dedicated breast ring PET scanner with high spatial resolution and better visualization of posterior breast tissue compared to current breast PET systems.

SSE21-05 A Hybrid Imaging Phantom for Quality Assurance and Research

Monday, Nov. 30 3:40PM - 3:50PM Location: S403A

Participants

Philipp Mann, MSc, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Thorsten Heusser, Dipl Phys, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Hugo de las Heras, PhD, Zorneding, Germany (*Abstract Co-Author*) Research Consultant, QUART GmbH
Ricardo d. Weigel, MA, Zorneding, Germany (*Abstract Co-Author*) Officer, QUART GmbH
Marc Kachelriess, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Bachert, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To construct and test a phantom that mimics the human pelvis for quality assurance, research, and performance measurements in both PET/CT and PET/MR devices.

METHOD AND MATERIALS

The phantom is enclosed in a PMMA box that can be filled with different liquids and radioactive tracers to simulate background signal. Refillable inserts mimic bladder, thigh bones, and prostate (including eight separate cells which can be filled with dissolved metabolites and radioactive tracers). The inserts were produced using 3D printing based on CAD models or MRI data from healthy volunteers. Activity introduced into the bladder model yields realistic PET signals while the thigh bones can be filled with fat- or bone-equivalent materials to obtain different attenuating properties. Additionally, an insert for an endorectal RF coil allows to perform MR spectroscopy (MRS). The phantom was used to check co-registration: the center of mass of the signals obtained by CT or MR within a single cell of the prostate insert was calculated and compared to the corresponding signal obtained by PET. The phantom was also used for research projects including MRS (e.g., quantification of creatine, citrate, and choline) and PET studies comparing reconstructions of data obtained with PET/MR and PET/CT scanners. Since the phantom is available as 3D voxel phantom all experiments can be cross-checked by simulations.

RESULTS

The misalignment of the co-registration of data from the employed PET/CT and PET/MR were 0.57 ± 0.30 pixels and 0.57 ± 0.20 pixels, respectively. The MRS analysis showed that all ^1H MR resonances of metabolites in the model solutions can be resolved. Offline PET simulations agree well with the outcome of phantom measurements (SUV_{mean} differences < 5 %). PET image distortions caused by false MR-based attenuation maps can be accurately reproduced using simulations based on the 3D voxel phantom.

CONCLUSION

The phantom is a flexible tool to study the performance of PET/CT and PET/MR systems. It can verify co-registration in a straightforward way. In addition, there is a variety of research applications, ranging from MR sequence testing to evaluations of new PET reconstruction algorithms.

CLINICAL RELEVANCE/APPLICATION

The phantom and its digital 3D version can help to improve quality assurance in clinical PET/CT and PET/MR scanners and offer simple approaches to test and evaluate new PET reconstruction algorithms.

SSE21-06 Statistical Methods to Verify Lesion Detection in Low Count Environments

Monday, Nov. 30 3:50PM - 4:00PM Location: S403A

Participants

Kenneth Nichols, PhD, New Hyde Park, NY (*Presenter*) Royalties, Syntermed, Inc;

PURPOSE

It can be helpful to quantify lesion-to-background contrast in resolving cases of questionable visual lesion detection. For low-count data this becomes problematic due to statistical uncertainty. This study was undertaken to determine whether curve fitting at potential lesion locations overcomes these difficulties.

METHOD AND MATERIALS

Algorithms were written in IDL to automatically identify likely locations of solid spheres and to sample neighboring uniform background volumes in multipurpose plastic and water phantoms used for routine SPECT quarterly quality assurance tests. Data were processed for 12 phantoms loaded with 370-925 MBq Tc-99m for acquisitions ranging from 11-27 seconds/projection for 64-128 projections. Each high-count acquisition was paired with low-count acquisitions for the same phantoms imaged for only 1 second/projection. Algorithms generated counts versus radii curves and counts versus angles curves, through which 3rd order polynomials were fit by minimizing χ^2 variance. Similar plots were formed for 6 background volumes. Contrast was computed as $(\text{maximum}-\text{minimum}) \div (\text{maximum}+\text{minimum})$ for both raw counts and fitted curves. One physicist read all images and graded sphere detection confidence on a 5-point scale for each sphere. The Kolmogorov-Smirnov test determined whether continuous variables were normally distributed, based on which the t-test or Wilcoxon test determined significance of differences between means.

RESULTS

Total counts were significantly greater for high-count than low-count acquisitions (32 ± 19 versus 3 ± 2 Million counts, $p < 0.0001$). Fitted contrast agreed with visual scores with higher accuracy (ROC area) than raw contrast ($85 \pm 3\%$ versus $61 \pm 5\%$, $p < 0.0001$), for both low counts ($84 \pm 5\%$ versus $67 \pm 7\%$, $p = 0.001$) and high counts ($88 \pm 4\%$ versus $75 \pm 6\%$, $p = 0.003$). Contrast was significantly different between high-count and low-count paired acquisitions for raw counts ($41 \pm 23\%$ versus $74 \pm 24\%$, $p < 0.0001$), but not for fitted contrast ($37 \pm 32\%$ versus $35 \pm 32\%$, $p = 0.27$). Raw contrast was correlated with total counts ($r = -0.51$, $p < 0.0001$), but fitted contrast was not ($r = 0.02$, $p = 0.79$).

CONCLUSION

Compared to straightforward contrast measurement, curve fitting provided better agreement with visual assessment and more stable measurements that were independent of acquired counts.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that radial count curve fitting may be useful to verify lesion detection in low count environments.

SSE03

Cardiac (TAVR and Other Nonsurgical Interventional Procedures)

Monday, Nov. 30 3:00PM - 4:00PM Location: S502AB



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

Discussions may include off-label uses.

Participants

Jonathon A. Leipsic, MD, Vancouver, BC (*Moderator*) Speakers Bureau, General Electric Company Speakers Bureau, Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc
Lynne M. Hurwitz, MD, Durham, NC (*Moderator*) Research Grant, Siemens AG Research Grant, General Electric Company

Honored Educators

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Jonathon A. Leipsic, MD - 2015 Honored Educator

Sub-Events

SSE03-01 Comparison of Three Dimensional Echocardiography with ECG-Gated Cardiac Tomography for Assessment of the Aortic Annulus Prior to Percutaneous Aortic Valve Replacement (TAVR)

Monday, Nov. 30 3:00PM - 3:10PM Location: S502AB

Participants

Gilda Boroumand, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Howard M. Julien, MD, MPH, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Nicholas J. Ruggiero II, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Praveen Mehrotra, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Ethan J. Halpern, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The morphology and size of the aortic annulus are critical factors for preprocedural planning of percutaneous aortic valve replacement (TAVR). We have previously demonstrated that the oval shape of the aortic annulus results in underestimation of annular area based upon anteroposterior (AP) measurements on 2D echocardiography relative to area measurements on ECG-gated cardiac CTA (cCTA). This study evaluated annular size on 3-dimensional transesophageal echocardiography (3D-TEE) in comparison to cCTA prior to a TAVR procedure.

METHOD AND MATERIALS

3D-TEE and ECG-gated cCTA measurements of the aortic annulus were compared from preprocedural studies on 25 consecutive TAVR patients. 3D-TEE measurements were obtained during mid-systole, while cCTA measurements were obtained at late-systole (40% of the R-R interval) and late-diastole (80% of the R-R interval). Annular area was measured by manual planimetry. Pearson correlation coefficients were computed and paired t-tests were performed to compare AP (short axis) and transverse (long axis) diameters of the annulus, as well as annular area as measured by echocardiography and by cCTA.

RESULTS

cCTA measurements in systole and diastole were highly correlated: $r=0.83$ for short axis diameter, $r=0.87$ for long axis diameter, $r=0.98$ for annular area. Good correlation was observed between 3D-TEE and cCTA for short axis diameter ($r = 0.73-0.87$), long axis diameter ($r = 0.72$) and annular area ($r = 0.87-0.88$). Long axis diameter and annular area measurements obtained by 3D-TEE were significantly smaller than those obtained by cCTA: Short axis diameter - 3D-TEE: 21.3mm; cCTA systole: 21.9mm; cCTA diastole: 20.7mm ($p>0.05$). Long axis diameter - 3D-TEE: 24.8mm; cCTA systole: 27.2mm; cCTA diastole: 26.4mm ($p<0.001$). Annular area - 3D-TEE: 413mm²; cCTA systole: 463mm² ($p<0.0001$); cCTA diastole: 435mm² ($p=0.034$).

CONCLUSION

Although all cCTA measurements of the aortic annulus are highly correlated with measurements by 3D-TEE, diastolic phase cCTA measurements tend to be closer to standard mid-systolic 3D-TTE measurements. This is especially true for measurement of aortic annular area which is over measured by an average of 50mm² on cCTA during systole relative to 3D-TEE.

CLINICAL RELEVANCE/APPLICATION

cCTA measurements of the aortic annulus are highly correlated between systole and diastole, but diastolic phase measurements provide a better match with 3D-TEE, especially with respect to annular area.

SSE03-02 Low-Contrast-Medium-Volume Low-Tube-Voltage Computed Tomography for Planning Transcatheter Aortic Valve Replacement

Monday, Nov. 30 3:10PM - 3:20PM Location: S502AB

Participants

Julian L. Wichmann, MD, Charleston, SC (*Presenter*) Nothing to Disclose
Lloyd Felmy, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

Carlo N. De Cecco, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Akos Varga-Szemes, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Stefanie Mangold, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ;
Giuseppe Muscogiuri, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Andrew D. McQuiston, BS, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Stephen R. Fuller, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively evaluate the feasibility, diagnostic quality, and safety of low-tube-voltage, low-contrast-volume comprehensive cardiac and aortoiliac computed tomography angiography (CTA) for planning transcatheter aortic valve replacement (TAVR).

METHOD AND MATERIALS

Forty consecutive TAVR candidates prospectively underwent combined contrast-enhanced (270mgI/mL iodixanol) CTA of the aortic root complex and aortoiliac vascular access route. Patients were assigned to group A (2nd generation dual-source CT [DSCT], 100 kV, 60 mL contrast material, 4.0 mL/s flow rate, iodine-delivery rate [IDR] 1.08 g/s) or group B (3rd generation DSCT, 70kV, 40 mL contrast material, 2.5 mL/s flow rate, IDR 0.675 g/s). Mean vascular attenuation, image noise, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) were measured. Subjective image quality was independently assessed by two blinded readers using five-point Likert scales. Patient creatinine levels on the day of the exam and during short- and long-term follow-up were measured.

RESULTS

Except for a higher body mass index in group B (24.8 ± 3.8 vs 28.1 ± 5.4 kg/m², $P = 0.0339$), no significant differences in patient characteristics between both groups were observed. Mean aortoiliac SNR ($P = 0.0003$) and CNR ($P = 0.4761$) were 13.1 ± 6.8 and 24.3 ± 11.9 (group A), and 15.4 ± 6.7 and 24.9 ± 12.3 (group B), respectively. Mean cardiac SNR ($P = 0.0003$) and CNR ($P = 0.0181$) were 15.6 ± 9.0 and 20.2 ± 13.4 (group A) and 12.2 ± 4.5 and 15.3 ± 6.7 (group B), respectively. Subjective image quality did not significantly differ ($P \geq 0.213$) except for lower aortoiliac image noise in group B (4.42 vs 4.12 , $P = 0.0374$). TAVR planning measurements were successfully obtained in all studies. There were no significant changes in creatinine levels among and between patient groups during short- and long-term follow-up ($P \geq 0.302$). Four patients expired during the study period because of unrelated causes, but no adverse events attributable to the use of iodinated contrast media were observed.

CONCLUSION

TAVR candidates can be safely and effectively evaluated by a comprehensive CTA protocol with low contrast volume using low-tube voltage acquisition.

CLINICAL RELEVANCE/APPLICATION

CTA imaging with reduced contrast volume in pre-TAVR evaluation may improve safety in multimorbid patients considered for this procedure.

SSE03-03 Incidence of Contrast Induced Nephropathy in Patients Undergoing TAVR Evaluation

Monday, Nov. 30 3:20PM - 3:30PM Location: S502AB

Participants

Alice Wang, Durham, NC (*Presenter*) Nothing to Disclose
Matthew Ellis, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
J. Kevin Harrison, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Todd Kiefer, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Rendon C. Nelson, MD, Durham, NC (*Abstract Co-Author*) Consultant, General Electric Company Consultant, Nemoto Kyorindo Co, Ltd Consultant, VoxelMetrix, LLC Research support, Bracco Group Research support, Becton, Dickinson and Company Speakers Bureau, Siemens AG Royalties, Wolters Kluwer nv
Hanghang Wang, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Lynne M. Hurwitz, MD, Durham, NC (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, General Electric Company

PURPOSE

Patients with severe aortic valve stenosis (AS) who are at high surgical risk are commonly evaluated for transcatheter aortic valve replacement (TAVR) with CT angiographic imaging (CTA) of relevant anatomy and coronary angiography (CC). Many of these patients have increased serum creatinine (Scr), increasing the risk of acute contrast induced nephropathy (CIN). Thus, the incidence of CIN in patients undergoing workup needs to be assessed.

METHOD AND MATERIALS

Between 2012 and 2014, 258 patients underwent work up for TAVR with CTA at a single academic medical center. Patients who underwent both CTA and CC with Scr values measured 24 hours before and within 48 hours after contrast exposure were included in the analysis ($n=123$). All CTA and CC exams were performed utilizing iopamidol 370mg/ml via intravenous and intra-arterial administration, respectively, with average contrast volume $110\text{ml} \pm 21\text{ml}$ and $124 \pm 65\text{ml}$, respectively. Fifty-five patients had CTA+CC within 24 hours, 66 patients had CTA+CC within 48 hours, and 55 patients underwent CTA+CC greater than 48 hours apart. Pre and post-imaging Scr were compared with paired student t-tests. CIN was defined as an increase in 20% of Scr.

RESULTS

The average age was 79 ± 9 years, 112 were Caucasian, 79 were male, and 52 had diabetes (DMII). Sixty-nine patients underwent TAVR and 16 underwent surgical AVR. Scr increased on average 0.057 (4.9%, $p=0.053$), 0.054 (4.3%, $p=0.039$) and 0.079 (6.6%, $p=0.068$) for patient groups who had CTA+CC within 24 hours, within 48 hours and greater than 48 hours, respectively. CIN developed in 12.7%, 11.9% and 12.5% of patients who had CTA+CC within 24 hours, 48 hours and greater than 48 hours, respectively. Patients with pre-existing chronic kidney disease had an increase in Scr of 0.0755 (5.1%, $p=0.041$) and a CIN rate 12.5% when CTA+CC were within 48 hours. Patients with DMII had an increase in Scr of 0.145 (9.76%, $p=0.002$) and increased rate of CIN at 20.7% when CTA+CC were within 48 hours. No patients required dialysis.

CONCLUSION

Work up for TAVR includes significant contrast loads with accompanying risks for CIN. There was a degree of CIN in all groups; however, patients with DMII are the most susceptible when contrast loads occur less than 48 hours apart.

CLINICAL RELEVANCE/APPLICATION

Incidence of CIN for all patient cohorts ranged from 11.9% to 12.5%. Patients with DMII are most susceptible to develop CIN when undergoing TAVR evaluation.

SSE03-04 Prediction of Transcatheter Aortic Valve Replacement (TAVR) Paravalvular Leak Diagnosed on Post-procedure Transthoracic Echo (TTE) with Pre-procedure 3D Printed Models: A Proof of Concept Study

Monday, Nov. 30 3:30PM - 3:40PM Location: S502AB

Participants

Beth A. Ripley, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Tatiana Kelil, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael Cheezum, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Alexandra Goncalves, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael L. Steigner, MD, Boston, MA (*Abstract Co-Author*) Speaker, Toshiba Corporation
Dimitris Mitsouras, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Amir Imanzadeh, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Tianrun Cai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Ron Blankstein, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Accurate sizing of TAVR prostheses is necessary to minimize post-procedural aortic regurgitation (PPAR or 'leak'), which is associated with adverse outcomes. We hypothesized that 3D-printed models of the aortic valve (AV) complex derived from pre-TAVR cardiac CT (CCT) could be used to determine whether the implanted valve would have an appropriate fit and thus predict which patients are more likely to develop PPAR.

METHOD AND MATERIALS

This retrospective study included 8 patients with pre-TAVR CCT and post-TAVR TTE who developed PPAR and 8 age, sex and valve size-matched controls. The aortic root, annulus and left ventricular outflow tract were segmented from pre-TAVR CCT (Vitrea 6.7, Vital Images) by a radiologist blinded to TTE findings and exported as 3D-printable (STL) files into CAD software (3matic, Materialise) for post-processing. Aortic models were 3D-printed using flexible stereolithography material; valve models meeting Sapien size specs (26 & 29mm) and a closed base were printed on a material extrusion 3D printer in hard plastic. The valve model corresponding to the implanted valve was carefully positioned in each aortic model and the presence of leak was determined via projection of light through the LVOT onto a thin film, captured with a digital camera. The presence of leak (defined as any paravalvular light transmission) was made by consensus of 2 readers blinded to TTE results

RESULTS

Six out of 8 paravalvular leaks were accurately predicted and 6 out of 8 patients without leaks were correctly ruled out (2 false negatives and false positives, respectively). The shape and location of light crescents predicting leaks matched PPAR location on post-procedure TTE.

CONCLUSION

Use of pre-TAVR 3D-printing provides a unique assessment of the 3D relationship between the AV complex and implanted valves, and may predict which patients are more likely to develop paravalvular leaks. This technology may assist in the development of future generations of transcatheter valves, with potential to improve outcomes. Given these initial results, further studies focusing on both clinical outcomes and 3D-printed model optimization are needed.

CLINICAL RELEVANCE/APPLICATION

Flexible 3D-printed models of the AV complex may allow for better TAVR patient selection, procedural planning, and valve size selection. If verified in future studies, this technology has the potential to lead to better patient outcomes.

SSE03-05 The Prevalence and Clinical Impact of CTA Incidental Findings in TAVI Work-up

Monday, Nov. 30 3:40PM - 3:50PM Location: S502AB

Participants

Floortje van Kesteren, MD, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Esther M. Wiegerinck, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jaap Stoker, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Research Consultant, Robarts Clinical Trials
Jan Baan JR, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
R. Nils Planken, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Computed Tomography Angiography (CTA) is used in the work-up for transcatheter aortic valve implantation (TAVI) to assess cardiovascular anatomy, annulus size and to determine the optimal access route. However, in the elderly TAVI population, CTA frequently reveals incidental findings that potentially change patient management and prognosis. We aim to determine the effect of incidental findings on the clinical course of patients in TAVI work-up.

METHOD AND MATERIALS

Single center retrospective analysis including patients who underwent a CTA (64 slice scanner) in TAVI work-up between 2009 and 2014. Experienced radiologists reviewed all examinations prospectively. Incidental findings were classified as (1) clinical significant

findings limiting eligibility for TAVI due to poor prognosis or requiring immediate action, including additional diagnostic testing or treatment, (2) findings requiring follow-up after TAVI and (3) findings without consequences.

RESULTS

A total of 623 patients were included, 354 (56.8%) were female. Mean age was 79.8 +/- 8.8 years. Clinical significant findings limiting TAVI or requiring immediate action were reported in 57 patients (9.1%), including; suspected malignancy (n=40, 6.4%), aortic aneurysm >5 cm (n=13, 2.1%), diverticulitis (n=2, 0.3%), cardiac thrombi (n=2, 0.3%) and suspected colitis (n=1, 0.2%). Malignancy and diverticulitis were confirmed in 13 and 2 patients (32.5% and 100%), respectively. Findings requiring follow up after TAVI were found in 78 patients (12.5%) including probably benign tumors (n=72, 11.6%) and aneurysms with follow up requirement (n=7, 1.1%). Non-significant findings were reported in 581 patients (93.3%). Patients with clinical significant findings requiring immediate action were more frequently rejected for TAVI than patients without those findings (n=12, 21.1% vs n=51, 9.0%; p=.004). There was no significant delay between CTA and the TAVI procedure between the groups (median 43.0 [14.5-86.5] vs 29.0 [14.0-63.5] days; p=.105).

CONCLUSION

The prevalence of incidental findings is high in elderly TAVI patients. Incidental findings significantly influence patient management due to an anticipation on poor prognosis and may lead to treatment delay.

CLINICAL RELEVANCE/APPLICATION

CTA prior to TAVI reveals incidental findings, leading to recurrent discussions in Heart Team meetings. Our results show that incidental findings are frequent and may influence the clinical course.

SSE03-06 A Strategy of Underexpansion and Ad Hoc Post-dilation of Balloon-Expandable Transcatheter Aortic Valves in Patients with Borderline Annular Dimensions: Favorable Midterm Outcomes

Monday, Nov. 30 3:50PM - 4:00PM Location: S502AB

Participants

Jonathon A. Leipsic, MD, Vancouver, BC (*Presenter*) Speakers Bureau, General Electric Company Speakers Bureau, Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc
Philipp Blanke, MD, Vancouver, BC (*Abstract Co-Author*) Consultant, Edwards Lifesciences Corporation ; Consultant, Neovasc Inc
Chesnal Dey Arepalli, MD, Burnaby, BC (*Abstract Co-Author*) Nothing to Disclose
Christopher Naoum, MBBS, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
David Wood, MD, FRCPC, Vancouver, BC (*Abstract Co-Author*) Consultant, Edwards Lifesciences Corporation; Consultant, St. Jude Medical, Inc; Consultant, Medtronic, Inc; Researcher, AstraZeneca PLC; Researcher, Edwards Lifesciences Corporation; Researcher, Boston Scientific Corporation; Researcher, Medtronic, Inc;
John Webb, MD, FRCPC, Vancouver, BC (*Abstract Co-Author*) Consultant, Edwards Lifesciences Corporation

PURPOSE

To evaluate one year outcomes with a strategy of intentional underexpansion of balloon expandable transcatheter heart valves (THVs) in terms of clinical outcomes, valve function, and frame durability at one year.

METHOD AND MATERIALS

We evaluated 47 patients at risk of annular injury who underwent TAVR with a deliberately underexpanded THV, followed by post-dilation if required. Clinical evaluation, echocardiography and cardiac CT were obtained pre-TAVR, post-TAVR, and at one year.

RESULTS

Deployment of oversized THVs with modest underfilling of the deployment balloon (<10% by volume) was not associated with significant annular injury. Paravalvular regurgitation was mild or less in 95.7% of patients, with post-dilation required in 10.7%. THV hemodynamic function was excellent and remained stable at one year. CT documented stent frame circularity in 87.5%. Underexpansion was greatest within the intra-annular THV inflow (stent frame area 85.8% of nominal). Progressive stent frame recoil, deformation, or fracture were not observed at one year.

CONCLUSION

In carefully selected patients with a borderline annulus dimensions and in whom excessive oversizing is a concern, a strategy of deliberate underexpansion, with ad hoc post-dilation if necessary, may reduce the risk of annular injury without compromising valve performance.

CLINICAL RELEVANCE/APPLICATION

We present the first intermediate term clinical and imaging follow up data on intentionally underfilled balloon expandable TAVR.

Honored Educators

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

Jonathon A. Leipsic, MD - 2015 Honored Educator

MSRO26

BOOST: Head and Neck-Case-based Review (An Interactive Session)

Monday, Nov. 30 3:00PM - 4:15PM Location: S103CD



AMA PRA Category 1 Credits™: 1.25
ARRT Category A+ Credits: 1.50

Participants

Suresh K. Mukherji, MD, Northville, MI (*Presenter*) Nothing to Disclose
Sung Kim, MD, New Brunswick, NJ (*Presenter*) Nothing to Disclose
Carol R. Bradford, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Francis P. Worden, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review common tumors of the head and neck. 2) Review imaging findings in head and neck malignancies that specifically change staging. 3) Review the value of imaging in directly affecting management and treatment.

ABSTRACT

This session will be tumor board that includes a head and neck radiologist, head and neck surgeon, medical oncologist and radiation oncologist. We will discuss a variety of head and neck cancer cases and illustrate the value-added benefits and highlight of imaging affects staging, treatment and management.

SSE20

ISP: Pediatrics (Neuroradiology)

Monday, Nov. 30 3:00PM - 4:00PM Location: S102AB



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

Participants

Ashok Panigrahy, MD, Pittsburgh, PA (*Moderator*) Nothing to Disclose

Susan Palasis, MD, Atlanta, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSE20-01 Pediatrics Keynote Speaker: Studying the Pediatric Connectome

Monday, Nov. 30 3:00PM - 3:10PM Location: S102AB

Participants

Michael J. Paldino, MD, Houston, TX (*Presenter*) Nothing to Disclose

SSE20-02 Post-treatment Diffusion Tensor Imaging to Evaluate Response to Total Body Hypothermia in Neonates with Hypoxic-ischemic Encephalopathy

Monday, Nov. 30 3:10PM - 3:20PM Location: S102AB

Participants

Laura Scarciolla, MD, Massafra, Italy (*Presenter*) Nothing to Disclose

Carlo Cosimo Quattrocchi, MD, PhD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Thomas Joseph Re, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Stefania Galassi, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

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

Antonio Napolitano, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Giuseppe Calbi, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Bruno Bernardi, MD, Bologna, Italy (*Abstract Co-Author*) Nothing to Disclose

Bruno Beomonte Zobel, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Daniela Longo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

to test the efficacy of ADC and FA for the evaluation of treatment response in newborns with moderate and severe hypoxic-ischemic encephalopathy (HIE) treated with total-body hypothermia.

METHOD AND MATERIALS

27 newborns with clinical criteria of moderate-severe HIE (17 treated with total body therapeutic hypothermia, 10 nontreated) and 10 healthy neonates were studied with MR imaging and DTI. Ten treated neonates and healthy neonates underwent a follow-up brain MRI and DTI at 6 months of life. All data were acquired on a 3-T Skyra (Siemens, Erlangen, Germany). Conventional MRI imaging included: axial T1 TSE (slice thickness = 2 mm, TR=550 ms, TE 6,7 ms, matrix size = 416x512), sagittal T1 TIRM (slice thickness = 3 mm, TR=2690 ms, TE 8,5 ms, matrix size = 256x256), axial and coronal T2 TSE (slice thickness = 2 mm, TR=10320 ms, TE 122 ms, matrix size= 348x384). DTI acquisition was performed by a single-shot echo-planar sequence, one volume not diffusion-weighted (b_0), and bipolar diffusion gradients ($b = 800 \text{ s/mm}^2$) applied in 30 directions. On ADC and FA maps, basal ganglia and thalamus ROIs were designed. Preprocessing of the raw DTI data was performed using FSL software. Diffusion toolkit along with TrackVis (trackvis.org) were used to reconstruct and visualize tractography pathways respectively.

RESULTS

Conventional MR imaging was normal in 11 (65%) treated neonates and in 3 (30%) nontreated neonates. All treated neonates presented lower FA values in all tracks, in BG and in Thalamus ROI ($p < 0.01$) comparing to healthy newborns but higher FA values ($p < 10^{-5}$) comparing to nontreated neonates. ADC values were higher in BG and in all white matter fibers ($p < 10^{-4}$) comparing to nontreated neonates. At 6 months follow-up MR, the treated neonates FA and ADC values were closer to normal.

CONCLUSION

FA and ADC may more accurately reflect true microstructure characteristics of brain immediately after therapeutic hypothermia and at 6-months follow-up than does conventional MRI. DTI data for nontreated neonates at 6 months would be required to confirm our results.

CLINICAL RELEVANCE/APPLICATION

As DTI metrics reflect a different aspect of brain microstructure than conventional MRI, they may provide a more accurate tool for diagnosing and following neonates with poor neurodevelopment due to HIE.

SSE20-03 Increased Gray Matter Volume of Emotional Circuits in Children without Direct Parental Care

Monday, Nov. 30 3:20PM - 3:30PM Location: S102AB

Participants

Yuan Xiao, Chengdu, China (*Presenter*) Nothing to Disclose

Lili Yang, Wenzhou, China (*Abstract Co-Author*) Nothing to Disclose

Zhihan Yan, Wenzhou, China (*Abstract Co-Author*) Nothing to Disclose

Yuchuan Fu, Wenzhou, China (*Abstract Co-Author*) Nothing to Disclose

Meimei Du, Wenzhou, China (*Abstract Co-Author*) Nothing to Disclose
Su Lui, MD, Chendu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

With the economic boom, hundreds of millions of laborers are migrating away from their children to pursue a better job. This international parental migration has resulted in millions of left-behind children (LBC) and has raised widespread concern. However, it is still unclear where and how the brain is affected in these children who lack parental care. Therefore, we aimed to explore the gray matter volume alteration in LBC in relative to those with parental care.

METHOD AND MATERIALS

This study was IRB approved and written informed consent was obtained from guardians. Thirty-eight LBC (age=9.6±1.8yrs, 21boys) and 30 comparison children (age=10.0±1.95yrs, 19boys) were included and performed a 3.0T MR scan. The LBC is defined as children who living with the absence of both of their biological parents for a period over six months. Image preprocessing and statistical analyses were performed with optimized voxel-based morphometry in SPM8. IQ of all participants was measured to quantify cognitive function.

RESULTS

Compared to controls, LBC showed significantly greater gray matter volume in bilateral fusiform gyri, bilateral parahippocampus, right superior parietal lobe, right thalamus, right superior occipital gyrus, left cuneus, right superior temporal gyrus, right superior medial frontal gyrus, left postcentral gyrus, left middle occipital gyrus and left putamen ($p < 0.05$, FDR corrected). The mean value of IQ scores in LBC was not significantly different from that in controls. Furthermore, gray matter volume in bilateral parahippocampus gyri in LBC was negatively correlated with IQ score ($p < 0.05$).

CONCLUSION

This study provided the first empirical evidence of larger gray matter volumes, especially in emotional circuits in LBC than children living with their parents, suggesting the parental care affects the brain development. Since the larger gray matter volume may reflect insufficient pruning and mature of brain, the negative correlation between the gray matter volume and IQ scores suggest that growing without parental care may delay the development of brain.

CLINICAL RELEVANCE/APPLICATION

To our knowledge, this study provides the first empirical evidence of larger gray matter volumes in emotional circuits in LBC, suggesting that parental care affects brain development. From a public health perspective, the study highlighted the importance of parental care in children and indicated early intervention and stimulation are needed to LBC.

SSE20-04 Age-dependent Signal Density of Diffusion Kurtosis Imaging (DKI) of Healthy Volunteers' Brains at Left-right Hemispheric Level Analyses

Monday, Nov. 30 3:30PM - 3:40PM Location: S102AB

Participants

Mamiko Koshiba, PhD, Iruma-gun, Japan (*Presenter*) Nothing to Disclose
Takako Aoki, PhD, Iruma-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Hayato Sakurai, MD, Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Tsuyoshi Sasaki, RT, Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomokazu Araki, RT, Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroko Kakei, Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Naomi Hotta, Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuuki Minamikawa, Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Mamoru Niitsu, MD, Saitama, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Kunikata, Iruma-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Hideo Yamanouchi, Iruma-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose

Background

For approaches to DKI application in neuropediatrics without any risky sedation, the lower resolution data of an infant's smaller brain raise a question whether significantly useful or not. As the preliminary evaluation, we are attempting to examine macroscopic DKI quantitative analyses in the data of our own medical staff volunteers if the linear regression would be visualized as previously reported age-dependency (2014).

Discussion

In the scatter diagrams with DKI signal density as a dependent variable and age as an explanatory variable, age-dependent increasing of DKI density was generally revealed repeatedly in both left and right hemispheres in the 2nd to 4th slices (e.g. square correlation coefficient (R^2) = 0.52) but not in either cerebellums (R^2 = 0.069) or eye balls (R^2 = 0.023) imaged in the 1st slice.

Conclusion

DKI hemispheric density quantification in adult was preliminarily confirmed as a practical simple approach to diagnose neuronal development. This macroscopic comprehension using DKI is expected possibly contributable to Neuropediatrics by MRI without sedation under lower resolution.

SSE20-05 Repeatability of Graph-Theoretical Metrics Derived from Resting-State fMRI in Pediatric Patients with Epilepsy

Monday, Nov. 30 3:40PM - 3:50PM Location: S102AB

Participants

Michael J. Paldino, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wei Zhang, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Zili David Chu, PhD, Houston, TX (*Presenter*) Nothing to Disclose

PURPOSE

To measure the test-retest repeatability of metrics that quantify network architecture in the brain derived from resting-state fMRI in a cohort of pediatric epilepsy patients.

METHOD AND MATERIALS

This IRB approved study identified patients with: 1. epilepsy; 2. brain MRI at 3 Tesla; 3. two identical resting state fMRI acquisitions performed in the same examination. Resting-state time series were co-registered to a T1-weighted structural image. Network nodes were defined by subdivision of whole brain gray matter into 400 (coarse parcellation) or 800 (fine parcellation) volumes of interest. The strength of an edge (connection) between two nodes was defined as the absolute value of the correlation between their BOLD time series. For each weighted connection matrix, correlation coefficients were thresholded over a range of values (0.7 to 0.98). The following topological properties were calculated for each graph: clustering coefficient, transitivity, modularity, characteristic path length, smallworldness, and global efficiency. A potential difference between observations was assessed using the Wilcoxon signed-rank test. For each parameter, we calculated: 1. Mean coefficient of variation (CoV). 2. Pearson Coefficient; 3. ICC; 4. Repeatability coefficient; 5. Ninety-five percent confidence limits (95%CL) for change.

RESULTS

12 patients were included (4-21 yrs). There was no significant difference between observations for any metric. Maximal test-retest estimates for each metric are presented in Table 1. ICC for modularity, transitivity and clustering was consistent across thresholds (Fig 1). By contrast, ICC for characteristic path length, smallworldness and global efficiency peaked over a narrow range of threshold. Modularity, path length and smallworldness were the most repeatable measures.

CONCLUSION

These findings demonstrate the test-retest repeatability of network metrics in a cohort of pediatric epilepsy patients. Change in an individual patient greater than the repeatability coefficient or 95%CL for change is unlikely to be related to intrinsic variability of the method.

CLINICAL RELEVANCE/APPLICATION

NA

SSE20-06 Identifying Medicated-naïve Boys with ADHD using Cortical Thickness via a Multivariate Pattern Analysis

Monday, Nov. 30 3:50PM - 4:00PM Location: S102AB

Participants

Qi Liu, Chengdu, China (*Presenter*) Nothing to Disclose
Lizhou Chen, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Ming Zhou, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Xinyu Hu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Ying Chen, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Lanting Guo, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Qiyong Gong, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoqi Huang, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Despite previous studies have reported structural and functional deficits in Attention-deficit/hyperactivity disorder (ADHD) children, it's still a challenge to translate the neuroanatomic abnormalities to clinical practice. Studies focus on adults with ADHD had shown the potential clinical value of support vector machine (SVM) in distinguishing patients with ADHD from healthy controls individually, but no study has explored its usage in unmedicated children with ADHD. As ADHD has a higher prevalence in males, our study sought to use cortical thickness (CT) to distinguish the medicated-naïve school-age ADHD boys from healthy controls via SVM.

METHOD AND MATERIALS

Forty drug-naïve ADHD boys (mean age: 10.1) and 40 healthy controls (mean age: 10.2) were recruited. The T1-weighted images were obtained by 3T MRI with SPGR sequence. The whole-brain analysis between two groups was performed via the Qdec surface-based group analysis tool in Freesurfer for CT with age as covariate (corrected by FDR $p < 0.05$). We used PROBID software to investigate the diagnosis potential of CT of each hemisphere separately based on SVM using leave-one-out cross-validation approach. Then we examined their combined discriminative power for both hemisphere ($p < 0.001$). We also drew Receiver Operating Characteristic (ROC) curves to assess the diagnosis accuracy power.

RESULTS

Compared to healthy group, ADHD boys showed significant reduction in cortical thickness of bilateral orbitofrontal, insula and lingual, right anterior and posterior cingulate, prefrontal, temporal and parietal cortex (Figure A), and left CT demonstrated obviously more significance in classification (sensitivity 80%, specificity 85%, accuracy 82.5%, $P \leq 0.001$, ROC area 0.841) (Figure B). The combined CT of both hemispheres didn't provide better result than left CT alone.

CONCLUSION

Our study demonstrated deficits in cortical thickness provides best solution for classification of medicated-naïve ADHD boys with healthy controls. The fact that left hemisphere is more useful in classification showed the lateralization in brain neural pathology of ADHD.

CLINICAL RELEVANCE/APPLICATION

Classification approach based on cortical thickness may be a useful technique to distinguish the ADHD individuals from healthy controls.

SSE16

Nuclear Medicine (Endocrine and Gastrointestinal Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: S505AB



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

FDA Discussions may include off-label uses.

Participants

M. Elizabeth Oates, MD, Lexington, KY (*Moderator*) Nothing to Disclose
Samuel E. Almodovar-Reteguis, MD, Birmingham, AL (*Moderator*) Nothing to Disclose

Sub-Events

SSE16-01 Parathyroid Imaging with Simultaneous Acquisition of Tc-99m-Sestamibi and I-123: The Relative Merits of Pinhole Collimation and SPECT-CT.

Monday, Nov. 30 3:00PM - 3:10PM Location: S505AB

Participants

Paraag R. Bhatt, MD, Aurora, CO (*Presenter*) Nothing to Disclose
William C. Klingensmith III, MD, Englewood, CO (*Abstract Co-Author*) Nothing to Disclose
Brian M. Bagrosky, MD, MS, Castle Pines, CO (*Abstract Co-Author*) Nothing to Disclose
Jacob C. Walter, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Kim McFann, PhD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Robert McIntyre Jr., MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Christopher Raeburn, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Phillip J. Koo, MD, Aurora, CO (*Abstract Co-Author*) Advisory Board, Bayer AG Research Consultant, Dendreon Corporation Speaker, Dendreon Corporation Consultant, Eli Lilly and Company Consultant, General Electric Company

PURPOSE

To determine the relative localization utility of three state-of-the-art parathyroid imaging protocols: 1) single time point simultaneous acquisition of Tc-99m-sestamibi and I-123 images with pinhole collimation in the anterior and bilateral anterior oblique projections, 2) single time point simultaneous acquisition of Tc-99m-sestamibi and I-123 images with SPECT-CT, and 3) the combination of protocols one and two.

METHOD AND MATERIALS

Fifty-nine patients with surgical proof of parathyroid adenomas were evaluated retrospectively. All three protocols included perfectly co-registered subtraction images created by subtracting the I-123 images from the Tc-99m-sestamibi images, plus an anterior parallel hole collimator image of the neck and upper chest. The pinhole protocol was performed first followed by the SPECT-CT protocol. Three image sets were derived from each study in each patient according to the above protocols. Two experienced observers recorded the size, location and degree of certainty of any identified lesion.

RESULTS

The 59 patients had sixty-one adenomas. For the two observers combined, the localization success rate was 88% for the pinhole protocol, 69% for the SPECT-CT protocol, and 81% for the combined protocol. The pinhole protocol detected more adenomas than the SPECT-CT protocol and missed fewer adenomas than either the SPECT-CT protocol or the combined pinhole and SPECT-CT protocol ($P < 0.01$). The two protocols that included SPECT-CT provided superior anatomic information relative to the location and size of the parathyroid adenomas.

CONCLUSION

Overall, the pinhole protocol localized significantly more adenomas than the SPECT-CT protocol. However, the protocols that included SPECT-CT provided more anatomic information than pinhole imaging alone.

CLINICAL RELEVANCE/APPLICATION

Accurate preoperative identification and localization of parathyroid adenoma(s) allows surgeons to perform image guided minimally invasive surgery with improved success rates, shorter operating times, and less morbidity. Consequently, it is important to optimize the accuracy of preoperative imaging in determining the presence, size, and location of parathyroid adenomas. Our hope with this study is to determine the most accurate imaging protocol with current available imaging modalities to overall optimize patient outcomes.

SSE16-02 Influence of Multigland Parathyroid Disease on Tc-99m-Sestamibi SPECT/CT Sensitivity

Monday, Nov. 30 3:10PM - 3:20PM Location: S505AB

Participants

Kenneth Nichols, PhD, New Hyde Park, NY (*Presenter*) Royalties, Syntermed, Inc;
Gene G. Tronco, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Palestro, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tc-99m-sestamibi (MIBI) imaging is a mainstay for preoperative parathyroid lesion localization in pts with primary hyperparathyroidism (PHP). Decreased sensitivity in multigland disease (MGD) compared to single gland disease (SGD) is a well recognized phenomenon for planar and SPECT protocols, but few data are available on the effect of MGD on the sensitivity of MIBI

parathyroid SPECT/CT.

METHOD AND MATERIALS

We retrospectively analyzed 272 pts (220 female pts, 52 male pts, age = 59±13 years) with PHP who underwent preoperative MIBI SPECT/CT. We used surgical and pathology reports to confirm numbers and weights of excised parathyroid lesions. Two experienced physicians read SPECT/CTs on 2 separate occasions without reference to each other's readings or final diagnoses. Lesion certainty was graded on a 5-point scale (0 = normal, 1 = probably normal, 2 = equivocal, 3 = probably abnormal, 4 = definitely abnormal). Mean scores were obtained for the 2 observers. Readings were compared for MGD and SGD lesions matched by weight and location.

RESULTS

230 pts had SGD, 42 had MGD (28 pts with 2 lesions, 11 pts with 3 lesions and 3 pts with 4 lesions). Lesion weight decreased progressively with increasing numbers of lesions (888±941 mg for 1 lesion, 436±570 mg for 2 lesions, 395±686 mg for 3 lesions, 89±120 mg for 4 lesions, $\rho = -0.43$, $p < 0.0001$). It was possible to match equal numbers of SGD and MGD lesions by weight for 132 lesions, with similar mass (526±678 versus 525±686 mg, $p = 0.99$), and similar location distributions ($p = 0.47$). Despite being matched by weight and location, reading confidence was significantly lower for MGD than SGD lesions (2.0±1.4 versus 3.4±0.8, $p < 0.0001$); confidence decreased progressively with increasing lesion numbers (2.2±1.3 for 2 lesions, 1.8±1.5 for 3 lesions, 1.0±0.9 for 4 lesions, $\rho = -0.51$, $p < 0.0001$). Sensitivity was significantly lower for MGD than SGD lesions (64% versus 98%, $p < 0.0001$); sensitivity decreased progressively with increasing lesion numbers (67% for 2 lesions, 65% for 3 lesions, 25% for 4 lesions, $\rho = -0.45$, $p < 0.0001$).

CONCLUSION

As with planar and SPECT MIBI, in PHP, Tc-99m-MIBI SPECT/CT reading confidence and sensitivity are significantly lower in multigland disease than in single gland disease.

CLINICAL RELEVANCE/APPLICATION

MIBI SPECT/CT is less sensitive for detecting lesions in MGD than lesions in SGD and therefore it must be used together with rapid intraoperative parathyroid hormone assay to ensure that all offending lesions are removed.

SSE16-03 Prognostic Value of FDG-PET/CT in Papillary Thyroid Cancer with the TENIS Syndrome

Monday, Nov. 30 3:20PM - 3:30PM Location: S505AB

Participants

Kunihiro Nakada, Sapporo, Japan (*Presenter*) Nothing to Disclose
Hiroki Sugie, MD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Ysushi Furuta, MD, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiromasa Takahashi, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Naoya Hattori, MD, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masayuki Sakurai, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Postsurgical papillary thyroid cancer (PCA) with thyroglobulin elevation and negative iodine scintigraphy (TENIS) generally show resistance to high-dose I-131 therapy. However, prognostic factors for PCA with the TENIS syndrome have not been well established. The aim of the study was to determine whether FDG uptake is linked with clinical behavior of the tumor in the TENIS syndrome.

METHOD AND MATERIALS

93 patients with PCA, who had previously underwent total thyroidectomy and remnant tissue ablation and were diagnosed as the TENIS syndrome, underwent FDG-PET/CT. Serum Tg levels at PET/CT ranged 2.9- 225.4 (ng/ml). Uptake of FDG was visually assessed and classified as positive or negative. When FDG uptake was positive, semi-quantitative analysis (SUVmax) was performed. If a patient had multiple tumors, average of SUVmax in the 2 largest tumors were used for evaluation. Patients were followed up for 28-83 months (median 46). Tg levels were measured at least 5 times or more after imaging of FDG-PET/CT. to determine Tg doubling time (Tg-DT). As a rule, changes in the tumor size were evaluated based upon RECIST1.1.

RESULTS

Of 93 patients, 74 showed positive FDG uptake while the remaining 19 showed negative FDG uptake. In the FDG positive group, 21 (28%) showed Tg-DT of < 1yr. Progressive disease (PD) was observed in 32 pts. (42%). SUVmax was significantly higher in patients with PD than others (6.7 vs.4.1, $p < 0.01$). 5 pts. died of PCA. In contrast, all patients in the FDG negative group had Tg-DT of either ≥ 3 yrs. or minus value regardless of baseline Tg value. PD was seen in only 1(5%). Cancer-associated death was not observed in any of the patients. There was an inverse correlation between SUVmax and Tg-DT in the positive FDG uptake group ($r = -0.56$).

CONCLUSION

Positive FDG uptake in the TENIS syndrome indicates shorter Tg-DT and higher risk of PD. In contrast, negative FDG uptake is associated with longer Tg-DT and gentle behavior of the tumor. FDG-PET/CT is helpful in characterizing prognosis of postsurgical PCA with the TENIS syndrome

CLINICAL RELEVANCE/APPLICATION

In patients with TENIS who have high FDG uptake, early start of additional therapies such external radiation, local ablation therapy such as RFA or PEI, or chemotherapy using sorafenib or lenvatinib may improve their prognosis. In contrast, the majority of patients with negative FDG uptake do not require aggressive additional treatments.

SSE16-04 Effectiveness of Semi-quantitative Analysis in I-123 Metaiodobenzylguanidine Scintigraphy for Diagnosing Pheochromocytoma

Monday, Nov. 30 3:30PM - 3:40PM Location: S505AB

Participants

Yoshiyuki Kitamura, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Shingo Baba, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Takuro Isoda, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuhiro Maruoka, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiichiro Tahara, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Akihiro Nishie, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Masayuki Sasaki, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

I-123 Metaiodobenzylguanidine (MIBG) scintigraphy is a sensitive and specific imaging tool for the diagnosis of suspected adrenal pheochromocytoma. Hybrid single photon emission computed tomography / computed tomography (SPECT/CT) is expected to provide additional anatomical information and more efficient diagnostic capability. Visual evaluation is usually used to diagnose the abnormality. However, evaluation standard is not yet established. In addition, the appearance of fusion image of SPECT /CT is largely depend on the window level of SPECT image. This may lead to equivocal or wrong diagnosis. In this study, we introduced a semi-quantitative method for the evaluation of I-123 MIBG. The purpose of this study is to evaluate the performance of this method with that of conventional visual evaluation.

METHOD AND MATERIALS

Twenty six patients (Male/Female=17/9, Age=57.5±14.4) with suspected pheochromocytoma were incorporated in this study. I-123 MIBG scintigraphy and adrenal SPECT/CT was performed in all patients. Twelve pheochromocytomas and 14 cortical adenoma were diagnosed histopathologically or based on the clinical course including MRI. For semi-quantitative analysis, tumor-to-liver ratio (T/L) was defined as ratio of maximum count of adrenal mass divided by maximum count of normal liver of right lobe. For visual evaluation of planar scintigraphy and SPECT/CT fusion image, aderenal uptake was classified as visual score (1 = lower than liver, 2 = equal to liver and 3 = higher than liver). Diagnostic performances of the three methods (T/L: SPECT, visual: planar and visual: SPECT/CT) were compared using receiver operating characteristic (ROC) analyses.

RESULTS

In ROC analysis, AUC of SPECT, planar and SPECT/CT were 0.98, 0.67 and 0.76 with cut-off value of 2.26, 3 and 3, respectively. There were significant difference between SPECT and planar ($p < 0.01$), SPECT and SPECT/CT ($p < 0.01$). No significant difference between planar and SPECT/CT ($p = 0.50$).

CONCLUSION

Semi-quantitative method using SPECT/CT was more sensitive and specific than visual evaluation in the diagnosis of pheochromocytoma in patients with adrenal tumor.

CLINICAL RELEVANCE/APPLICATION

Semi-quantitative method using SPECT/CT was more sensitive and specific than visual evaluation in the diagnosis of pheochromocytoma in patients with adrenal tumor.

SSE16-05 Postablation Radioiodine Scintigraphy SPECT/CT: Functional and Anatomic Correlation

Monday, Nov. 30 3:40PM - 3:50PM Location: S505AB

Participants

Ana M. Franceschi, MD, New York, NY (*Presenter*) Nothing to Disclose
Robert Matthews, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Lev Bangiyev, DO, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Dinko Franceschi, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

SPECT/CT was utilized to localize radioiodine uptake in thyroid carcinoma patients status post radiodine ablation. Anatomic correlation with central neck uptake evident on planar I-131 scintigraphy was assessed.

METHOD AND MATERIALS

In this retrospective study, one nuclear medicine physician and one neuroradiologist reviewed SPECT/CT findings to assess accuracy of radioiodine uptake localization on planar whole-body images in the central neck region. Inclusion criteria included thyroid carcinoma patients at our institution who underwent postablation planar and SPECT/CT I-131 scintigraphy from October 1, 2013 to June 1, 2014. Radioiodine dose was 50-200 mCi.

RESULTS

44 consecutive patients were included in the study (10 male, 34 female). Age range was 20 - 74. Most of the patients, 40 (91%) had obvious foci of radioiodine uptake in the central neck on planar and SPECT imaging, while remaining 4 patients had no significant radioiodine uptake in the neck. Of the patients with radioiodine uptake in the neck, 12 (27%) had uptake within the thyroid bed region only, 13 (30%) had focal uptake corresponding just to the thyroglossal duct remnant, and 15 (34%) had uptake within both, thyroid bed region and thyroglossal duct remnants. Therefore, majority of the patients with central neck uptake 28/40 (70%) had visualization of the thyroglossal duct remnant activity.

CONCLUSION

The anatomic CT correlation with planar and SPECT images demonstrated the majority of the focal radioiodine uptake to be located exclusively within the thyroid bed and thyroglossal duct remnant.

CLINICAL RELEVANCE/APPLICATION

In low risk patients with thyroid cancer, our findings may support low dose consideration prior to radioiodine ablation.

SSE16-06 Evaluate Correlation of Duodenogastric Reflux Detected on Tc-99m Mebrofenin Hepatobiliary Scintigraphy with Symptomatic Gastroesophageal Reflux Disease: A Retrospective Study

Monday, Nov. 30 3:50PM - 4:00PM Location: S505AB

Participants

Ammar A. Chaudhry, MD, Corona, CA (*Presenter*) Nothing to Disclose

Maryam Gul, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose

Abbas A. Chaudhry, BSc, Westbury, NY (*Abstract Co-Author*) Nothing to Disclose

Robert Matthews, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

GERD is thought to result primarily from gastric acid reflux. Recent literature suggests that symptomatic GERD also occurs from duodenogastric reflux of bile acids. This has been termed alkaline variant GERD and appears to be more damaging to the esophagus and has a more symptomatic clinical course. We aim to evaluate whether the presence of duodenogastric reflux (DGR) seen on Tc-99m mebrofenin hepatobiliary scintigraphy (MHBS) correlates with presence of clinical GERD and whether degree of DGR seen correlates with clinical severity of GERD.

METHOD AND MATERIALS

300 Tc-99m MHBS exams conducted from January 2011-December 2014 were included in this study and were evaluated for presence of DGR. Patients' chart were reviewed to identify for clinical diagnosis of GERD and the severity of GERD that was determined using clinical data points including endoscopic evaluation of GERD, oral medications for treatment of GERD and presence/absence Barrett's esophagus, etc.

RESULTS

83 patients (45 females and 38 males) with mean age 47.9 (range: 13 - 93 years old) were identified to have evidence of DGR. Of these patients, 31.3% patients were diagnosed with cholecystitis and 7.2% patients were diagnosed with biliary colic. 25.3% patients had only clinical history of GERD and no additional significant history. Of the patients with clinical evidence of GERD, 42.9% patients had evidence of severe DGR, 38.1% had moderate DGR and 19% had mild DGR noted. 4.7% patients with GERD and severe DGR had histopathologic evidence of Barrett's esophagus.

CONCLUSION

DGR is easily detected and frequently identified on Tc-99m MHBS. Our study shows 25% of patients with otherwise unremarkable Tc-99mMHBS scintigraphy have evidence of DGR and majority of these have moderate to severe GERD. As emerging literature is demonstrating stronger correlation between bile acid reflux and symptomatic GERD, DGR is an important diagnostic consideration as the cause of patients presenting symptoms in an otherwise normal HIDA study.

CLINICAL RELEVANCE/APPLICATION

DGR is easily detected and frequently identified on Tc-99m MHBS and a significant proportion patients with scintigraphic evidence of DGR have GERD. Reporting severity of reflux in report can facilitate patient management by alerting clinician to DGR as an important diagnostic consideration as the cause of patients presenting symptoms in an otherwise normal HIDA study.

SPEP21

Planning Today for a Better Tomorrow

Monday, Nov. 30 3:00PM - 5:30PM Location: E253AB

OT

CME credit is not available for this session.
ARRT Category A+ Credit: 0

Participants

Alicia K. Waltenberger, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Fundamentals of conventional estate planning for any financial situation. 2) Planning strategies for income and estate taxes, and charitable giving. 3) Sophisticated strategies to leverage taxable gifts and transfer wealth to lower generations.

ABSTRACT

It is important to understand the fundamentals of estate planning and the importance of having a solid plan in place regardless of your financial situation. The desire to be tax efficient and keep up with the changing tax environment can sometimes feel like an insurmountable feat. In this seminar, we will explore a number of issues in the financial and tax planning arena including: o Income and Estate Tax Updates - understanding the impact of the recent income and estate tax legislation on your planning, as well as exploring strategies that may reduce your tax exposure; o Estate Planning Basics - a review of estate planning fundamentals, including a look at conventional estate planning strategies and how the changes in the estate tax laws may impact that conventional planning; o Sophisticated Planning Strategies - there are various planning techniques available to leverage taxable gifts, allowing wealth to be funneled to lower generations on a tax-advantaged basis both during lifetime and at death; o Non-Tax Related Planning - a look at how family dynamics, asset protection and state tax issues may impact the estate plan; and o Charitable Planning - identifying the types of gifts and giving techniques that offer the greatest tax benefit to donors both during lifetime and at death. In addition to comprehensive discussion outlined above, the session will include ample opportunity for QandA.

ISP: Radiation Oncology (Gastrointestinal: Lower Gastrointestinal, Liver)

Monday, Nov. 30 3:00PM - 4:00PM Location: S104A



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

Participants

Edward Y. Kim, MD, Seattle, WA (*Moderator*) Research support, Eisai Co, Ltd; Research support, Novartis AG; Research support, Johnson & Johnson; Research support, Bayer AG; Research support, Threshold Pharmaceuticals, Inc ; Research support, Eli Lilly and Company; Research support, MabVax Therapeutics Inc;
Richard Tuli, MD, PhD, Los Angeles, CA (*Moderator*) Nothing to Disclose

Sub-Events**SSE24-01 Radiation Oncology Keynote Speaker: Liver Risk and Reward-What Does the Evidence Tell Us?**

Monday, Nov. 30 3:00PM - 3:10PM Location: S104A

Participants

Michael I. Lock, MD, FRCPC, London, ON (*Presenter*) Research Consultant, Accuray Incorporated; Speaker, AbbVie Inc

SSE24-02 Single-Institutional Experience on Stereotactic Body Radiation Therapy for Inoperable Liver Tumors

Monday, Nov. 30 3:10PM - 3:20PM Location: S104A

Participants

Hussam Hijazi, Montreal, QC (*Presenter*) Nothing to Disclose
Guila Delouya, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Marie-Pierre Campeau, MD, FRCPC, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Real Lapointe, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
David Roberge, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
David Donath, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Daniel Tausky, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Stereotactic body radiation therapy is an emerging treatment option for liver tumors unsuitable for ablation or surgery. We report our experience to evaluate the feasibility and safety of SBRT in the treatment of liver tumors unsuitable for standard local treatment. **Materials/Methods:** From July 2009 to January 2015, all patients with inoperable primary or secondary liver cancer treated with SBRT were reviewed. Patients who had previous surgical resection, chemotherapy, TACE or radio frequency ablation were eligible. The primary end point of this study was in-field local control (LC). The secondary end points were progression free survival, overall survival (OS) and toxicity. **Results:** Sixty-six patients with a total of 70 liver lesions (4 patients had 2 liver tumors) were treated in this study. The median age was 71 (27-89 years). Hepatocellular carcinoma (HCC) in 21 cirrhotic patients (32%) with Child-Pugh A (47%), B (33%) and C (10%) was treated. Six patients (9%) had intrahepatic cholangiocarcinoma. The remaining 59% (39 patients) had metastatic liver lesions. Colorectal adenocarcinoma was the most common primary tumor type (31 patients). Median size for HCC and metastatic lesions was 5cm (2-9cm) and 4cm (1-8cm) respectively. Median prescribed dose was 45Gy (16-50Gy) in 5 Fractions (2-8). The most common prescription was 45Gy to the periphery of the lesion in 3 fractions. Median follow-up was 8 months (1-37 months). Actuarial 1-year local control for HCC and metastatic patients was 84% and 54% respectively. Distant progression free survival at one year was 49%. Treatment was well tolerated with CTCAE v3 grade 1 acute gastrointestinal toxicity in 3 patients, grade 3 nausea in 1 patient and grade 3 acute dermatitis in another patient. No late toxicity was seen. **Conclusion:** Stereotactic body radiotherapy is a safe and effective alternative option for inoperable patients with low toxicity.

SSE24-03 Physician Factors and Stage at Diagnosis of Colorectal Cancer

Monday, Nov. 30 3:20PM - 3:30PM Location: S104A

Participants

Aleksandra Kuczmarzka, Scranton, PA (*Presenter*) Nothing to Disclose
Samuel Lesko, Scranton, PA (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Colorectal cancer is the third most common cancer in both men and women in the United States. Survival is strongly determined by stage at the time of diagnosis, but only approximately 40% of all new cases are diagnosed at local stage. Effective screening methods are available which can lead to early detection and reduced mortality from this disease, but these remain underutilized. The objectives of this research are to identify physician factors associated with stage at diagnosis of colorectal cancer in a high-risk, underserved population of northeast Pennsylvania. **Materials/Methods:** 649 patients with incident local stage invasive colorectal cancer were compared with 1,394 control patients with more advanced stage disease identified from a population-based cancer registry. These patients were cared for by 292 primary care physicians. Multi-level logistic regression was used to assess the relationship between cancer stage and physician characteristics and behaviors while controlling for confounding factors. **Results:** Patients cared for by board certified physicians were less likely to have advanced stage cancer (odds ratio= 0.52; 95% confidence interval (CI), 0.33-0.81) compared to those whose providers were not board certified. Likewise, patients cared for by physicians who felt that fecal occult blood testing (FOBT) was "very effective" compared to those who believed this test was only "somewhat effective" or "not effective" were also less likely to have advanced stage cancer (OR = 0.47; 95% CI, 0.27-0.81). Physician age, race and sex were not significantly associated with stage at diagnosis among their patients. **Conclusion:** Board certification and physician beliefs regarding the value of FOBT screening for colorectal cancer were associated with earlier stage at diagnosis and likely better outcomes. While colonoscopy was the preferred method of colorectal

cancer screening, these findings suggest a continued role for FOBT, particularly among patients unwilling to undergo colonoscopy.

SSE24-04 Comparison of Clinical Outcome Among Pathologic Complete Responders (pCR) and Incomplete Responders (non pCR) to Neoadjuvant Chemoradiation Therapy for Locally Advanced Carcinoma Rectum : A Single-Institution Study

Monday, Nov. 30 3:30PM - 3:40PM Location: S104A

Participants

Roshni Syam, Trivandrum, India (*Presenter*) Nothing to Disclose
Arun Vasudevan, Trivandrum, India (*Abstract Co-Author*) Nothing to Disclose
Attokaran L. Lijeesh, Trivandrum, India (*Abstract Co-Author*) Nothing to Disclose
C D Sivanandan, Trivandrum, India (*Abstract Co-Author*) Nothing to Disclose
P G Jayaprakash, Trivandrum, India (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Locally advanced rectal cancer is treated with preoperative concurrent chemoradiation followed by surgery. Pre op chemo RT has shown to provide tumor downstaging, improved tumor resectability and better rates of anal sphincter preservation. Patients with no microscopic residual disease in the surgical specimen after pre op chemo radiotherapy are termed pathologic complete responders (pCR) and those with any residual disease in the surgical specimen are termed incomplete responders (non pCR). This study was done to compare the clinical outcome among the pCR and non pCR group patients, treated with pre op chemo RT for locally advanced carcinoma rectum. **Materials/Methods:** One hundred and fourteen patients treated during 1/1/2008 to 30/12/2012 with preoperative chemo-RT for carcinoma rectum were included in the study. The patients were followed up until December 31st 2014. The Disease free survival (DFS) and Overall survival (OS) were calculated using Kaplan Meier method. The DFS and OS among the pCR and non pCR group were compared using log rank test. **Results:** Among the 114 patients included in the analysis, 74 were males and 40 were females. 79% of the patients were radiologically T3 stage and 21% were T4 stage. The dose of the pre operative Radiotherapy was 45 to 50.40 Gy given at 1.8-2 Gy per fraction. The concurrent chemotherapeutic agent used was either intravenous 5FU or Oral Capecitabine. Abdomino perineal resection was the most commonly performed surgery (55%) followed by low anterior resection (36%) and laproscopic assisted abdomino perineal resection (9%). All the patients in the analysis had some degree of tumor down staging following pre operative chemo-radiotherapy. Twenty patients (14%) had a complete response to pre op chemo-RT (pCR) and the rest 86% were incomplete responders (non pCR). Poorly differentiated Adeno carcinoma constituted the major histology (50%) among the pCR group followed by moderately differentiated adeno carcinoma (40%). Only one patient (5%) among the pCR group had disease recurrence while seventeen patients (18%) among the non pCR group had disease recurrence. Brain (1/1) was the only site of recurrence in the pCR group while liver (7/17) and lungs (5/17) were the common sites of recurrence in the non PCR group. The three year disease free survival (DFS) was 94% for the pCR group and 80% for the non pCR group. The three year overall survival (OS) was 100% for the pCR group and 82% for non pCR group. pCR(N=20)non pCR (N=94)p value3 year DFS94%80%0.563year OS100%82%0.29 **Conclusion:** The complete responders to pre op chemo-radiotherapy (pCR) have definitely a better outcome compared to incomplete responders (non pCR) with respect to disease free survival and overall survival, though it was statistically not significant. Thus the response to pre op chemo RT is an important predictor of disease outcome.

SSE24-05 Implementing a Well Follow-up Care Plan for Colorectal Cancer Patients: Quality Assurance and Lessons Learned

Monday, Nov. 30 3:40PM - 3:50PM Location: S104A

Participants

Chunzi Jenny Jin, MD, Oak Brook, IL (*Presenter*) Nothing to Disclose
Jim Biagi, MD, Kingston, ON (*Abstract Co-Author*) Nothing to Disclose
Hugh Langley, Kingston, ON (*Abstract Co-Author*) Nothing to Disclose
Candice Christmas, Kingston, ON (*Abstract Co-Author*) Nothing to Disclose
Julia Niblett, Kingston, ON (*Abstract Co-Author*) Nothing to Disclose
Aamer Mahmud, MD, FRCR, Kingston, ON (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): With an increasing number of cancer survivors and limited resources, a trend of follow-up outside cancer clinics is emerging. There is little consensus on how to operationalize plan delivery. Our aims were to pilot a sustainable colorectal cancer well follow-up care plan (WFU) with embedded quality assurance measures, to ascertain satisfaction of stakeholders and identify potential barriers. **Materials/Methods:** Toolkits were developed for primary care providers (PCP) i.e. standardized discharge letters, guidelines on frequency of visits and investigations, CEA form and a receipt letter. Patients received a discharge letter; a brochure on follow-up; a list of symptoms, common issues and questions; and healthy living and useful community resources. Toolkits are also available on the hospital website. Satisfaction surveys were developed for patients, PCPs and specialists. **Results:** Since July 2014, 48 stable patients meeting the criteria for transfer of care were discharged to PCPs for WFU when seen at the 3-month visit following treatment completion. Completion rate of patient survey was 25%, reporting an overall satisfaction. Feedback from PCPs has been positive with an interest in additional information and timely access to specialists. Some raised concerns over additional work load. Receipt letters were received in 35% of cases and reminders are being sent for the rest. Oncology specialists supported this initiative when surveyed. Barriers to discharge included not having a PCP, concern about communication between physicians, and a lack of patient education. We continue to collect data and will update the results. **Conclusion:** Key features of a sustainable WFU care plan includes user-friendly toolkits for patients, PCPs and engagement of specialists. We are evaluating feasibility and safety as well as satisfaction measures. This study may also help to identify ways of knowledge translation to meet the needs of patients and PCPs.

SSE24-06 Use of Functional MRI Imaging to Identify Area to be Boosted in Anal Cancer Treatments

Monday, Nov. 30 3:50PM - 4:00PM Location: S104A

Participants

Ivan Fazio, MD, Palermo, Italy (*Presenter*) Nothing to Disclose
Vittorio macchiarella, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimiliano Spada, MD, cefalu, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonella Mazzonello, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Evaluating if functional MRI imaging in the treatment of anal cancer, can help in identifying hypercellularity in the site of the primary tumor or in case of nodal involvement, selecting patients in which dose has to be increased to obtain remission of disease. Materials/Methods: from January to September 2013, 10 patients affected by anal cancer in different stage of disease, had a simulation using CT and MRI imaging. In the MRI imaging we performed the DWI B 800 study which can identify in squamous cell carcinomas areas of hypercellularity which can suggest the presence of tumor tissue. All patients underwent IMRT radiation for 45 Gy in 25 fractions plus chemotherapy and a boost of 14,4 Gy using VMAT only on DWI MRI positive areas. Results: In the short follow-up (2-8 months), we observed a clinical and radiologic complete response in 8 patients and a partial response in 2 patients (with inguinal nodes involvement). The treatment was well tolerated with only grade II skin and rectal toxicity in all 10 patients. In the follow-up functional MRI imaging we observed a progressive decreasing of the extension of DWI positivity (fig.1) up to the disappearance of it. Conclusion: Clinical use of hyperconformal treatments as IMRT or VMAT need a precise identify of areas to be treated with high doses. Functional MRI DWI study can help in squamous cell carcinomas (less in other hystologies) in recognizing areas of subclinical extension of disease. Functional MRI imaging seems to be effective in differentiate inflammatory areas which seems to be positive at FDG-PET imaging.

SSE12

ISP: Health Service, Policy and Research (Economic Analyses/Utilities)

Monday, Nov. 30 3:00PM - 4:00PM Location: S102D

HP

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

Participants

Christoph I. Lee, MD, Los Angeles, CA (*Moderator*) Research Grant, General Electric Company; Clinical Advisory Board, Castlight Health, Inc;
Pari Pandharipande, MD, MPH, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSE12-01 Health Service, Policy and Research Keynote Speaker: Increasing Transparency of Costs and Utilities Used in Cost-effectiveness Analyses

Monday, Nov. 30 3:00PM - 3:10PM Location: S102D

Participants

Christoph I. Lee, MD, Los Angeles, CA (*Presenter*) Research Grant, General Electric Company; Clinical Advisory Board, Castlight Health, Inc;

SSE12-02 Cost-effectiveness of Initial MRCP versus a Risk Stratification Algorithm for Management of Suspected Choledocholithiasis

Monday, Nov. 30 3:10PM - 3:20PM Location: S102D

Participants

David H. Hoffman, MD, New York, NY (*Presenter*) Nothing to Disclose
Scott Braithwaite, MD, MSc, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Stella Kang, MD, MSc, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

For symptomatic cholelithiasis, a number of diagnostic strategies with conflicting recommendations for MRCP have been proposed for evaluating suspected common duct (CD) stones. Our purpose was to analyze the cost-effectiveness of the American Society of Gastrointestinal Endoscopy (ASGE) risk stratification guidelines for triage to endoscopy or MRCP, versus uniform MRCP for all patients with suspected CD stones.

METHOD AND MATERIALS

A decision-analytic model was constructed to compare cost and effectiveness of three diagnostic strategies for suspected CD stones: non-contrast MRCP for all patients, contrast-enhanced MRCP for all patients, or application of ASGE criteria based on lab values and patient characteristics (contrast-enhanced MRCP for intermediate risk, ERCP for high risk, and no test for low risk of CD stones); analysis was performed from a societal perspective over a 1 year time horizon. The model accounted for benign or malignant causes of biliary obstruction and procedural complications as informed by the literature. Cost information was based on Medicare reimbursements. Sensitivity analysis assessed effects of parameter variability on model results.

RESULTS

Using the ASGE algorithm was less costly than initial non-contrast or contrast-enhanced MRCP (\$3577 versus \$3645, \$3767 respectively). Quality adjusted life years in all strategies were similar (0.947-0.949). ASGE guidelines provided the highest net monetary benefit (\$181 more than initial non-contrast MRCP). Results were most sensitive to probability of major procedural complication and cost of endoscopic procedures. Initial MRCP strategies were dominated, and initial non-contrast MRCP became the most cost-effective strategy only with probability of major procedural complication of ≥ 0.4 , and concurrent 85% reduction in cost with $\geq 95\%$ sensitivity and specificity.

CONCLUSION

The ASGE risk stratification criteria for suspected choledocholithiasis offers a cost-effective means of triaging patients to ERCP or MRCP, while initial MRCP is not cost-effective unless sensitivity and specificity are excellent at very low cost. Patients at high risk of procedural complication may benefit from initial MRCP regardless of ASGE classification, however.

CLINICAL RELEVANCE/APPLICATION

ASGE criteria for risk stratification in suspected choledocholithiasis provide a cost-effective triage tool to determine the need for MRCP versus direct endoscopic evaluation.

SSE12-03 Defining the Cost of Advanced Imaging Technology in Image-guided Radiation Therapy Using Time-driven Activity-based Costing

Monday, Nov. 30 3:20PM - 3:30PM Location: S102D

Participants

Nikhil G. Thaker, MD, Houston, TX (*Presenter*) Nothing to Disclose
Tharakeswara K. Bathala, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Thomas Pugh, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Deborah A. Kuban, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Value-based healthcare holds promise of improving outcomes and reducing costs. Effective yet costly imaging technologies, such as MRI, will need to be evaluated in the context of how they improve outcomes or lower costs over the full cycle of care. Although providers have begun to measure outcomes, cost measurement remains a challenge. In this proof-of-principle study, we utilize time-driven activity-based costing (TDABC) to measure the cost of an MRI protocol compared to a traditional CT and ultrasound-based protocol in prostate brachytherapy (PB).

METHOD AND MATERIALS

Process maps of the traditional protocol and the MRI protocol were created from consultation to 1-year after PB. The MRI protocol utilizes one MRI scan for evaluation and treatment planning and a second scan for post-operative dosimetry, rather than CT and ultrasound scans in the traditional protocol. We identified the resource (personnel, equipment, or facility) and time in minutes required for each step in the care cycle. TDABC costs were calculated by multiplying time by the cost per minute at each step.

RESULTS

The largest cost drivers were the operating room (40-45% of total cost), treatment planning (9%), and consultation (6-8%). The two MRI protocol scans comprised 14% of the full cycle cost. Personnel comprised 72-77% of all costs, including the radiation oncologist (25%), anesthesiologist (11%), dosimetrist (10%), mid-level provider (5%), and radiologist (4%). The MRI scan was 2.4x more costly than the evaluation and planning CT and ultrasound scans. Full cycle cost from consultation through one year of follow-up after implantation was only 9.8% higher for the MRI protocol than the traditional protocol (Figure).

CONCLUSION

TDABC is a powerful cost accounting tool that can measure the true costs of imaging technologies. MRI holds promise of improving outcomes at modest cost increases to the provider. However, radiologists will need to measure both outcomes and cost over the full cycle of care, rather than over a specific intervention, to evaluate the value of care delivery. With the onset of bundled payments, providers will experience increasing pressure to enhance value, and costly technology will need to tangibly improve patient outcomes to be justified.

CLINICAL RELEVANCE/APPLICATION

TDABC can accurately measure the true cost of advanced imaging and image-guided technologies and is a vital component to enhancing the value of radiology.

SSE12-04 Imaging Decision Support Does Not Drive Out-of-Network Leakage of Referred Imaging

Monday, Nov. 30 3:30PM - 3:40PM Location: S102D

Participants

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PURPOSE

Decision support systems are an important step to ensuring appropriate imaging of patients. However, decision support could theoretically drive out-of-network leakage if ordering providers attempt to circumvent decision support recommendations by obtaining studies that received a low decision support appropriateness score from other imaging providers. We assessed the incidence of out-of-network leakage for imaging studies with low appropriateness scores.

METHOD AND MATERIALS

This study was IRB-approved and HIPAA compliant. We queried our outpatient decision support software system over a three year period (2011-2013) for studies that received a low decision support appropriateness score and then were canceled by the ordering physician. For patients meeting these criteria and participating in risk-shared contracts, we cross referenced their imaging utilization reports in the risk-contract insurance database to determine if they received outpatient imaging contrary to the decision support recommendation within 60 days of the index order. The demographics of these cases were analyzed for trends.

RESULTS

The risk-contract insurance database contained average of 63,378 patients/year (2011: 71,233; 2012: 58,644; 2013: 60,258) from three insurance companies. These patients had 18,008 MRIs and 18,014 CTs over the study period. The number of these studies that had a low decision support appropriateness score and were subsequently canceled were 2,350 CTs and 2,516 MRIs. 175 imaging studies were performed contrary to the decision support recommendation within 60 days of the index order, 74 (3.1%) CTs and 101 (4.0%) MRIs. 97.1% (170/175) of these studies were ultimately performed within our hospital system and only 2.9% (5/175) of studies were performed outside of our hospital system.

CONCLUSION

Decision support systems for ordering providers do not appear to drive imaging referrals out of hospital systems to other institutions. Hospital systems can implement decision support without this fear.

CLINICAL RELEVANCE/APPLICATION

Implementing decision support systems for ordering providers does not drive out-of-network leakage of referred imaging.

SSE12-05 Impact of Hyperbolic Discounting on Preferences for Screening for Lung Cancer

Monday, Nov. 30 3:40PM - 3:50PM Location: S102D

Participants

Saurabh Jha, MD, Philadelphia, PA (*Presenter*) Speaker, Toshiba Corporation
A. C. Powell, PhD, Boston, MA (*Abstract Co-Author*) President, Payer+Provider Syndicate; Cofounder, ArxViva, Inc.; Researcher, HealthHelp, LLC

PURPOSE

To explore how preferences for screening for lung cancer are influenced by hyperbolic discounting. Behavioral economists have shown that individuals do not uniformly discount events in the near and far future. Instead, events in the far future are discounted at a higher rate than events in the near future. This is relevant to screening for lung cancer because the benefit of reduction in mortality from lung cancer is a far event whereas the harms of screening are a near event. The benefit/risk calculus can be affected by hyperbolic discounting.

METHOD AND MATERIALS

Time-variant preferences are explored using a decision model. Cohorts of smokers were modeled at ages 55, 65 and 75. A higher discount rate is applied to outcomes further in the future. Sensitivity analysis explores the effect of varying the differential in the discount rate (degree of hyperbolic discounting) and the risk of early complications of screening. Parameters have been extracted from the National Lung Screening Trial which reported an absolute risk reduction in mortality when screened by CT from lung cancer of 0.4 % over seven years, and an absolute increase in major complications of 0.24 % over sixty days.

RESULTS

Hyperbolic discounting affects the decision to be screened and when to be screened. Preferences are most sensitive at the bounds of the current recommended age range for screening. Framing the outcomes can lead to reversal of preferences.

CONCLUSION

Hyperbolic discounting affects the decision of smokers to be screened. Physicians counselling patients for screening for lung cancer should elicit this phenomenon and counsel patients about its presence, while respecting patient choice.

CLINICAL RELEVANCE/APPLICATION

We present a conceptual framework for understanding when screening might be foregone in order to enhance shared decision making process.

SSE12-06 Developing an Economic Strategy for Assessing Pregnancy-related Portable Ultrasound Use in Lower-income Countries: Guatemala, Kenya, Democratic Republic of Congo, Pakistan, and Zambia

Monday, Nov. 30 3:50PM - 4:00PM Location: S102D

Participants

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PURPOSE

To assess the existing literature and to develop data collection strategies for conducting an economic evaluation alongside a randomized controlled trial studying portable ultrasound use to improve maternal and neonatal health in five lower-income countries.

METHOD AND MATERIALS

We assessed the published literature related to portable ultrasound use in lower-income settings and developed a conceptual model for an economic evaluation linked to a cluster-randomized trial conducted by the Global Network for Women's and Children's Health Research (Democratic Republic of Congo, Guatemala, Kenya, Pakistan, and Zambia). To evaluate resource use associated with sonographer training, antenatal care, and interventions for pregnancy-related complications, we developed a preliminary conceptual model along with use- and cost-targeted data collection forms.

RESULTS

Substantial evidence gaps were identified for large, multi-country clinical studies and there were no comprehensive economic evaluations of portable ultrasound use to improve maternal and neonatal health. Our mapping of care-delivery processes identified components for economic data collection: equipment, training and quality controls for sonographers, antenatal provider visits, and referrals to facilities for pregnancy-related complications, such as urgent or hospital-based care. Country characteristics and health system infrastructure, such as transportation, energy, cultural issues, and competing health programs were also deemed essential to consider for robust economic assessments. Resource use and cost-related data forms were developed and reviewed by

sites/experts in participating countries to ensure the face validity, consistency, and appropriateness of our approach.

CONCLUSION

Literature reporting clinical or economic implications of maternal health portable ultrasound use in lower-income countries was limited. Economic evaluations should systematically assess clinical and financial impacts of ultrasound training/equipment, antenatal and follow-up care, identification and treatment of complications, as well as country-level infrastructure and burden on patients.

CLINICAL RELEVANCE/APPLICATION

Collecting trial-based clinical and economic data in lower-income countries will allow decision makers to compare costs and consequences of using portable ultrasound screening in maternal health.

SSE23

Physics (MRI I-Image Quality, Evaluation)

Monday, Nov. 30 3:00PM - 4:00PM Location: S404AB

MR PH

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

FDA Discussions may include off-label uses.

Participants

John D. Hazle, PhD, Houston, TX (*Moderator*) Nothing to Disclose
Seth A. Smith, PhD, Nashville, TN (*Moderator*) Nothing to Disclose

Sub-Events

SSE23-01 Multi-Centric, Inter- and Intra-Scanner Variability of Quantitative, Organ-specific Measures in Whole-Body MR Imaging

Monday, Nov. 30 3:00PM - 3:10PM Location: S404AB

Participants

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PURPOSE

Whole-body MR imaging is increasingly being implemented in population-based cohorts and certain clinical settings. However, to quantify the variability introduced by the different scanners is essential to make conclusions about clinical and biological data, and relevant for internal and external validity. Thus, we determined the inter- and intra-scanner variability of seven different 3 Tesla MR systems representing four major vendors.

METHOD AND MATERIALS

Healthy volunteers underwent multi-centric, inter- and intra-scanner (n=30 and n=12, respectively) imaging with a predefined whole-body MR protocol (including neurological, cardiovascular, thoracoabdominal and musculoskeletal sequences). A set of quantitative organ-specific measures (n=20; e.g. volume of brain's gray/white matter, SNR in TOF of basal cerebral arteries, LV endsystolic/-diastolic volume, pulmonary trunk diameter, vertebral body height, cartilage thickness, SNR of the lung, liver diameter) were obtained in a blinded fashion. Reproducibility was determined using mean weighted relative differences and interclass correlation coefficients (ICC).

RESULTS

All volunteers (44±14 years, 50% females) successfully completed imaging except for two scans due to technical issues; thus, 100 whole-body exams were finally analyzed. Mean scan time was 2:32 hrs and differed significantly across scanners (range: 1:59 to 3:12 hrs). A higher reproducibility of organ-specific MR-measurements was observed for intra- than for inter-scanner comparisons (mean ICC: 0.80±0.17 vs. 0.60±0.31, p=0.005, respectively). In the inter-scanner comparison, the mean relative differences ranged from 1.0% to 53.2%, with 45% of measurements demonstrating excellent reproducibility (ICC≥0.75). Conversely, in the intra-device comparison, the mean relative differences ranged from 0.1% to 15.6%, with 65% of measurements showing excellent reproducibility. There were no differences regarding intra- and inter-scanner reproducibility between individual organ systems (all

p≥0.24).

CONCLUSION

In this study of seven different 3 Tesla MR systems, whole-body imaging-derived organ parameters showed good to excellent reproducibility, with less variability observed when using identical MR scanners.

CLINICAL RELEVANCE/APPLICATION

Whole-body MRI shows acceptable relative differences and high reproducibility for most organ-specific measurements, indicating internal validity and the potential for pooling data across different cohorts.

SSE23-02 Magnetic Resonance Elastography of the Brain: Assessment of Scan-rescan Reproducibility

Monday, Nov. 30 3:10PM - 3:20PM Location: S404AB

Participants

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PURPOSE

Magnetic resonance elastography (MRE) has shown brain tumor to differ in stiffness in comparison to normal brain tissue. The purpose of this study was to measure the shear modulus of white and grey matter using MRE, and to assess scan-rescan reproducibility.

METHOD AND MATERIALS

MRE of the brain was performed in 10 healthy volunteers on a 3T MRI scanner using a 2D EPI MRE sequence. Shear waves were induced at frequencies of 60, 50, and 40 Hz, using an ergonomic flexible driver connected to a speaker system via a polyvinyl chloride tube. MRE phase data was acquired using a single slice and 8 temporal phases with axial T2-weighted images as reference. Motion encoding was performed in the through plane direction (Z). Elastograms were reconstructed using GE direct inversion post processing software. Each subject was repositioned and rescanned within the hour. Wilcoxon signed-rank test was used to compare white and grey matter shear modulus measurement at each driver frequency.

RESULTS

White matter shear modulus measurements at 60, 50, and 40 Hz were 3.9 ± 0.4 kPa, 3.8 ± 0.5 kPa, and 3.4 ± 0.3 kPa, respectively. 60, 50, and 40 Hz grey matter shear modulus measurements were 3.3 ± 0.5 kPa, 2.8 ± 0.5 kPa, and 2.2 ± 0.4 kPa, respectively. White matter shear modulus measurements were significantly higher than grey matter at all frequencies ($P < 0.001$). The within-subject coefficient of variation of white matter and grey matter shear modulus measurements for all frequencies ranged 3.74-4.10%, and 4.68-5.95%, respectively.

CONCLUSION

Our results show that brain tissue shear modulus increases with driver frequency which highlights the importance of standardizing MRE settings in order to facilitate cross-institutional comparison. Both white matter and grey matter shear modulus measurements exhibit high reproducibility, enabling MRE as a potential clinical quantitative imaging technique.

CLINICAL RELEVANCE/APPLICATION

MRE allows for the differentiation between the shear modulus of normal brain tissue and malignancy. This technique with high reproducibility has potential for differentiating radiation necrosis from tumor recurrence in the brain.

SSE23-03 Quantification of MRI Geometric Distortion for Radiation Treatment Planning Applications

Monday, Nov. 30 3:20PM - 3:30PM Location: S404AB

Participants

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Clifton D. Fuller, MD, PhD, Houston, TX (*Abstract Co-Author*) In-kind support, General Electric Company; Research Grant, Elekta AB;
; ;
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PURPOSE

Uncertainties related to geometric distortion are a major obstacle for use of MRI in radiation treatment planning. The aim of this study is to quantify the geometric distortion in patient images by comparing their in treatment position's MRIs with the corresponding planning CT, using CT as the non-distorted gold standard.

METHOD AND MATERIALS

Twenty-one head and neck cancer patients were imaged with MRI as part of a prospective IRB approved study. All patients had their treatment planning CT done on the same day or within one week of the MRI. MR Images were acquired with a T2 SE sequence (1x1x2.5mm voxel size) in the same immobilization position as in the CT scans. MRI to CT rigid registration was then done and geometric distortion comparison was assessed by measuring the corresponding anatomical landmarks on both the MRI and the CT images by two observers. Several skin to skin (STS; 9 landmarks), bone to bone (BTB; 8 landmarks), and soft tissue (TTT; 3

landmarks) were measured at specific levels in horizontal and vertical planes of both scans.

RESULTS

The mean distortion for all landmark measurements in all scans was 1.6 ± 1.7 mm. For each patient 10 measurements were done in the horizontal plane and 10 were done in the vertical plane. The measured geometric distortion were significantly lower in the horizontal axis compared to the vertical axis (1.4 ± 0.05 vs. 1.7 ± 0.05 mm, respectively, $P=0.0002^*$). The magnitude of distortion was lower in the BTB landmarks compared to the STS landmarks (1.2 ± 0.06 vs. 2.0 ± 0.07 mm, $P<0.0001^*$). Likewise, the magnitude of distortion was lower in the TTT landmarks compared to the STS landmarks (1.5 ± 0.09 vs. 2.0 ± 0.07 mm, $P<0.0001^*$). BTB distortion measurements were insignificantly different from TTT (1.2 ± 0.06 vs. 1.5 ± 0.09 mm, $P=0.9$). The mean distortion measured by observer one was not significantly different compared to observer 2 (1.6 ± 0.07 vs 1.6 ± 0.13 mm, $P=0.16$)

CONCLUSION

MRI geometric distortions were quantified in radiotherapy planning applications with clinically insignificant error of less than 2 mm compared to the gold standard CT.

CLINICAL RELEVANCE/APPLICATION

After QA against gold standard CT for quantification of errors related to geometric distortion, MRI acquired in treatment position with customized immobilization devices and intra-oral stent is potentially usable for radiotherapy planning purposes.

SSE23-04 Multi-diffusivity and Multi-orientation Reproducibility of Apparent Diffusion Coefficient Measurement

Monday, Nov. 30 3:30PM - 3:40PM Location: S404AB

Participants

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Michael Boss, PhD, Boulder, CO (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Apparent Diffusion Coefficient (ADC) of diffusion weighted imaging (DWI) has been used clinically as a biomarker for various diseases. However, the most broadly used DWI approach, echo planer imaging (EPI) sequence, is vulnerable to artifacts and highly dependent on MRI scanner system. Our study aims at investigating accuracy of ADC measurements across platforms from one vendor and in different orientation of image acquisition in a wide range of diffusivity.

METHOD AND MATERIALS

An RSNA QIBA ADC phantom containing 13 20ml polypropylene scintillation vials filled with aqueous solutions of polyvinylpyrrolidone (PVP) was used for measurement, as shown in Fig. 1. DWI scans were conducted with the phantom at 0°C on 8 types of Siemens scanners (3T TIM Verio, 1.5T TIM Avanto, 1.5T TIM Symphony, 1.5T TIM Espresso, 3T TIM Trio, 1.5T Aera, 3T Skyra and 3T Prisma) with head coils and identical acquisition protocol. Three orthogonal imaging orientations, i.e. axial, sagittal and coronal directions were tested with b-values of 0, 500, 1000 and 2000 s/mm^2 ; $\text{TR}=5000\text{ms}$; $\text{TE}=136\text{ms}$; parallel acceleration factor (iPAT)=2; acquisition matrix 256×256 ; FOV 230×230 mm 2 ; 5 slices crossing the vials, 4mm thickness. ADC measurement for each vial was performed with ROI analysis using ADC maps from scanner.

RESULTS

Measured ADC from 8 scanners in three orientations for 13 vials are shown in Fig.2. ADC bias error of vials filled with water with respect to the reported value at 0°C was 2.1% at 3T and 1.5% at 1.5T. Overall standard deviation of ADC in water-only vials was 1.71%. Multi-platform coefficients of variance (CV) of ADC from three orientations for 5 types of vials were listed in table 1, with measured ADC ranging from 200 to 1100 mm^2/s . Variability in orientation does not have a significant influence ($\text{CV} \leq 5$) on acquired ADC values.

CONCLUSION

Reproducibility of iso-center ADC measurements on eight scanners from the single vendor was verified in a wide range of diffusivity. Orientation of the image did not have a significant effect on ADC measurement; but slightly increased variance was observed with lower diffusivity. The quality assurance procedure was tested to be feasible and applicable for other vendors.

CLINICAL RELEVANCE/APPLICATION

Reproducibility of ADC values across scanners and orientation is crucial for clinical diagnosis and treatment evaluation requiring repeated scans and multi-platform comparison.

SSE23-05 Multicenter Study of Reproducibility of Wide Range of ADC at 0°C

Monday, Nov. 30 3:40PM - 3:50PM Location: S404AB

Participants

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Ona Wu, PhD, Charlestown, MA (*Abstract Co-Author*) Royalties, General Electric Company; Royalties, Olea Medical; License agreement, General Electric Company; License agreement, Olea Medical
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PURPOSE

MR DWI measurands are potential quantitative imaging biomarkers. However, at this juncture, there is variability in quantification of DWI data. This variability can be due to hardware differences, pulse sequence implementation and acquisition parameter choices, and b-value selection. Our study aims to determine the intrinsic, scanner-induced variability of the apparent diffusion coefficient (ADC) across multiple sites, vendors, and field strengths.

METHOD AND MATERIALS

Multiple copies of a phantom developed by NIST and RSNA QIBA, using varying concentrations of polyvinylpyrrolidone (PVP) in aqueous solution to generate physiologically relevant apparent diffusion coefficient (ADC) values, were produced and distributed. These phantoms have been scanned at isocenter to evaluate hardware across multiple institutions and platforms using a 0 °C ice-water fill solution to eliminate variability in ADC introduced by temperature differences across scanners, as well as at ambient conditions. All sites used a standardized SS-EPI pulse sequence with $b = 0, 500, 900$ and $2000 \text{ mm}^2/\text{s}$.

RESULTS

Initial results across 5 (out of an eventual 13) sites, 3 vendor platforms, and 2 field strengths indicate that the phantom provides a high degree of reproducibility and a wide range of ADC values. ADCs ranged from 0.12 (50% PVP by mass) up to $1.1 \times 10^{-3} \text{ mm}^2/\text{s}$ (water) at 0 °C, with repeatability coefficients (RCs) of 1.7% or less for water vials across sites. RCs were below 6% for all but the lowest ADC components of the phantom at 0 °C. A wider range of ADC values was seen at 37 °C, from ~ 0.6 to $\sim 3.0 \times 10^{-3} \text{ mm}^2/\text{s}$, but with larger measurement error.

CONCLUSION

Stable, well-characterized phantoms allow for understanding sources of inter-hardware and longitudinal bias and variability and for providing a robust quality control and site qualification platform for DWI acquisitions. Slightly higher ADCs exhibited by the outermost water vial, $\sim 70 \text{ mm}$ from the phantom center, may indicate spatially-dependent bias, possibly due to gradient non-linearity effects. The intrinsic variability across scanners when measuring ADC is low; however, significantly larger errors can be expected when measuring slow diffusion components.

CLINICAL RELEVANCE/APPLICATION

This work demonstrates the utility of the phantom for quality control purposes in a multicenter, multivendor study. It allows pulse sequence testing over a relevant physiological range of ADC values.

SSE23-06 Evaluation of Whole-body Ferrodetection Systems in Clinical MRI

Monday, Nov. 30 3:50PM - 4:00PM Location: S404AB

Participants

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PURPOSE

In the environment of a MRI, ferromagnetic objects can cause severe injuries. According to manufacturers whole-body ferrodetection ensures maximum patient safety and minimize risks for personnel and MRI equipment in clinical routine. This study aims to evaluate if a screener or an door guard system for ferromagnetic metals can increase patient safety and is reliably working in clinical practice.

METHOD AND MATERIALS

A highly sensitive screener for ferromagnetic objects (Ferrogard Screener, Metrasens, GB) as well as an door guard system (Ferrogard Guardian, Metrasens, GB) focusing larger ferromagnetic objects, were installed in the preparation room and at the doorway to an MRI room (Fig 1). Subsequently 400 patients were scanned with the screener as well as another 2500 patients with the door guard system. Patients examined with the screener were asked to turn around 360° in front of the system. Measurement time was documented for each first scanning process. All patients were regularly asked to remove all metal objects and inform the radiologist about any implants that might contain metal parts. In case of an alarm the patient was rescanned for a reproducible result, otherwise a false positive finding was documented. If the alarm was confirmed the patient was searched for ferrous materials and findings were documented, until no more alarm is given.

RESULTS

The screener system identified unknown ferrous objects in 2% of the cases. In two cases ferrous foreign bodies were found. The average measurement time for the screener was 80 sec (varying from 10 to 300 sec). The door guard system detected unknown ferrous objects in 0,3% of the cases. There were two false-positive alerts (non reproducible).

CONCLUSION

The number of ferrous object which are brought to the scanner room by accident, can be reduced with usage of a whole-body ferrodetection system. To avoid false alarms the door guard system requires a ferrous free environment and perfectly ferrous free clothing for the medical personnel. Ferrodetection can aid and complement, but not replace patient education and MRI safety training.

CLINICAL RELEVANCE/APPLICATION

The biggest risk of an MRI examination are the impact of ferromagnetic objects, that are unconsciously brought into the magnetic room. Effective mechanisms are mandatory to avoid MR-accidents.

SSE13

Informatics (3D Printing)

Monday, Nov. 30 3:00PM - 4:00PM Location: S404CD

IN

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

Participants

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Sub-Events

SSE13-01 Using Computed Tomography and 3D Printing (Additive Manufacturing) to Aid Construction of Custom Prosthetics and Attachment Devices for Our Wounded Warriors

Monday, Nov. 30 3:00PM - 3:10PM Location: S404CD

Participants

Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
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PURPOSE

The technology in the design and function of the prosthetics the military uses to restore function and mobility to our wounded warriors is highly advanced and in many instances not yet available to the general public. These typically young patients are extremely active and desire to take part in numerous complex activities such as kayaking, skiing, and scuba. While prosthetists can accommodate and manufacture numerous devices with standard materials and limb assemblies currently on the market, patients often may require individualized prosthetic design and/or modification to enable them to participate fully in more complex activities.

METHOD AND MATERIALS

Prosthetists, Rehabilitation Therapists, and Assistive Technologists work in collaboration to digitally design the necessary equipment or prosthetic modification necessary for their wounded warrior's rehabilitation needs. These designs are then produced using additive manufacturing from an array of materials. Many of these designs need to be form fitting to a particular prosthetic socket, impression, or thermoplastic mold. These sockets, impressions, and specialty items can be scanned using computed tomography and digitally reconstructed to produce a virtual three-dimensional model the engineer can use to design the necessary complementary features of the desired prosthetic, device, or attachment. Completed devices are tested for fit and function. Some of these designs and devices require multiple interactions to achieve the overall objective(s).

RESULTS

Over 20 unique custom prosthetic and attachments were successfully completed, which featured the use of computed tomography (CT) reconstructions. These included: two sets of Bilateral Hockey Skates; multiple wheel chair mushroom adapters, allowing patients to push their wheel chair without changing their terminal device; and a custom weight lifting prosthetic hand.

CONCLUSION

Additive Manufacturing is the most flexible and applicable solution to aid in these limited quantity production needs. CT imaging can be successfully used to provide proper design of custom attachments and assistive technology devices. Even though some these prosthetics attachments may be relatively simple in design to an engineer, they make a world of difference in the lives of our wounded warriors.

CLINICAL RELEVANCE/APPLICATION

Using Computed Tomography and 3D Printing (Additive Manufacturing) to Aid Construction of Custom Prosthetics.

SSE13-02 The Remnant Standard Tessellation Language (STL) Volume is a Novel Metric for 3D Printing Quality and the Remnant STL Volume Used to Validate 3D Printing from CT Images of Bone at Reduced Radiation Dose

Monday, Nov. 30 3:10PM - 3:20PM Location: S404CD

Participants

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Dimitris Mitsouras, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation

PURPOSE

Most 3D-Printed (3DP) medical models use CT for its high spatial resolution and signal to noise ratio (SNR). To date, there is no

published data regarding 3DP quality and CT radiation dose. This study (a) defines the remnant Standard Tessellation Language (STL) volume (STLv) as a metric of 3DP quality and, (b) uses it to evaluate simulated tube current reduction and iterative reconstruction for 3DP bone models.

METHOD AND MATERIALS

Raw CT data (1st gen 320x0.5mm, 80kV, 0.5s rot) from 2 pts underwent noise addition (Poisson, photon stats plus Gaussian, electronic) to simulate 50%, 40%, 30%, and 20% of the clinical ref tube current (155 mAs). For all 10 recons per pt (ref mAs + 4 reduced doses, using both FBP and IR), image SNR was calculated from mean and SD regions of interest. Bone segmentation (Mimics, Materialise) was used (HU>226 threshold) to produce 3D-printable STL files. The remnant STL volume (STLv) was defined by topologic subtraction (union subtracted from intersection: Remnant STLv= [(Configuration U Reference) - (Configuration n Reference)]). Reference standard STLv was obtained from the clinical mAs IR recon.

RESULTS

Pt 1: FBP SNR range was 1.23 (20% dose) to 2.83 (100% dose). Remnant STLv was 2.84% of reference STLv at 30% dose (20% dose STL could not be produced) and reduced to 1.43% at 100% dose. With IR, SNR range was 3.38 (20%) to 4.54 (100%); the remnant STLv was 2.65% of reference at 20% dose, and reduced to 1.31% at 50% dose. Pt 2: FBP SNR range was 1.92 (20%) to 4.21 (100%); Remnant STLv ranged from 2.84% at 40% dose (STLs could not be produced at lower doses) to 1.54% at 100% dose. With IR, SNR range was 4.4 (20%) to 6.36 (100%) and remnant STLv range was 3.86% at 20% dose to 1.8% at 50% dose. In all cases, remnant STLv morphology was a 0.08-0.04mm layer at the outer bone surface. For example, 3DP models at 40% dose differ from full dose models by <2.2% by vol and <0.5mm in thickness.

CONCLUSION

The remnant volume is a novel metric for 3DP quality. High inherent SNR of bone supports 3DP at reduced CT radiation doses, particularly with IR. Further testing on soft tissue structures is warranted, given the different noise properties.

CLINICAL RELEVANCE/APPLICATION

This initial study relating 3DP models and patient radiation exposure introduces a novel metric for 3DP quality and supports reduced radiation dose images for high-quality 3DP of bone.

SSE13-03 3D Printing of Complex Oncologic Pelvic Models Using CT and MRI Data for Pre-operative Surgical Planning

Monday, Nov. 30 3:20PM - 3:30PM Location: S404CD

Participants

Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Peter S. Rose, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Doris E. Wenger, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Franklin Sim, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Michael Yaszemski, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jane S. Matsumoto, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To share our experience creating 3D printed individual life size pelvic models to aid in surgical planning for patients with pelvic tumors undergoing resection and reconstruction or revision from previous surgery and radiation.

METHOD AND MATERIALS

After institution IRB approval a retrospective review of our 3D printing experience in complex pelvic oncologic models was reviewed. DICOM imaging data from CT and/or MR was transferred to a dedicated server. Utilizing Mimics software, (Materialize, Leuven, Belgium) the DICOM data was segmented using a combination of thresholding and hand segmentation tools separating and color coding critical anatomy such as bone, vasculature, bladder and ureters, lumbosacral plexus and tumor. Images were converted into STL files and exported into 3matic software. The STL files, was sent to the 3D printer software where materials and colors were assigned. The models were printed on poly jet Connex 350 printer (Stratasys, Eden Prairie MN).

RESULTS

Sixteen 3D printed individualized pelvic models were printed from patient's imaging data. Cases included six chondrosarcomas and single cases each of Ewings, Chondroblastic OGS, Myeloma, Schwannoma, Giant Cell tumor and Synovial Chondromatosis. In addition, two models of the pelvis and two models of the pelvis and lumbar spine, were created in patients needing revision following previous surgery and radiation therapy. All models were created using high resolution CT images. In 10 cases there was contrast enhancement for aid in segmentation of vessels. In 8 cases additional MR imaging data was used and co-registered on the CT data. In 6 cases only CT data was used. MR imaging is essential in evaluating tumor involvement and demonstrating the relationship of the lumbosacral plexus to the tumor.

CONCLUSION

Accurate life size physical models created from CT and MR imaging data aid in surgical planning in complex cases. These models improve comprehension of critical anatomic relationship, focus surgical decision making by multispecialty surgical teams and enhance resident and family education.

CLINICAL RELEVANCE/APPLICATION

Life size anatomic models of complex pelvic tumors using CT and MR imaging data add value by contributing to patient care, safety and education.

SSE13-04 3D Printing in Radiology Using Low Cost 3D Printers and Open-Source Software

Monday, Nov. 30 3:30PM - 3:40PM Location: S404CD

Participants

Artur Salmalioglu, MD, Istanbul, Turkey (*Presenter*) Nothing to Disclose
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Bulent Acunas, MD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The introduction of cheap 3D printers and open source software decreased the costs associated with owning and using a 3D printer considerably. The purpose of our presentation is to describe a workflow using a cheap 3D printer and free or open source software for 3D printing in radiologic patients.

METHOD AND MATERIALS

A locally manufactured 3D printer kit and a roll of 3D printing filament (made from polylactic acid (PLA)) were bought for approximately 540 USD. Patients with pathological findings in enhanced Computed Tomography (CT) or rotational angiography were selected from the archives. DICOM images were imported and processed with Slicer software (www.slicer.org) for segmentation and 3D object creation. The created objects were post-processed with MeshLab (MeshLab -Visual Computing Lab, meshlab.sourceforge.net) to correct possible segmentation errors or to remove unwanted segments. The objects were then imported to Meshmixer (Autodesk, www.meshmixer.com) to check for printability and to create supports for overhanging parts. The final object was then loaded to Cura (software.ultimaker.com/), which generated printing instructions (called g-code) and sent them to the printer. All of the used software were free or open source.

RESULTS

Following a short training period, it was possible to segment and postprocess DICOM data to obtain 3D printable objects representing pathologic structures. The material cost per object was very low (1-7 USD per object) compared to professional printers or professional printing services. The printed parts could be used for patient education and training residents. It was also possible to use water soluble filaments (like Polyvinyl Alcohol - PVA) to create dissolvable models, which could be embedded in silicone molds or covered with silicone and then dissolved to create hollow silicone models for training purposes.

CONCLUSION

3D Printing is an important technology which is now accessible and affordable thanks to the lower costs associated with the use of cheaper printers and open source software. This affordability and the ability to create patient or pathology specific models could be beneficial for patient education and resident training.

CLINICAL RELEVANCE/APPLICATION

Thanks to the advances in 3D printing and open source software, it is possible to create patient specific, imaging derived pathologic models with very low initial investment and low running cost.

SSE13-05 Realistic Fabrication of Patient-Specific Tracheo-Bronchial Model with 3D Printing for Pre-interventional Planning

Monday, Nov. 30 3:40PM - 3:50PM Location: S404CD

Participants

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Guk-Bae Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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So Jung Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Background

3D volumetric tracheobronchial MDCT might not be adequate enough to explain the disease extent and planning the bronchoscopic intervention of the tracheobronchial tree. For obtaining the comprehensive image for tracheobronchial stenosis, this study investigates patient-specific tracheobronchial object using a 3D printing, which has widely used to create fabricated replicas of anatomical structures. To estimate 3D printing application, a patient-specific airway stent model with a formation of tailored side hole for the second airway in geometry is also developed.

Evaluation

We fabricated the 3D models of the 6 patients with tracheobronchial narrowing by a stoma stenosis (n=1), central bronchogenic/adenoid cystic cancers (n=2), endobronchial metastasis (n=2), and trachea-esophageal fistula after radiation (n=1) involving trachea/main stem bronchus based on pre-interventional tracheobronchial MDCT. The airway lumen was segmented by a seeded region growing method in MDCT images without gap (< 1mm reconstruction, conventional kernel). For the 3D modeling from mask images by a marching cubes algorithm and the STL (Standard Tessellation Language) converting, the in-house software was developed. The airway model was generated by the airway lumen model by outside offsetting function of Magics (Materialise Inc., Leuven, Belgium). For 3D printing, we used Object 500 Connex 3 (Stratasys Inc., Eden Prairie, MN). Two radiologists and a bronchoscopy specialist evaluated an optimum condition of material hardness in consensus. In addition, we fabricated a patient-specific modeling having a realistic airway model equipped with cartilage features, which were artificially made by computer-aided design method

Discussion

By mixing soft and hard materials, we could figure out the optimum softness-to-hardness ratio between 4:5 and 3:7 (Fig. 1). Airway phantom with cartilage features was fabricated for more a realistic phantom study (Fig. 2).

Conclusion

This patient-specific 3D printing is practical application of pre-interventional planning in a variety of complicated patients who have central airway stenosis and subsequent stent developing. Simulation is also promising using the fabricated 3D replica.

SSE13-06 Quality Control and Spatial Accuracy in Anatomic Modeling Using 3D Printing Techniques

Monday, Nov. 30 3:50PM - 4:00PM Location: S404CD

Participants

Shuai Leng, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
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Jonathan M. Morris, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Kiaran P. McGee, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Joel L. Kuhlmann, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

To establish a quality control (QC) program for the 3D printing used in clinical practice and to assess the accuracy and precision of each step of the 3D printing procedure.

METHOD AND MATERIALS

A systematic QC program was established to assess each step of the 3D printing: 1) Scan and reconstruction techniques were optimized to meet the need of 3D modeling. All imaging equipment were accredited by American College of Radiology and routinely tested. 2) Image segmentation and modeling were performed by experienced technologists and radiologists using FDA approved software (Mimics, Materialize). The contour of segmented objects was overlaid with original images and the agreement checked in all 3 planes over the whole model. 3) Annual maintenance of the printer was performed by the manufacturer. To assess the accuracy of the whole procedure, a QC phantom was developed that contained 11 groups of line-pairs with different sized air openings. This phantom was 3D printed using the same procedure as clinical models to generate a printed QC phantom. The size of the air opening for each group of bar patterns was then measured with a caliper for both the original phantom and its printed 3D model. After fabricated using the 3D printer, the clinical models were scanned on a CT scanner using a high resolution mode. The images were then registered to the segmented model, and distance between them was calculated on a point-by-point base. The same process was repeated for a radial-ulna clinical data set to compare 3D model scan and the original patient scan.

RESULTS

The imaging system provided high geometrical accuracy and spatial resolution (<1mm). For the QC phantom, the size of bar pattern on the 3D model agreed well with that of the original resolution phantom, with the measured differences ranged from -0.32 mm to 0.13 mm. For a radial-ulna clinical data set, the mean distance between the original data set and the scanned printed model was -0.12 mm, with a standard deviation of 0.17 mm. Differences ranged from -0.57 to 0.34 mm.

CONCLUSION

A comprehensive QC program has been established to access each step in the 3D printing procedure to ensure the printed anatomic models fulfill quality requirements in medical practice.

CLINICAL RELEVANCE/APPLICATION

Quality control is essential in 3D printing to ensure the printed model accurately represents the human anatomy and pathology so that they can be used in medical practice, research and education.

SSE22

Physics (CT III-Reconstruction)

Monday, Nov. 30 3:00PM - 4:00PM Location: S403B



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

Discussions may include off-label uses.

Participants

Marc Kachelriess, PhD, Heidelberg, Germany (*Moderator*) Nothing to Disclose
Xiangyang Tang, PhD, Atlanta, GA (*Moderator*) Research Grant, Sinovision Technologies Co Ltd

Sub-Events

SSE22-01 Spectral PICCS Image Reconstruction for Noise Reduction in Multi-Energy CT

Monday, Nov. 30 3:00PM - 3:10PM Location: S403B

Participants

Zhicong Yu, Rochester, MN (*Presenter*) Nothing to Disclose
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Steven M. Jorgensen, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
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Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

Photon-counting CT (PCCT) is able to generate energy specific images using photons that belong to relatively narrow energy bins. The price paid is a significant increase in quantum noise due to the reduced number of photons in each bin. This work aimed to use iterative reconstruction techniques to reduce noise in bin images.

METHOD AND MATERIALS

The Spectral PICCS (prior image constrained compressed sensing) algorithm was used for reconstructing bin images. This algorithm is an adaption of PICCS to spectral CT imaging; it consists of 2 steps: bin-data fidelity enforcement via SART (simultaneous algebraic reconstruction technique), and TV (total variance) minimization constrained by a prior image that is reconstructed by the classical FBP (filtered back-projection) algorithm using full-spectrum X-ray photons. The algorithm stops when a fixed iteration number is reached or the impact of the SART step is below a threshold. Different from PICCS, Spectral PICCS uses adaptive step sizes for both the SART and TV minimization. We demonstrate the impact of Spectral PICCS using data acquired from a prototype whole-body PCCT system (Siemens Healthcare, Germany) during an in vivo swine study. Three axial scans over the liver, neck, and brain regions of the swine were performed using 110 mAs and 140 kV with thresholds of 25, 45, 65, 85 keV. Each scan generated 8 sets of projection data (4 bin data sets and 4 threshold data sets), which were preprocessed on a Siemens research-only workstation. The preprocessed bin data were then reconstructed by Spectral PICCS using the full-spectrum (25-140 keV) FBP images as a prior. Image quality was assessed and compared between FBP and Spectral PICCS.

RESULTS

The Spectral PICCS algorithm converged monotonically. An average noise reduction of 70% was achieved in bin images by Spectral PICCS. With reduced noise, we observed enhanced low-contrast detectability in low-energy bin images, and reduction of beam hardening and Calcium blooming in high-energy bin images.

CONCLUSION

The Spectral PICCS algorithm can achieve significant noise reduction in energy bin images, which will benefit spectral CT imaging applications.

CLINICAL RELEVANCE/APPLICATION

Spectral PICCS substantially suppresses image noise at reduced usage of X-ray photons, which may translate to the realization of PCCT applications in clinical practice.

SSE22-02 1024 Matrix Forward Projection Based Iterative Reconstruction Improves Image Quality in Abdominal CT: Qualitative and Classifier Trained Quantitative Evaluation

Monday, Nov. 30 3:10PM - 3:20PM Location: S403B

Participants

Patrik Rogalla, MD, Toronto, ON (*Presenter*) Research Grant, Toshiba Coporation; Speakers Bureau, Bayer AG
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Paul Dufort, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate forward projection based iterative reconstruction (FPB-IR) at 512 and 1024 image matrix against hybrid iterative

reconstruction (AIDR-3D) using qualitative and machine learning analyses in abdominal CT.

METHOD AND MATERIALS

Raw-data from 23 subsequent CTs of the abdomen were reconstructed in 9 different methods: AIDR-3D standard and strong (FC14), FPB-IR at 3 progressive regularization parameters with a 512 image matrix (mild, standard, strong) and at 4 parameters with a 1024 matrix (b=16,20,24,28). All nine datasets were displayed on one screen; 3 radiologists (19, 7 and 1 years of clinical experience, blinded to all parameters) were asked to forced rank (1-9) the datasets according to their preference along 4 axes: conspicuity; noise texture; low contrast; and overall preference. Standard deviations (SD) were measured in all patients in air. To quantify the differences between the various reconstruction methods, two categories of metrics were computed: (i) the image spectral power as a function of spatial frequency, averaged over the 23 subject scans for each reconstruction method; and (ii) the standard deviations of difference images, computed by subtracting two CATPHAN scans reconstructed using the same nine different methods. Machine learning was then used to predict the rankings based on these quantitative data.

RESULTS

SDs in air for AIDR (standard, strong), FPB-IR 512 matrix (mild, standard, strong) and 1024 matrix (b=16, 20, 24, 28) were 13.2, 11.5, 14.7, 12.1, 9.6, 9.6, 8.3, 7.4, and 6.8, respectively with a mean value of -1001 HU. Averaged over all 3 readers, FPB-IR 1024 b=20 was preferred for conspicuity (2.1) and low contrast detectability (2.7), whereas b=24 ranked best for noise texture (3.0) and overall preference (2.7). The most accurate predictions of ranking (normalized discounted cumulative gain of 0.92 out of a maximum of 1.0, $p < 0.001$) were achieved using the CATPHAN difference image SDs.

CONCLUSION

1024 matrix FPB-IR is preferred over 512 matrix FPB-IR and AIDR-3D. A machine learning analysis revealed that radiologist rankings could be accurately predicted based on quantitative metrics, with the standard deviations performing best.

CLINICAL RELEVANCE/APPLICATION

Image quality in abdomen imaging can be improved by 1024 matrix forward projection based iterative reconstruction. Machine learning may assist in the future with optimizing reconstruction parameters.

SSE22-03 Metal Artifact Reduction in Computed Tomography Using Computer-Aided Design Data of Metallic Implants as Prior Information

Monday, Nov. 30 3:20PM - 3:30PM Location: S403B

Participants

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Marcel Beister, Erlangen, Germany (*Abstract Co-Author*) Employee, CT Imaging GmbH
Willi A. Kalender, PhD, Erlangen, Germany (*Abstract Co-Author*) Consultant, Siemens AG Consultant, Bayer AG Founder, CT Imaging GmbH Scientific Advisor, CT Imaging GmbH CEO, CT Imaging GmbH

PURPOSE

The performance of metal artifact reduction (MAR) methods in computed tomography (CT) suffers from incorrect identification of metallic implants in the artifact-affected volumetric images. The aim of this study was to investigate potential improvements of state-of-the-art MAR methods by using prior information on the implant geometry and material.

METHOD AND MATERIALS

Two MAR methods were investigated; both are based on an initial reconstruction without correction. 1. Threshold-based MAR (TH-MAR) uses adaptive threshold segmentation of the volumetric images to identify metal. 2. Computer aided design (CAD)-based MAR (CAD-MAR), which we present here, uses 3D-registration of implant CAD data and the volumetric images to determine the position and orientation of the metal implant. Subsequently, for both methods, the selected voxels are projected into the raw-data domain to mark metal areas. Attenuation values in these areas are replaced by interpolation and tissue-class modeling followed by a second reconstruction. Finally the previously selected metal voxels are replaced by the initial reconstruction (TH-MAR) or the CAD data (CAD-MAR). We evaluated if knowledge of the exact implant shape extracted from the CAD data provided by the manufacturer of the implant can improve MAR results. In addition to phantom setups with removable metallic implants, the leg of a human cadaver was scanned using a clinical CT system before and after implanting of the artificial knee joint. The results were compared regarding efficacy of artifact reduction, CT value accuracy and image noise.

RESULTS

The CAD-MAR with use of prior information was more efficient than the TH-MAR. The typical streak artifacts oriented tangentially to metal were reduced. The determination of the implant shape was more exact and not dependent on a threshold value. The visibility of structures surrounding metallic implants was markedly improved when comparing the new approach to the standard method. This was confirmed by the improved CT value accuracy and reduced image noise.

CONCLUSION

The CAD-MAR approach based on prior implant information provided image quality superior to TH-MAR correction, especially when there were further high-contrast structures.

CLINICAL RELEVANCE/APPLICATION

The use of prior information on implant geometry and material can reduce artifacts in the reconstructed volumetric images and thereby provide improved diagnostic value.

SSE22-04 Fast Implementation of the Katsevich Reconstruction Algorithm for Dedicated Breast CT

Monday, Nov. 30 3:30PM - 3:40PM Location: S403B

Participants

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Willi A. Kalender, PhD, Erlangen, Germany (*Abstract Co-Author*) Consultant, Siemens AG Consultant, Bayer AG Founder, CT Imaging GmbH Scientific Advisor, CT Imaging GmbH CEO, CT Imaging GmbH

PURPOSE

We designed a dedicated breast computed tomography (BCT) system with photon-counting technology with a small detector size in cone direction and use dynamic pitch spiral trajectories starting directly at the patient table in order to cover the whole breast. The Katsevich image reconstruction algorithm is suited for such trajectories, but no fast dynamic pitch implementation is available. The aim of this study was to investigate if the algorithm can be accelerated sufficiently to allow for routine clinical workflow.

METHOD AND MATERIALS

The Katsevich algorithm is an exact filtered backprojection type algorithm suitable for both constant and dynamic pitch spiral cone beam trajectories. The algorithm consists of two major parts: preprocessing of the 2D projection data and 3D backprojection. Both were adapted to support dynamic pitch datasets and to allow for fast and parallelized computation. The algorithm was accelerated by graphics processing units (GPU) using the CUDA framework. The datasets used for the measurements consisted of 6000 projections with 2816x512 pixels. We performed two reconstructions tasks: A fast preview mode with 256 images with 512² pixels and a high-resolution mode with 1024 images with 1536² pixels. Speed and image quality measurements were performed on a high-end system with an NVIDIA Quadro K5200 GPU. Image quality of the Katsevich-reconstructed images was compared to that of a standard Feldkamp-type spiral reconstruction (SFDK) algorithm.

RESULTS

2D preprocessing took 19 s and 253 s for preview and high-resolution mode, respectively. 3D backprojection took 48 s and 420 s which resulted in a total reconstruction time of 93 s and 12 min 15 s for preview and high-resolution mode, respectively. Katsevich reconstructed images were cone-beam artifact-free in contrast to SFDK images. Resolution and image noise were equivalent to the results of SFDK.

CONCLUSION

The proposed GPU implementation improved speed of reconstruction markedly and provided artifact-free high-resolution BCT images. Less than 2 minutes for the preview and less than 13 minutes for the high-resolution reconstruction appear sufficient for routine clinical workflow and can be further reduced by using multiple GPUs.

CLINICAL RELEVANCE/APPLICATION

Fast dynamic pitch spiral reconstruction is available and allows for adequate clinical workflow.

SSE22-05 Performance of a Novel Third Generation Adaptive Statistical Iterative Reconstruction-V (ASiR-V) for Dose Reduction in MDCT: Task-specific Quantitative and Qualitative Evaluation

Monday, Nov. 30 3:40PM - 3:50PM Location: S403B

Participants

Ranish Deedar Ali Khawaja, MD, Salem, MA (*Presenter*) Nothing to Disclose
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Mannudeep K. Kalra, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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Ehsan Samei, PhD, Durham, NC (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Carestream Health, Inc

PURPOSE

To assess the comparative task-specific performance of Adaptive Statistical Iterative Reconstruction-V (ASiR-V, GE Healthcare) and filtered-back-projection (FBP) reconstruction techniques across clinically relevant dose ranges and phantom sizes.

METHOD AND MATERIALS

A task-specific proprietary image quality phantom (Mercury 3.0), consisting of low contrast-detail and five variable diameter sections, was imaged on a prototype 256-row CT scanner (Revolution, GE Healthcare) at 120 kVp and incremental CTDIvol of 0.75 - 6.0 mGy using fixed and modulated tube current protocols. The images were reconstructed using FBP and ASiR-V (at three strengths: 50%, 80% and 100%) at incremental slice thicknesses of 0.625 - 5.0 mm, and characterized in terms of five task-specific metrics including detectability index [*d'*] for a 5.0 mm, 200 HU contrast lesion, and the observer task of number of visible objects [VO]. Statistical analyses were performed using Student's t test and ANOVA.

RESULTS

ASiR-V demonstrated noise reduction potential of up to 74% compared to FBP images. Both FBP and ASiR-V demonstrated a higher *d'* using modulated-current than fixed-current at larger body sizes (30 and 37-cm diameter), but in pediatric sizes (12 and 16-cm), *d'* using a fixed-current was markedly higher ($P < .01$). VO increased with increasing dose and slice thickness but not necessarily with increasing ASiR-V strength. At all dose levels, the VO was significantly higher with ASiR-V compared to FBP. The absolute score (difference between FBP and ASiR-V ranged from 0.51 - 0.59 (CI 95%= 0.17-1.00, $P < .01$).

CONCLUSION

The Mercury Phantom is an effective tool for a systematic study of performance for CT protocols and technology. ASiR-V technique has a significantly better detectability index than FBP technique at incremental CTDIvol between 0.75 - 6.0 mGy with marked reduction in image noise.

CLINICAL RELEVANCE/APPLICATION

ASiR-V iterative reconstruction technique results in higher low-contrast detection and lower objective image noise at the incremental CTDIvol range of 0.75 - 6.0 mGy compared to FBP technique.

SSE22-06 A Method for Cross-platform Comparison of Reconstruction Kernels in CT

Monday, Nov. 30 3:50PM - 4:00PM Location: S403B

Participants

John M. Hoffman, BS, Los Angeles, CA (*Presenter*) Nothing to Disclose

Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ;

Background

It is often necessary to standardize CT protocols across dissimilar systems. While many systems implement a version of filtered backprojection (FBP), reconstruction kernels differ between manufacturers. These differences, both in structure and name, make it difficult to identify which selection(s) will produce similar images. In this study, a method for extracting underlying kernel structure from an image was employed to describe and compare kernels within and across systems.

Evaluation

A scan of a QA water phantom was acquired and two sets of images were reconstructed: one using the kernel of interest (test condition), and one with a ramp filter (reference condition) using custom software. All other reconstruction parameters were fixed. The two-dimensional Fourier transform of each image was taken, and the ratio of each image in the test set to the corresponding image in the ramp set (reference condition) was calculated. A radial average was taken of each ratio image to reduce noise and recreate the relative kernel in the frequency domain for each image. The results are then multiplied by the reference kernel to isolate the test kernel. The results represent the target characteristics of the kernel for any other system that is to be matched to the reference system. This method has been applied to a range of kernels within a commercial scanner, as well as custom kernels and results have compared favorably.

Discussion

Our preliminary results indicate that this method will be a valuable tool in development of cross-platform protocols. The lack of dependence of the method on anything other than image data makes it extremely flexible and portable across scanners and manufacturers. Absolute representations of the kernel properties require a known kernel; if this is not available, valuable comparisons of kernels can still be made. In the future, we hope to extend the method across reconstruction algorithms.

Conclusion

A system-independent method to match performance characteristics of heterogeneous CT systems has been developed. This system has been tested on FBP reconstructions with different kernels and will provide an excellent basis for selecting the best matches of reconstruction kernels across scanners.

SSE05

Chest (Interventional/Ablation)

Monday, Nov. 30 3:00PM - 4:00PM Location: S402AB



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

Participants

Jo-Anne O. Shepard, MD, Boston, MA (*Moderator*) Nothing to Disclose

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

Sub-Events

SSE05-01 **Microwave Ablation (MWA), Radiofrequency Ablation (RFA) and Laser-induced Interstitial Thermo-therapy (LITT) in Patients with Primary and Secondary Lung Tumors: Evaluation of Tumor Volume and Recurrence Rate**

Monday, Nov. 30 3:00PM - 3:10PM Location: S402AB

Awards

RSNA Country Presents Travel Award

Participants

Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Presenter*) Nothing to Disclose

Sybille Exner, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

Stefan Zangos, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

Katrin Eichler, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Comparison of tumor response with volumetric assessment for tumor size after treatment of primary or secondary lung tumors with microwave ablation (MWA), radiofrequency ablation (RFA) and laser-induced interstitial tumor therapy (LITT).

METHOD AND MATERIALS

Between 04/2002 and 09/2013 165 patients (70 males, 95 females) suffering from 263 lesions (primary or secondary lung tumor) were treated with thermal ablation (MWA, RFA and/or LITT). Patients with colorectal carcinoma with lung metastases were not included in this study. At 24-hour; 3-, 6-, 12-, 18- and 24-month intervals diagnosis and follow-up were accomplished using magnetic resonance imaging (MRI), unenhanced and contrast-enhanced computed tomography (CT). The results were evaluated in a retrospective study according to the RECIST criteria and survival data were assessed. Patients treated with more than one method of thermal ablation (n=10) were excluded from patient-related analysis. Patients without follow-up data were excluded from relapse analysis.

RESULTS

In 19 patients with 25 lesions treated with LITT recurrent foci were found in 27.3% of lesions. Average tumor volume of lesions with complete response (CR) was 6.1 ml before therapy, in lesions with recurrent foci 15.39 ml. Recurrence rate (RR) for 3, 6, 12, 18, 24 months was 16.7%, 7.1%, 0%, 10% and 11.1%. In 40 patients with 65 lesions treated with RFA recurrent foci were found in 20.4% of lesions. Average tumor volume of lesions with CR was 2.82 ml before therapy, in lesions with recurrent foci 16.73 ml. RR for 3, 6, 12, 18, 24 months was 2.1%, 7.7%, 12.5%, 11.1% and 0%. 106 patients with 173 lesions were treated with MWA. Average tumor volume of lesions with CR was 5.52 ml before therapy, in lesions with recurrent foci 19.14 ml. RR for 3, 6, 12, 18, 24 months was 1%, 5.1%, 0%, 2.9% and 11.1%. There was a significant difference in rates of recurrent foci between LITT, RFA and MWA (P=0.038, Fisher test) with the lowest RR in the MWA group. Mean survival was 983 days in patients treated with LITT, 899 days with MWA and 690 days with RFA using the Kaplan-Meier method (P= 0.003).

CONCLUSION

In conclusion LITT, RFA and MWA showed a significant difference in the treatment of primary and secondary lung metastases regarding CR, RR and mean survival

CLINICAL RELEVANCE/APPLICATION

MWA showed the best results concerning RR, LITT concerning mean survival

SSE05-02 **Thermal Ablation of Colorectal Lung Metastases: Retrospective Comparison of LITT, RFA and MWA Concerning Local Tumor Control Rate, Time to Progression, and Survival Rates**

Monday, Nov. 30 3:10PM - 3:20PM Location: S402AB

Participants

Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Presenter*) Nothing to Disclose

Romina Eckert, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

Peter Kleine, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively evaluate local tumor control, time-to-progression, and survival in patients with CRC lung metastases who received laser-induced thermo-therapy (LITT), microwave ablation (MWA), or radiofrequency ablation (MWA).

METHOD AND MATERIALS

In this retrospective study data on 109 patients (71 males/38 females; mean, 68.6±11.2 years; range, 34-94) were collected in 231 CT-guided ablation sessions from 05/2000-12/2013. 47 patients (125 ablations) underwent MWA, 21 patients (31 ablations) LITT and 41 patients (75 ablations) RFA. CT was performed at 24 hours and at 3, 6, 12, 18 and 24 months post ablation. Survival rates were calculated from first ablation using Kaplan-Meier and log-rank test. Volume changes were measured by the Kruskal-Wallis method.

RESULTS

Local tumor control was achieved in MWA in 91/103 (88.3%) lesions, in LITT in 17/25 (68%) lesions, and in RFA in 45/65 (69.2%) lesions with significant differences in MWA vs. LITT at 18 months ($p=0.01$) and in MWA vs. RFA at 6 ($p=0.004$) and 18 ($p=0.01$) months. Median time-to-progression was 7.5 months in MWA, 10.4 months in LITT and 7.2 months in RFA with no significant difference. 1-, 2- and 4-year overall survival was 82.7%, 67.5% and 16.6% for MWA (median: 32.8 months), 95.2%, 47.6% and 23.8% for LITT (median: 22.1 months), and 76.9%, 50.8% and 8% for RFA (median 24.2 months) with no significant difference. 1-, 2-, 3-, and 4-year progression-free survival was 54.6%, 29.1%, 10.0% and 1% for MWA, 96.8%, 52.7%, 24% and 19.1% for LITT; and 77.3%, 50.2%, 30.8% and 16.4% for RFA with no significant difference.

CONCLUSION

MWA, LITT and RFA are effective therapeutic options for CRC lung metastases with differences documented in local tumor control and no significant differences in progression time, overall survival and progression-free survival rates.

CLINICAL RELEVANCE/APPLICATION

LITT, RFA and MWA in the treatment of colorectal lung metastases can be used with similar results concerning progression time, overall survival and progression-free survival rates. MWA, however, results in better local tumor control.

SSE05-03 CT-Guided Hook-Wire Localization Prior to Video Assisted Thoracoscopic Surgery (VATS) of Suspected Pulmonary Metastases: Safety, Efficacy and Outcome

Monday, Nov. 30 3:20PM - 3:30PM Location: S402AB

Participants

Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (*Presenter*) Nothing to Disclose
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Mohammed A. Alsubhi, BMBS, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Beeres, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan Zangos, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the feasibility, safety and efficacy of CT-guided pulmonary nodule localization using hooked guide wire before thoracoscopic surgical resection

METHOD AND MATERIALS

The study included 79 consecutive patients with a history of malignancies outside the lung associated with suspected pulmonary nodules. The CT-guided-hook-wire localization procedures were performed under aseptic conditions and local anesthesia. Mean lesion size was 0.7cm (range 0.5 - 1.8 cm) and the mean lesion distance to the pleural surface was 1.5 cm (range 0.2-5 cm). All lesions ($n=82$) were marked with a 22-G hook-wire. The technique was designed to insert the tip of hook-wire within or maximally 1cm from the edge of the lesion.

RESULTS

The hooked-guide wire was positioned successfully in all 82 pulmonary nodules within mean time of 9 min (8-20 min, SD: 2.5). The procedure time was inversely proportional to the size of the lesion (Spearman correlation factor 0.7). The mean total radiation dose associated with the procedure was 336 mGy.cm from which the mean DLP of the guide-wire localization was 31 mGy.cm (9.2%). Minimal pneumothoraces were observed in 5 patients (7.6%) without requirement for chest tubes. Pneumothorax was not correlated to the histopathology of the pulmonary nodules (p value > 0.09). Pneumothorax was significantly correlated to emphysema (p value: 0.02). Focal perilesional pulmonary hemorrhage was developed in 4 patients (5%). Both hemorrhage and pneumothorax were significantly correlated to lesion < 10 mm (p value: 0.02 and 0.01 respectively). The resected volume of lung tissue was significantly larger in lesions in which the guide wire was inserted at 1 cm distance from the lesion; in comparison to lesions in which the guide-wire was positioned within the lesion ($p=0.01$). Additionally, the volume of resected lung tissue was significantly correlated to lesion of increased distance from the pleural surface > 2.5 cm in comparison to lesions of less than the 2.5 cm from the pleural surface.

CONCLUSION

CT-guided pulmonary nodule localization prior to thoracoscopic resection could allow a safe and accurate surgical guidance for the localization of small pulmonary nodules during thoracoscopic resection.

CLINICAL RELEVANCE/APPLICATION

This technique facilitates the identification and allows adequate resection of small pulmonary nodules during thoracoscopic resection.

SSE05-04 Pneumothorax Complicating Coaxial and Non-Coaxial CT-Guided Lung Biopsy: Comparative Analysis of Determining Risk Factors

Monday, Nov. 30 3:30PM - 3:40PM Location: S402AB

Participants

Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (*Presenter*) Nothing to Disclose

Mohammed A. Alsubhi, BMBS, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Beeres, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the scope and determining risk factors related to the development of pneumothorax throughout CT-guided biopsy of pulmonary lesions in coaxial and non-coaxial techniques

METHOD AND MATERIALS

The study included CT-guided percutaneous lung biopsies in 650 consecutive patients (407 males, 243 females; mean age 54.6 years, SD: 5.2) from November 2008 to June 2013 in a retrospective design. Patients were classified according to lung biopsy technique into coaxial-group (318 lesions) and non-coaxial-group (332 lesions). Exclusion criteria for biopsy were: lesions < 5mm in diameter, uncorrectable coagulopathy, positive-pressure ventilation, severe respiratory compromise, pulmonary arterial hypertension or refusal of the procedure.

RESULTS

The incidence of pneumothorax complicating CT-guided lung biopsy was less in the non-coaxial group (23.2%, 77 out of 332) than the coaxial-group (27%, 86 out of 318). The difference in incidence between both groups was statistically insignificant ($p=0.14$). Significant risk factors for the development of pneumothorax in both groups were emphysema ($p<0.001$ in both groups), traversing a fissure with the biopsy needle (p -value 0.005 in non-coaxial group and 0.001 in coaxial group), small lesion, less than 2cm in diameter (p -value 0.02 in both groups), location of the lesion in the basal or mid sections of the lung ($p=0.003$ and <0.001 in non-coaxial and coaxial groups respectively) and increased needle track path within the lung tissue of more than 2.5cm (p -value 0.01 in both groups). Simultaneous incidence of pneumothorax and pulmonary hemorrhage was 27.3% (21/77) in non-coaxial group and in 30.2% (26/86) in coaxial-group. Conservative management was sufficient for treatment of 91 out of 101 patients of pneumothorax in both groups (90.1%).

CONCLUSION

Pneumothorax complicating CT-guided core biopsy of pulmonary lesions, showed insignificant difference between coaxial and non-coaxial techniques. However both techniques have the same significant risk factors including small and basal lesions, increased lesion's depth from pleural surface, increased length of aerated lung parenchyma crossed by biopsy needle and passing through pulmonary fissures in the needle tract.

CLINICAL RELEVANCE/APPLICATION

Significant risk factors of pneumothorax complicating lung biopsy in both coaxial and non-coaxial techniques are similar and include: technical risk factors, patient related risk factors, and lesion associated risk factors.

SSE05-05 Appearances Can be Deceiving: Pulmonary Nodules in Non-pulmonary Solid Tumor Bearing Patients are not Always Metastatic

Monday, Nov. 30 3:40PM - 3:50PM Location: S402AB

Participants

Mauricio R. Moura SR, MD, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Publio C. Viana, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Menezes, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Milena Mak, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rafael Bitton, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Olavo Feher, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pulmonary nodules (PNs) in patients (pts) with non-pulmonary solid tumors present a diagnostic challenge; comprising other possibilities than metastatic disease, such as primary lung cancers, infectious diseases and scar tissue. The precise diagnosis will ultimately impact in treatment decisions and prognosis. This study aimed to determine variables correlated with finding metastatic disease on a pulmonary biopsy, helping the decision process of indicating a PN biopsy in this scenario.

METHOD AND MATERIALS

In this single-institution retrospective study, we included consecutive pts with non-pulmonary solid malignancies that presented PN and no extra pulmonary metastases. Pts were submitted to a computed tomography (CT) guided biopsy from January 2011 to December 2013. Exclusion criteria are as follows: presence of lung primary, hematologic malignancies, or extra pulmonary metastatic disease. Correlation between imaging and clinical characteristics that yielded higher probability of finding metastatic disease on biopsy was determined by logistic regression analysis.

RESULTS

From a total of 487 pts submitted to pulmonary biopsy, 228 were included in the final analysis. Metastatic disease to the lungs was confirmed in 63.1%. Lung primaries were found in 26.3%. Other findings included infectious diseases (7.4%) and benign lesions (2.6%). On multivariate analysis, presence of multiple PNs was associated with higher odds of metastatic disease (OR 4.24; 95% CI 1.97-9.14, $p<0.01$), as well as nodule cavitation and/or necrosis on CT scan (OR 4.01; 95% CI 1.24-13.01, $p=0.02$). Procedure complications demanding active interventions occurred in 6 patients. No procedure-related death occurred.

CONCLUSION

Presence of multiple PNs and nodule cavitation were associated with higher odds of finding biopsy-proven metastatic disease. However, a high rate of non-metastatic disease was found in this group of pts. Given that procedural complications were low, we conclude that tissue sample is still essential for accurately diagnosing and treating pts with solid tumors presenting with PNs.

CLINICAL RELEVANCE/APPLICATION

Assuming all PN observed in cancer patients as being metastatic disease will lead to high rates of inaccurate diagnosis and

inappropriate subsequent treatments. Tissue sampling is still fundamental for accurately diagnosing and treating cancer patients.

SSE05-06 CT-guided Transthoracic Needle Biopsy of Subsolid Pulmonary Nodules: Technical Feasibility and Diagnostic Yield with Surgical Correlation and Long Term Follow-up.

Monday, Nov. 30 3:50PM - 4:00PM Location: S402AB

Participants

Nantaka Kiranantawat, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Presenter*) Nothing to Disclose
Matthew D. Gilman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Florian J. Fintelmann, MD, FRCPC, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jo-Anne O. Shepard, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Carol C. Wu, MD, Houston, TX (*Abstract Co-Author*) Author, Reed Elsevier
Victorine V. Muse, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Milena Petranovic, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Amita Sharma, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the technical and diagnostic success of CT-guided transthoracic needle biopsy (TNB) of subsolid pulmonary nodules.

METHOD AND MATERIALS

Retrospective review of 94 TNB of subsolid nodules performed between 2009-2013 with standard co-axial technique using 19 g introducer, 22g fine needle aspirate and 20g core needles and under conscious sedation. Inclusion criteria included surgical correlation or a minimum follow up of 2 years by imaging. There were a total of 94 patients (M:F 29: 65; mean age and range; 70.4 and 33-89 years). The mean size and range of nodule; 25mm; range 7-95mm. Fine needle aspirate was performed in all and core biopsy was done in 21 patients (24 %). Technical success rate for all attempts was calculated. Sensitivity and specificity for malignant and benign diagnoses for successful biopsies was calculated (86/94). The correlation with surgical pathology was available for 69% (59/86) and complication rate of procedure were assessed.

RESULTS

The technical success was 95% (89/94). There were 80 cancers and 6 benign lesions. The overall accuracy of TNB is 93% (80/86). There were 6 false negative malignant nodules on TNB. The sensitivity and specificity on TNB for malignant lesions is 92 and 100%. The concordance with surgery was 90 % (53/59). The sensitivity of biopsy was higher for nodules >20 mm (95% vs. 88%) and for nodules <50% groundglass component (98% vs. 94 %). Core biopsy improved yield in only 5% (1/21). Minor hemoptysis was seen in 7.7%, pneumothorax in 21%. 19 patients had a small pneumothorax on CT (20.9%). No patient required a chest tube.

CONCLUSION

CT-guided transthoracic needle biopsy of subsolid nodules is a safe procedure with a high sensitivity and specificity for diagnosing malignant nodules.

CLINICAL RELEVANCE/APPLICATION

The high sensitivity and specificity of transthoracic needle biopsy in subsolid nodules, supports wider application of this technique, especially in the era of lung cancer screening.

Honored Educators

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

Subba R. Digumarthy, MD - 2013 Honored Educator

SSE18

Neuroradiology (Stroke and Recovery)

Monday, Nov. 30 3:00PM - 4:00PM Location: N229



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

Participants

David J. Mikulis, MD, Toronto, ON (*Moderator*) Stockholder, Thornhill Research Inc; Research Grant, General Electric Company;
Pina C. Sanelli, MD, Manhasset, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSE18-01 **Magnitude of Predictive Error When Employing ASPECTS Methodology for Core and Penumbra Estimation Towards Diagnosis and Prognostication in Acute Ischemic Stroke: A Paradigm Challenge of Imaging-Based Approaches to Therapy Selection**

Monday, Nov. 30 3:00PM - 3:10PM Location: N229

Participants

Meredith Bowen, BA, Atlanta, GA (*Presenter*) Nothing to Disclose
Seena Dehkharghani, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jason W. Allen, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Srikant Rangaraju, MBBS, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Adam B. Prater, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Deqiang Qiu, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jian Kang, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Fadi Nahab, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Emerging treatment strategies in acute ischemic stroke (AIS) propose CTP-derived therapy selection paradigms; however, speed and availability of non-contrast CT may compel fast, qualitative approaches to risk stratification using ASPECTS. The superiority of rigorous automated approaches has been recently reported, although the magnitude of potential error in estimating core and putatively at-risk volumes using qualitative approaches remains unknown. We proposed the analysis of prediction error towards core and penumbral volumes using qualitative approaches, hypothesizing broad ranges across potential values, with greatest vulnerability to error using NCCT ASPECTS

METHOD AND MATERIALS

54 patients (36 female, 71 years \pm 16) with anterior circulation AIS imaged with NCCT and CTP were evaluated. Perfusion analysis (time \sim 2.5 min) was performed in an operator independent environment (RAPID). Estimated core infarct volume was calculated by relative CBF. At-risk volume was calculated at T_{max}>6s. NCCT and CTP ASPECTS were determined by two independent evaluators. Linear regression models were fitted with each of the volume variables as outcome and qualitative scores as covariates. F-statistics of ANOVA were performed.

RESULTS

Demographics included median NIHSS=16 (IQR 15), mean time to imaging=233min (IQR 252). Mean (sd) volumes for rCBF core for NCCT-ASPECTS scores 8-10 were 27(31.6), 11.2(17.8), 4.7(7.8), respectively (p<0.001), while at-risk volumes at T_{max}>6s were 68.3(30.9), 56.4(55.4), 44.2(42.1) (p=0.36). For CBV-ASPECTS scores 7-10, rCBF volumes were 12.2(23), 5.1(9.4), 0(0), 0(0) (p=0.004), while at-risk volumes, T_{max}>6s were 42.2(28.7), 44.3(34.6), 17.1(26.7), 47.1(56.1) (p=0.04). For CBF-ASPECTS scores 7-10, rCBF volumes were 17.6(30.5), 5(10), 0(0), 3.2(4.5) (p=0.05), while at-risk volumes, T_{max}>6s were 40.4(20.8), 44.5(40), 17.1(26.7), 15.7(12.7) (p=0.07).

CONCLUSION

ASPECTS is widely reported as a quick approach to risk stratification and treatment selection in AIS, but tissue changes may lag hypoperfusion and irreversible injury. While not practical as an estimation of at risk tissue, the present study further challenges the feasibility of such approaches as predictors of irreversible core at presentation.

CLINICAL RELEVANCE/APPLICATION

Qualitative methods are prone to wide ranges of core and at-risk tissue volume for any one appearance in AIS; fast, comprehensive image triage may be advisable for therapy choice, risk stratification.

SSE18-02 **Detection of Small Vessel Occlusions Using a Wavelet-based CT Angiography Reconstructed from CT Perfusion Data in Acute Ischemic Stroke**

Monday, Nov. 30 3:10PM - 3:20PM Location: N229

Participants

Wolfgang G. Kunz, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Lukas Havla, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Wieland H. Sommer, MD, Munich, Germany (*Abstract Co-Author*) Founder, QMedify GmbH
Olaf Dietrich, PhD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Kolja M. Thierfelder, MD, MSc, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Birgit B. Ertl-Wagner, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate a newly developed wavelet-based CTA (waveCTA) reconstructed from whole-brain CT perfusion (WB-CTP) data in stroke patients in which conventional single-phase CTA (spCTA) failed to demonstrate a vessel occlusion.

METHOD AND MATERIALS

Out of a retrospective cohort of 658 consecutive patients who had undergone multiparametric CT due to suspected stroke, we included all patients with the following inclusion criteria: (1) CT perfusion deficit as assessed by CBF, (2) no evidence of occlusion in spCTA, and (3) acute ischemic non-watershed infarction as confirmed by follow-up MRI or CT within 72hrs. waveCTA images were calculated from whole-brain CT perfusion data after initial rigid-body motion correction using the wavelet transform (Paul wavelet, order 1) of each pixel attenuation time course, from which the angiographic signal intensity was extracted as the maximum of the wavelet power spectrum. waveCTA was analyzed by two blinded and experienced readers with respect to presence and location of vessel occlusions and detail visibility of vessels in comparison to spCTA.

RESULTS

Sixty-three patients (9.6%, mean age 74.8 yrs, range 34-89) fulfilled the inclusion criteria. waveCTA reconstruction was successful in all patients. Overall, in 31 (49.2%) of these patients with negative spCTA, an occlusion could be identified using waveCTA. In the subgroup of 48 MCA infarctions, 24 occlusions (50.0%) were detected by waveCTA, mainly located on the M2- (12) and M3-level (10). A subgroup of ACA and PCA infarctions with 6 patients each demonstrated occlusions using waveCTA in 3 cases each. Detail visibility of small vessels (M2-4 level) was rated significantly higher for waveCTA vs. spCTA (4.5 vs. 2.8; $p < 0.001$).

CONCLUSION

Wavelet-based CT angiography reconstructed from CT perfusion data allows the detection of small vessel occlusions that are missed by spCTA in around 50% of the cases.

CLINICAL RELEVANCE/APPLICATION

waveCTA is a promising new angiographic reconstruction technique of WB-CTP data that improves the sensitivity in the detection of small-vessel occlusions. Further studies on the prognostic value of these occlusions may contribute to clinical decision making in acute ischemic stroke.

SSE18-03 Effects of Radiation Dose Reduction in Volume Perfusion CT Imaging of Acute Ischemic Stroke

Monday, Nov. 30 3:20PM - 3:30PM Location: N229

Participants

Ahmed E. Othman, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
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Saif Afat, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Rastislav Pjontek, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Omid Nikoubashman, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
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Jong H. Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Martin Wiesmann, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To examine the influence of radiation dose reduction on image quality and sensitivity of Volume Perfusion CT (VPCT) maps regarding the detection of ischemic brain lesions.

METHOD AND MATERIALS

VPCT data of 20 patients with suspected ischemic stroke acquired at 80 kV and 180 mAs were included. Using realistic reduced-dose simulation, low-dose VPCT datasets with 144 mAs, 108 mAs, 72 mAs and 36 mAs (80%, 60%, 40% and 20% of the original levels) were generated, resulting in a total of 100 datasets. Perfusion maps were created and signal-to-noise-ratio (SNR) measurements were performed. Qualitative analyses were conducted by two blinded readers, who also assessed the presence/absence of ischemic lesions and scored CBV and CBF maps using a modified ASPECTS-score.

RESULTS

SNR of all low-dose datasets were significantly lower than those of the original datasets ($p < 0.05$). All datasets down to 72 mAs (40%) yielded sufficient image quality and high sensitivity with excellent inter-observer-agreements, whereas 36 mAs datasets (20%) yielded poor image quality in 15% of the cases with lower sensitivity and inter-observer-agreements (Figure)).

CONCLUSION

Low-dose VPCT using decreased tube currents down to 72 mAs (40% of original radiation dose) produces sufficient perfusion maps for the detection of ischemic brain lesions.

CLINICAL RELEVANCE/APPLICATION

The application of LD-CTP is associated with lower patient radiation exposure while maintaining high diagnostic accuracy for the detection of ischemic brain lesions.

SSE18-04 Comparing Different Imaging Strategies in Acute Ischemic Stroke

Monday, Nov. 30 3:30PM - 3:40PM Location: N229

Participants

Omar N. Kallas, New York, NY (*Presenter*) Nothing to Disclose
Jana Ivanidze, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Ajay Gupta, MD, New York, NY (*Abstract Co-Author*) Research Consultant, Biomedical Systems; Research support, General Electric Company

Pina C. Sanelli, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of our study was to compare two different imaging strategies in acute ischemic stroke: using Noncontrast CT (NCCT) versus CT Angiography and Perfusion (CTAP) as the first imaging modality after patient presentation. Our hypothesis is that using CTAP as the first imaging modality may correlate with better outcomes compared to NCCT depending on patient characteristics of age, NIHSS and time from symptom onset to presentation.

METHOD AND MATERIALS

In this institutional review board-approved retrospective study, 373 patients with acute ischemic stroke who presented within a one year period at two large institutions were enrolled in this study. Inclusion criteria included presentation within 8 hours of stroke symptom onset, and no evidence of hemorrhage on initial imaging study. Patients were divided into two groups: those who received NCCT and those who received CTAP as their first imaging study. Patients were subsequently stratified based on treatment strategy (no treatment, Intravenous tPA (IVTPA) treatment, and endovascular therapy), and sub-stratified based on age, NIHSS, and time to from symptom onset to presentation. Outcomes of mRS scores were compared between groups to determine the best imaging strategy based on patient characteristics.

RESULTS

Among the patients who were eventually treated with IVTPA, patients who received CTAP as their first imaging study had significantly lower mRS scores compared to those who received NCCT first ($p < 0.001$). This difference in mRS scores was seen in the subgroup of patients greater than 70 years old, with NIHSS greater than 5, and who presented within 4.5 hours of symptom onset. There was no significant difference in outcomes between the two imaging strategies in patients who did not receive treatment at all, and those who only received endovascular therapy.

CONCLUSION

In those patients who were eventually treated with IVTPA, significantly better outcomes were observed in patients who underwent CTAP as their first imaging study compared to those who received NCCT first (the current imaging standard). In patients greater than 70 years of age, with NIHSS greater than 5 and presenting within 4.5 hours of symptoms onset, CTAP may better inform physicians as to subsequent treatment strategy.

CLINICAL RELEVANCE/APPLICATION

Imaging strategies for ischemic stroke patients should be individualized based on patient characteristics of age, NIHSS and time from symptom onset to presentation.

SSE18-05 Dynamic Grey Matter Changes during Motor Recovery after Pontine Infarction: A Voxel-based Morphometry Study

Monday, Nov. 30 3:40PM - 3:50PM Location: N229

Participants

Peipei Wang, Beijing, China (*Presenter*) Nothing to Disclose

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Tianyi Qian, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Chengxu Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

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Miao Zhang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

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Qingfeng Ma, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Jie Lu, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Kuncheng Li, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the neural mechanisms of motor recovery after pontine infarction, we explored changes of grey matter within motor cortex by voxel-based morphometry (VBM) analysis method and calculated the correlations between the thickness of grey matter of each voxel and clinical scores.

METHOD AND MATERIALS

Fifteen stroke patients with unilateral infarction of pontine area were scanned and neurologically assessed 5 times after the stroke (within 3~7 days, at 2 weeks, 1 month, 3 months, and 6 months after stroke onset). All patients underwent MPRAGE scans on a Siemens Magnetom Trio 3.0T scanner. Fifteen age-sex with left and right handed matched healthy participants were also examined with the same protocol. The gray matter volume changes after infarction were assessed using VBM and motor deficits were evaluated with Fugl-Meyer Motor Scale (FMMS) score at the same time. The correlation between gray matter changes, infarction volumes and FMMS scores were respectively analyzed.

RESULTS

The FMMS significantly increased progressively from the seventh day to the sixth month after infarction ($P < 0.05$). In pontine group, GMV were increased in putamen, pallidus, frontal gyrus, temporal gyrus, inferior parietal lobule, and occipital gyrus, which mostly located in the contralateral. And GMV were decreased in frontal gyrus, postcentral gyrus, precuneus, caudate culmen, and uvula. The results of group analysis showed that there was no significant change in normal control group between different time point. While, in stroke group the GMV showed increase in ipsilateral thalamus within 7 days compared to 3 month and 6 month. Comparison between two groups at each time point, we found that the volume of contralateral inferior parietal lobule increased continually, however, ipsilateral precuneus showed decrease of GMV during the study period. The changes of GMV in the contralateral putamen and pallidus were positive correlated with the changes in the FMMS of stroke patients ($r = 0.287$, $p = 0.012$); Changes in ipsilateral postcentral was negative correlated with changes in FMMS ($r = -4.20$, $p = 0.000$).

CONCLUSION

The existence of gray matter volume increased, and spontaneous with motor recovery in patients with pontine infarction is closely related to brain plasticity.

CLINICAL RELEVANCE/APPLICATION

Our findings provide imaging evidences that reveal the motor function recovery mechanisms after cerebral infarction.

SSE18-06 A Correlation Study between Diffusivity of Ischemic White Matter Fiber Tract and Neuro-functional Recovery in Patients with Acute Stroke by Using DTI Technique

Monday, Nov. 30 3:50PM - 4:00PM Location: N229

Participants

Shuohui Yang, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Fang Lu, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jiang Lin, MD, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Ruixin Cheng, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Qiong Zhu, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Songhua Zhan, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the correlation between diffusivity of ischemic white matter fiber tract and neuro-functional recovery in acute stroke patients by using DTI, and try to predict motor outcome of these patients.

METHOD AND MATERIALS

Forty unilateral cerebral ischemic patients with motor dysfunction underwent MRI and DTI study within 3 days after the onset of illness. MRI scans were done 1, 2 and 3 month after treatment. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) maps were obtained. With the reference of DW images, regions of interest (ROIs) were selected on the ischemic white matter fiber tract, and the control ROIs were selected on the contra-lateral homonymic tract. The ratios of FA and ADC (rFA and rADC) within these ROIs and infarction volume (IV) were calculated. The relationship between DTI parameters with IV and national institute of health stroke scale (NIHSS) scores were assessed. According to motricity index (MI), a total of 32 stroke follow-up patients after one year were divided into no motor deficit group and motor deficit group; DTI parameters were used to predict the motor outcome.

RESULTS

Significant differences were found regarding rFA, rADC and IV of ischemic white matter fiber tract among the onset, 1, 2 and 3 month of acute stroke patients ($F = 13.84, P = 0.00, F = 64.57, P = 0.00$ and $F = 37.41, P = 0.00$). There was significantly negative correlation between rFA and NIHSS scores at the onset and 1 month ($r = -0.59, t = -4.59, P = 0.00, r = -0.34, t = -2.27, P = 0.02$) and between rADC and NIHSS at the onset ($r = -0.44, t = -3.04, P = 0.00$). There was significantly positive correlation between rADC and NIHSS scores ($r = 0.28, t = 1.83, P = 0.04, r = 0.39, t = 2.69, P = 0.00, r = 0.63, t = 4.99, P = 0.00$) and between IV and NIHSS ($r = 0.4, t = 2.73, P = 0.01, r = 0.44, t = 3.05, P = 0.00, r = 0.32, t = 2.13, P = 0.04$) at 1,2, and 3 month from the onset. There was significant correlation between the rADC of 3 month and MI of 32 stroke patients after one year ($t = 2.75, P = 0.01$) with AUC of ROC being 0.905.

CONCLUSION

There could be a significant correlation between the change of diffusivity of the ischemic white matter and the neuro-functional recovery in acute stroke patients by analyzing DTI metrics. rADC at 3 month after onset may be used to predict the motor outcome.

CLINICAL RELEVANCE/APPLICATION

ADC values of DTI at 3 month after onset of stroke patients may be used to predict the motor outcome.

SSE19

Neuroradiology (Epilepsy)

Monday, Nov. 30 3:00PM - 4:00PM Location: N230



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

Participants

Steven M. Stuffelbeam, MD, Charlestown, MA (*Moderator*) Nothing to Disclose

Roland R. Lee, MD, San Diego, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSE19-01 **A Novel Electrocohortography Grid Using Conductive Nanoparticles in a Polymer Thick Film on an Organic Substrate Improves CT and MR Imaging**

Monday, Nov. 30 3:00PM - 3:10PM Location: N230

Participants

Emad Ahmadi, MD, Boston, MA (*Presenter*) Nothing to Disclose

Husam A. Katnani, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Laleh Daftariresheli, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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Reza Atefi, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose

Martin Y. Villeneuve, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose

Emad N. Eskandar, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company Stockholder, General Electric Company

Alexandra J. Golby, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Rajiv Gupta, PhD, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Giorgio Bonmassar, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Conventional electrocortigraphy (ECoG) grids produce extensive metal artifacts at CT and MR imaging. This study compares CT and MR artifacts from conventional ECoG grids with those from a grid developed by deposition of conductive nanoparticles in polymer thick film on an organic substrate (PTFOS).

METHOD AND MATERIALS

We compared the induced artifacts between the newly developed PTFOS grid and the conventional ECoG grids at CT and MR imaging. All imaging was performed on a cadaveric human head specimen. We then asked two neuroradiologists to score the quality of CT and MR images in the cases of the head sample with no grid, with conventional grids, and with PTFOS grids. The functioning of the PTFOS for cortical recording and stimulation was tested in mice. We used electron microscopy to study the microstructural changes of PTFOS after long-term implantation in mice. We also studied changes in electrical properties of the PTFOS after long-term submersion in a saline bath.

RESULTS

The PTFOS grid produced no appreciable artifacts in CT and MR images, and the image quality reported by neuroradiologists was significantly higher for the PTFOS compared to conventional grids ($P < 0.05$). Cortical recording and stimulation was successfully done in mice using PTFOS. PTFOS pieces showed no appreciable microstructural changes after long-term implantation in mice. After long-term submersion in the saline bath, the impedance of the PTFOS traces did not change ($P > 0.05$) and remained within the range of 150-300 Ω which is favorable for cortical recording and stimulation.

CONCLUSION

PTFOS grids are an attractive alternative to conventional grids as they show no appreciable artifacts at CT and MR imaging, and remain stable after long-term in-vivo implantation.

CLINICAL RELEVANCE/APPLICATION

Diagnosis of surgical complications of electrocortigraphy grids implantation is largely dependent on CT and MR imaging. The newly developed PTFOS grid demonstrated excellent image quality both at CT and MR imaging, which can facilitate diagnosis of post-operative complications.

SSE19-02 **A Novel Electrocohortography Grid Using Conductive Nanoparticles in a Polymer Thick Film on an Organic Substrate Causesless MRI Heating Compared to Conventional Grids**

Monday, Nov. 30 3:10PM - 3:20PM Location: N230

Participants

Emad Ahmadi, MD, Boston, MA (*Presenter*) Nothing to Disclose

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Rajiv Gupta, PhD, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Giorgio Bonmassar, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Conventional electrocorticography (ECoG) grids might cause significant heating during MR imaging. This study compares MRI heating, at a 3T scanner, caused by a conventional ECoG grid with that caused by a grid developed by deposition of conductive nanoparticles in polymer thick film on an organic substrate (PTFOS).

METHOD AND MATERIALS

A 64-contact electrocorticography grid was developed in a PTFOS construct via deposition of silver and carbon nanoparticles on denaturated collagen. We placed the developed PTFOS grid over a head phantom and measured the temperature changes around the grid during 30 minutes of MRI at a 3T scanner. The phantom had MRI heating properties similar to human tissues. Temperature was measured using eight optical sensors placed within the phantom. For comparison purposes, we also studied temperature changes during MR imaging in the cases of the head phantom with no grid and with a conventional platinum grid.

RESULTS

The maximal temperature increase among the eight sensors during 30 minutes of MR images was 4, 11, and 4.5 degrees Celsius for the cases of the phantom without any grid, with the platinum grid, and with the PTFOS grid, respectively (Figure 1).

CONCLUSION

Conventional platinum grids might cause considerable heating during MR imaging, while the newly developed PTFOS grid causes minimal, if any, heating during MR imaging.

CLINICAL RELEVANCE/APPLICATION

Diagnosis of surgical complications of electrocorticography grids implantation is largely dependent on MR imaging. Our results raise the concern that conventional electrocorticography grids might not be safe for MR imaging at the field strength of 3T, because they might cause considerable MRI heating. On the other hand, the newly developed PTFOS grid showed favorable MRI heating profile at the field strength of 3T.

SSE19-03 Language Reorganization in Temporal Lobe Epilepsy - A Task Based fMRI Connectome Study

Monday, Nov. 30 3:20PM - 3:30PM Location: N230

Participants

Gregor Kasprian, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Christian Widmann, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Karl-Heinz Nenning, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Ekaterina Patarai, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georg Langs, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Christoph Baumgartner, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Thomas Czech, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Daniela Prayer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Atypical language representations are frequently seen in left hemispheric temporal lobe epilepsy (ITLE) patients. fMRI based language connectome analysis allows to study neuronal networks, linked to language function. The aim of this study was to visualize the (re-) organization of the language connectome (LC) in a cohort of ITLE patients.

METHOD AND MATERIALS

The functional LC was calculated on the basis of functional MRI data (3 Tesla, TE=35ms, TR=3000ms, slice thickness: 4mm, 32 slices, 96x96 matrix, 2.4x2.4x4mm, 100 dynamics, verb generation task, FreeSurfer, FSL). The LC of 8 patients with non lesional ITLE (median age 35) and 12 ITLE patients with hippocampal sclerosis (HS) (median age 42) were compared to a reference LC based on 13 healthy controls (median age 38). Variations in the functional connectome analysis were quantified using the network-based statistics (NBS) approach.

RESULTS

The language connectome of non lesional ITLE patients and HS patients showed a significantly increased interhemispheric connectivity ($p < 0.001$), compared to healthy controls (Figure). A stronger ipsilateral connectivity of the default mode network was found in controls. Non lesional ITLE and HS patients showed an increased node degree in the Broca region.

CONCLUSION

The task-based language connectome of ITLE patients shows widespread alterations (Figure). Recruitment of interhemispheric connections may be related to functional language network reorganization due to structural alterations of the left temporal lobe and/or seizure activity.

CLINICAL RELEVANCE/APPLICATION

Task-based NBS analysis offers a new perspective in understanding the lesion induced reorganization of language function in the human brain. These results will impact the preoperative evaluation of individual ITLE patients and may reduce the incidence of postoperative language deficits.

SSE19-04 Ultra High Field MR-microscopy for Diagnosis of Hippocampal Sclerosis in Patients with Mesial Temporal Lobe Epilepsy

Monday, Nov. 30 3:30PM - 3:40PM Location: N230

Participants

Clarissa Gillmann, PhD, Erlangen, Germany (*Presenter*) Nothing to Disclose
Roland Coras, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Karl Roessler, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Amd Dorfler, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose

Michael Uder, MD, Erlangen, Germany (*Abstract Co-Author*) Speakers Bureau, Bracco Group; Speakers Bureau, Siemens AG; Research Grant, Siemens AG;
Ingmar Blumcke, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Tobias Baeuerle, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate ultra high field MR-microscopy for the discrimination of sclerotic and non-sclerotic hippocampi (HC) in patients with mesial temporal lobe epilepsy (mTLE).

METHOD AND MATERIALS

Resected HC of 11 patients diagnosed with mTLE were scanned on a preclinical 7T MRI (ClinScan, Bruker). Morphologic images (T2w, resolution: 42x42x300 μm) were acquired. Diffusion tensor imaging was performed and voxel based maps of T1-, T2- and T2*-times were calculated for each HC. On morphologic images, the pyramid cell layer (PCL) was segmented on 10 consecutive slices. The segmentation mask was transferred to the respective parameter maps. Depending on the neuropathologic diagnosis, HC were classified sclerotic (n=9) or non-sclerotic (n=2). The parameters PCL volume, T1-, T2- and T2*-times, apparent diffusion coefficient (ADC), fractional anisotropy (FA) and trace of the diffusion tensor (TW) were inserted into a multiparametric analysis and parameter-probability curves were adjusted using GNU R's logistic response model.

RESULTS

On morphologic images, a narrowing of the PCL for the sclerotic as compared to the non-sclerotic HC is discernible (Fig. 1a). The median parameter values were determined in the PCL for sclerotic/non-sclerotic HC including PCL volume (8/11 mm³), T1 time (736/1094 ms), T2 time (85/129 ms), T2* time (42/41 ms), ADC (593/228 $\mu\text{m}^2/\text{s}$), FA (0.495/0.476 a.u.), TW (495/384 mm²/s). As a result of the multiparametric analysis, T1 time is the most significant predictor of sclerosis (p=0.026), followed by T2 time (p=0.072) and PCL volume (p=0.097). The respective parameter-probability curves are shown in Fig. 1b. HC with T1 times below 750 ms have a probability higher than 90 % of being sclerotic.

CONCLUSION

Ultra high field MR-microscopy revealed distinct characteristics in morphology and significantly different T1 times in the PCL of sclerotic and non-sclerotic HC. Time-adapted imaging protocols might be translated for clinical application on ultra high field systems.

CLINICAL RELEVANCE/APPLICATION

Non-invasive diagnosis of hippocampal sclerosis to preoperatively evaluate the patients' benefit of hippocampus resection using ultra high field MR-microscopy.

SSE19-05 Clinical Comparison of Three Methods for Analysis of SPECT Imaging of Epilepsy

Monday, Nov. 30 3:40PM - 3:50PM Location: N230

Participants

Zaiyang Long, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Benjamin H. Brinkmann, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Michael K. O'Connor, PhD, Rochester, MN (*Abstract Co-Author*) Royalties, Gamma Medica, Inc

PURPOSE

Ictal-interictal SPECT with co-registration to MRI provides a valuable non-invasive method to localize the seizure onset zone in focal epilepsy. Currently both statistical parametric mapping (SPM)-based methods and conventional subtraction methods (e.g. SISCOM) are employed, with SPM methods providing the context of normal physiological variation. However, SPM-based methods require specialized tools and are more complex to use. Commercial software packages that are more easily integrated into the clinical practice are becoming available. The current study compares SISCOM, an SPM-based method, and a commercial package MIMneuro (MIM Software), which uses both cluster analysis and statistical differences in co-registered images.

METHOD AND MATERIALS

We retrospectively reviewed the records of 366 patients who underwent ictal/interictal Tc99m-ECD SPECT scans. We identified 25 with surgical resection and postoperative follow up for at least one year. Surgical outcomes were scored by ILAE criteria (Range 1-5: 1=seizure freedom and 5=seizures continue or increase). Hyperperfusion and hypoperfusion SPECT images co-registered with MRI images were analyzed using SISCOM, SPM and MIMneuro. Correlation between SPECT localization and resected tissue was scored on a 1-5 scale (1=localization closely matches resection, 5=no match to resection location) and correlated with the patient's ILAE score.

RESULTS

Using optimized parameters, the resection overlap of images analyzed by MIMneuro showed a significant correlation with ILAE score (R²=0.76, p<0.001). SPM also showed a significant correlation with ILAE score (R²=0.51, p<0.05), whereas SISCOM did not show a significant correlation with ILAE score (R²=0.19). Summed ILAE score for all patients were 57, while summed MIMneuro, SPM and SISCOM scores were 57, 66 and 69, respectively. On a standard Windows 7 workstation (Intel Core i5-4300U CPU and 8GB of RAM), processing time per patient took less than 2 min with MIM Neuro, and took 10-15 min with SPM.

CONCLUSION

MIMneuro and SPM SPECT localizations showed better predictive value for surgical outcome compared to SISCOM. MIMneuro took less computation time than SPM, potentially providing further benefit to the clinical workflow.

CLINICAL RELEVANCE/APPLICATION

SPM and commercial MIMneuro package provide powerful tools for analyzing SPECT images for epilepsy evaluation. MIMneuro with optimized parameters can further reduce analysis time and improve localization.

SSE19-06 Stereotactic Laser Ablation for Temporal Lobe Epilepsy: MRI Findings Predictive of Seizure Freedom Outcome

Participants

Bruno P. Soares, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Amit M. Saindane, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jon Willie, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Daniel Drane, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Deqiang Qiu, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Robert E. Gross, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MRI-guided stereotactic laser ablation is currently being used for amygdalohippocampotomy in mesial temporal lobe epilepsy (MTLE). The technique aims to eliminate seizures while minimizing adverse cognitive effects of open resection procedures. The purpose of this study is to establish pre- and postprocedural MRI findings that predict seizure freedom outcome with laser amygdalohippocampotomy.

METHOD AND MATERIALS

This retrospective study included 24 patients with diagnosis of MTLE who were treated with amygdalohippocampotomy and for which 12-month seizure freedom outcome data was available. Two neuroradiologists experienced in epilepsy imaging evaluated the MRI exams. On baseline exams, T2 signal intensity and volume of mesial temporal lobe regions were rated utilizing coronal oblique images. On periprocedural exams, extent of ablation of each region was rated utilizing postcontrast coronal oblique 3D T1 MPRAGE images. The patients were followed-up at 12 months after ablation and classified according to the Engel scale as seizure free / almost free or not improved. MRI findings were correlated with seizure freedom outcome by employing Fisher's exact test and Chi-square test.

RESULTS

16 patients fulfilled imaging criteria for mesial temporal sclerosis (MTS). Among these patients, 10/16 (62.5%) were seizure free 12 months after ablation. Three out of 8 patients without MRI diagnosis of MTS were free of seizures arising from the side of ablation at follow-up, while 5 of them were not improved. Among patients with MTS diagnosis, there was a significant correlation between the extent of amygdala ablation - in addition to the hippocampus - and favorable seizure freedom outcome ($p=0.032$). 9/11 patients with 50% or greater ablation of the amygdala were seizure free after 12 months, compared to 1/5 patients in which the amygdala was less than 50% ablated.

CONCLUSION

MRI diagnosis of MTS predicts improved seizure freedom outcomes in patients treated with laser amygdalohippocampotomy. In these patients, our data suggests that seizure freedom outcome is improved by greater extent of ablation of the amygdala, in addition of the hippocampus. Larger sample sizes are required to better predict outcome in non-MTS patients.

CLINICAL RELEVANCE/APPLICATION

Precise knowledge of the extent and location of the ablation zone is crucial to predict seizure freedom and cognitive effects of stereotactic laser amygdalohippocampotomy in MTLE.

MSRO23

BOOST: Gynecology-Case-based Review (An Interactive Session)

Monday, Nov. 30 3:00PM - 4:15PM Location: S103AB

GU **RO**

AMA PRA Category 1 Credits™: 1.25
ARRT Category A+ Credits: 1.50

Participants

Kevin V. Albuquerque, MD, MS, Dallas, TX, (kevin.albuquerque@utsouthwestern.edu) (*Presenter*) Nothing to Disclose
April A. Bailey, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Stephen Thomas, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Yasmin Hasan, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Present the multimodality management of selected gynecologic cancers including surgery, radiation and chemotherapy. 2) Highlight the importance of imaging in the diagnosis and followup of gynecologic cancers. 3) Highlight the importance of imaging in the planning and delivery of radiation.

ABSTRACT

The care of patients with gynecologic cancers requires the collaboration of imaging specialists as well as gynecologic and radiation oncologists. Radiologic imaging is key in defining disease at diagnosis and following patients for detection of recurrence after treatment. In conjunction with computerised planning, sectional imaging allows for sophisticated planning of external beam and brachytherapy and is key in maximizing the benefits of radiation while minimizing the risks. Case examples of the pivotal impact of imaging and its importance in multidisciplinary care will be highlighted in this session

SSE01

Breast Imaging (MR Response to Tx)

Monday, Nov. 30 3:00PM - 4:00PM Location: Arie Crown Theater



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

Participants

Nola M. Hylton, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose
Constance D. Lehman, MD, PhD, Seattle, WA (*Moderator*) Research Consultant, General Electric Company;

Sub-Events

SSE01-01 DCE-MRI Early Predict Pathological Complete Response to Neoadjuvant Chemotherapy in Resectable Primary Breast Cancer

Monday, Nov. 30 3:00PM - 3:10PM Location: Arie Crown Theater

Participants

Ying-Shi Sun, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yanling Li, MD, Beijing, China (*Presenter*) Nothing to Disclose
Xiaoting Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Kun Cao, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To establish a predictive model using dynamic enhanced MRI multi-parameters for early predicting pathological complete response (pCR) to neoadjuvant chemotherapy (NAC) in breast cancer.

METHOD AND MATERIALS

In this prospective cohort study, 170 breast cancer patients treated with NAC were enrolled and were randomly grouped into training sample (136 patients) and revalidation sample (34 patients). DCE-MRI parameters achieved before the start of the NAC and at the end of the first cycle of NAC were screened to establish the predictive model by using multivariate logistic regression model according to pCR status. Receiver operating characteristic curves were conducted to assess the predictive capability. The association between MRI-predicted pCR status and survival outcomes was estimated by using the Kaplan-Meier method.

RESULTS

Multivariate analysis showed $\Delta\text{Areamax}$, ΔI and $\Delta\text{Slopemax}$ were independent predictors for pCR, OR were 0.939(95%CI, 0.915 to 0.964), and 0.966(95%CI, 0.947 to 0.986), respectively. A predictive model was established " $Y = -0.089 * \Delta\text{Areamax} - 0.022 * \Delta\text{Slopemax}$ ", a cut-off point of 2.8 was determined. The AUC for training and revalidation sample were 0.908 (95%CI, 0.844 to 0.972) and 0.884 (95%CI, 0.772 to 0.998), respectively. MRI-predicted pCR status showed significant association with DFS ($P=0.045$), nearly significant association with RFS ($P=0.086$) and no significant association with OS ($P=0.23$).

CONCLUSION

The multi-parameter MRI model can be potentially used for early predicting pCR status and especially be used for accurately finding out patients not achieving pCR. MRI-predicted pCR status achieved at an early stage of NAC allows regimen refinement before definitive surgical treatment.

CLINICAL RELEVANCE/APPLICATION

This is the first time that a prospective study has constructed a multi-parameter MRI model for early predicting pCR to neoadjuvant chemotherapy in breast cancer patients. The pCR status achieved at an early stage of NAC before surgical resection allows in time regimen alteration and give an opportunity to refine treatment plans before definitive surgical treatment. This might also serve as an early indicator for predicting comparative effectiveness in clinical trials.

SSE01-02 Multiparametric Breast Magnetic Resonance Imaging (MRI) in Patients Eligible for Neoadjuvant Chemotherapy (NAC): Can We Predict Tumor Response According to Baseline Features?

Monday, Nov. 30 3:10PM - 3:20PM Location: Arie Crown Theater

Participants

Marta Maria Panzeri, Milan, Italy (*Presenter*) Nothing to Disclose
Francesco Ballati, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Claudio Losio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

NAC is the standard treatment of locally advanced breast cancer, but only a minority of the patients obtain a complete pathologic complete response (pCR), which correlates with prognosis. Identification of potential responders could avoid ineffective toxic treatment and delay in surgery. Breast MRI is considered the best technique for monitoring NAC, but there is no consensus on its predictive role. We evaluated the potential role of morphological, dynamic and functional tumor features, assessed with baseline MRI, as markers of tumor response to NAC.

METHOD AND MATERIALS

Seventy-two patients with histopathologically proven locally advanced breast cancer underwent baseline MRI (1.5T) before starting

NAC. T2 TSE sequences, diffusion-weighted imaging (DWI) and dynamic gadolinium-enhanced studies were performed. Morphological parameters included tumor size, morphology, presence or absence of pseudocapsule, oedema, rim enhancement, necrosis and vascular map. T2 signal intensity and Apparent Diffusion Coefficient (ADC) obtained from DWI were assessed. Dynamic parameters included kinetic curve patterns and contrast enhancement data (Maximum relative enhancement, Wash-in and wash-out rates, brevity of enhancement [BOE]). Final response to NAC was histopathologically defined. Univariate and multivariate analysis using logistic binary regression were performed.

RESULTS

All women completed NAC and 40% achieved a pCR. At univariate analysis, presence of peritumoral oedema was significantly associated with pCR [OR 3.33 (IC95%: 1.13-9.82), $p=0.029$]. Chemosensitive tumors showed higher mean ADC values [OR 1.03 (IC95%: 1.01-1.07), $p=0.032$]. BOE was higher in patients who achieved pCR [OR 1.08 (IC95%: 1.01-1.14), $p=0.015$]. At multivariate analysis, BOE [OR 1.08 (IC95%: 1.01-1.16), $p=0.025$] and mean ADC values [OR 1.03 (IC95%: 1.01-1.07), $p=0.049$] were significantly associated with pCR.

CONCLUSION

Some tumor features at baseline MRI are reflective of growth patterns and aggressiveness, influencing the response to NAC in different ways. BOE and ADC seem the strongest predictors of responsiveness.

CLINICAL RELEVANCE/APPLICATION

Quantitative DWI and Brevity of enhancement assessed with baseline Breast MRI can potentially predict chemosensitivity to NAC.

SSE01-03 Tumor Heterogeneity Patterns on DCE-MRI Parametric Response Maps May Augment Early Assessment of Neoadjuvant Chemotherapy in Locally Advanced Breast Cancer: A Pilot Study of ACRIN 6657/I-SPY 1

Monday, Nov. 30 3:20PM - 3:30PM Location: Arie Crown Theater

Participants

Jia Wu, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Siemens AG
Andrew Oustimov, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Ning Yu, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Yangming Ou, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Mark A. Rosen, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Angela DeMichele, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Christos Davatzikos, Philadelphia, PA (*Abstract Co-Author*) Shareholder, Gliomics LLC
Despina Kontos, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

PURPOSE

To investigate the performance of tumor heterogeneity metrics derived from parametric response mapping (PRM), in their capacity to predict early pathologic complete response (pCR) to neoadjuvant chemotherapy (NAC) in women with locally advanced breast cancer, based on longitudinal assessment of dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI).

METHOD AND MATERIALS

A subset 27 patients from ACRIN 6657/I-SPY 1 TRIAL were retrospectively analyzed. Four kinetic features (i.e., signal enhancement ratio, peak enhancement, wash-in and wash-out slope) were computed separately from DCE-MRI acquired before chemotherapy and at the first post treatment visit. For each feature, voxel-wise measures of variation during chemotherapy were assessed via PRM, and the degree of spatial heterogeneity for these voxel-level variations were quantified by selected statistical texture-based indices. The resulting heterogeneity-based PRM-index was compared with current standard measures in predicting pCR using logistic regression, where each model was also adjusted for age and tumor subtype. Performance was assessed via receiver operating characteristic (ROC) analysis.

RESULTS

After adjusting for patient's age and tumor subtype (ER/PR+, Her2+, TN), the heterogeneity-based PRM-index outperformed all current standard measures (AUC = 0.93 (95% CI: 0.83 - 1.00), PRM-index p -value = 0.08), including the "hot spot" signal enhancement ratio (SER) (AUC = 0.87 (95% CI: 0.71 - 1.00), SER p -value = 0.76), tumor longest diameter (LD) (AUC = 0.89 (95% CI: 0.67 - 1.00), LD p -value = 0.13), and tumor volume (AUC = 0.87 (95% CI: 0.71 - 1.00), volume p -value = 0.34). A similar trend was observed for unadjusted models, although classification performance was generally lower across all models.

CONCLUSION

Our study provides preliminary evidence that metrics of spatial tumor heterogeneity are valuable in revealing patterns of early tumor response to breast NAC, and could augment pCR prediction based on standard MRI measures, age and tumor subtype.

CLINICAL RELEVANCE/APPLICATION

Patterns of quantitative tumor heterogeneity analysis based on voxel-level DCE-MRI kinetic feature changes may augment early prediction of tumor pathologic response to breast neoadjuvant chemotherapy.

SSE01-04 Texture Analysis of Magnetic Resonance Images Predicts Ultimate Residual Cancer Burden (RCB) Scores in Patients Undergoing Neoadjuvant Chemotherapy for Breast Cancer

Monday, Nov. 30 3:30PM - 3:40PM Location: Arie Crown Theater

Participants

Shelley Waugh, PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sarah J. Vinnicombe, MRCP, FRCR, Dundee, United Kingdom (*Presenter*) Nothing to Disclose
Colin Purdie, MBChB, PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Richard A. Lerski, PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Marilyn Johnston, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrew Evans, MRCP, FRCR, Dundee, United Kingdom (*Abstract Co-Author*) Research Grant, SuperSonic Imagine Speakers Bureau, SuperSonic imagine
Alastair Thompson, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether lesion heterogeneity, as measured using texture analysis on Magnetic Resonance Imaging (MRI), is associated with residual cancer burden in patients receiving neoadjuvant chemotherapy (NAC) for primary breast cancer.

METHOD AND MATERIALS

IRB approval was waived for this retrospective study of anonymised data. T2-weighted images (voxel size: 1.1 mm³) from 61 consecutive patients undergoing a total of 6 cycles of anthracycline based NAC. All patients underwent baseline (pre-NAC) and interim (post 3-cycles of NAC) MRI examinations on a 32-channel 3.0T MRI scanner (Trio; Siemens, Erlangen) using a 7 element open breast biopsy coil. Texture analysis was performed using MaZda (University of Lodz, Poland) with manually placed regions of interest within the lesion on one slice matched between each imaging time-point. Lesion heterogeneity was assessed using the entropy feature as derived from the co-occurrence matrix. Final pathological response on the resected cancer was assessed using the Residual Cancer Burden (RCB), (calculated from tumour bed dimensions, cellularity and axillary node burden).

RESULTS

Patients who ultimately achieved a pathological complete response (pCR; RCB-0) or who had minimal residual disease (RCB-I) demonstrated a greater reduction in lesion heterogeneity between baseline and interim examinations compared with those who ultimately went on to have moderate (RCB-II) or extensive (RCB-III) disease at surgical resection (Figure 1). Average reduction in entropy values between baseline and interim examinations were as follows: pCR:20.0%, RCB-I:10.6%, RCB-II:6.8% and RCB-III: 3.4%. Differences in entropy change were highly significant ($p < 0.001$; Mann-Whitney U) between the good responders (pCR and RCB-I) and the poor responders (RCB-II and RCB-III).

CONCLUSION

Changes in lesion T2 heterogeneity between baseline and interim MR examinations, as measured using texture analysis of T2-weighted images, can predict residual cancer burden after NAC for breast cancer.

CLINICAL RELEVANCE/APPLICATION

Changes in lesion T2 heterogeneity on MR imaging between baseline and 3 cycles of NAC are strongly associated with ultimate pathologic response and could therefore facilitate timely surgical planning.

SSE01-05 Higher Background Parenchymal Enhancement at Preoperative MRI: Association with Poor Prognosis in Breast Cancer Patients Treated with Neoadjuvant Chemotherapy

Monday, Nov. 30 3:40PM - 3:50PM Location: Arie Crown Theater

Participants

Ji Soo Choi, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Sook Ko, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Boo-Kyung Han, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Young Ko, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ga Ram Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively investigate whether background parenchymal enhancement (BPE) of the contralateral breast at preoperative dynamic contrast material-enhanced magnetic resonance imaging (DCE-MRI) are associated with therapy outcome in patients with unilateral invasive breast cancer after neoadjuvant chemotherapy (NAC).

METHOD AND MATERIALS

The institutional review board approved this retrospective study. Between 2009 and 2011, 170 women with unilateral invasive breast cancers had undergone NAC, and pre- and post-treatment DCE-MRI before curative breast surgery. Among these, 93 women (43 premenopausal women who performed pretreatment MRI between day 7 and 20 of the menstrual cycle, 50 postmenopausal women) were finally included in this study. MRI features (BPE grade [minimal, mild, moderate, severe] of contralateral breast, size and number of lesions, lesion kinetics, and the percent change of lesion size between pre- and post-treatment MRI) and clinicopathologic features (age, menopausal status, clinical tumor and nodal stages, pathologic response to NAC, tumor size, nuclear grade, immunohistochemical subtype, presence of lymphovascular invasion, and adjuvant therapy) were analyzed. Patients were grouped according to BPE grade (high [moderate or severe], low [minimal or mild]) of contralateral breast. A Cox regression model was used to determine the association between MRI features and disease-free survival after controlling for clinicopathologic variables.

RESULTS

Median follow-up was 46 months. There were 23 recurrent cases (2 ipsilateral breast, 6 regional, 15 distant). Multivariate analysis showed that high BPE of contralateral breast at pretreatment DCE-MRI (hazard ratio [HR]=4.242, $P=0.005$), lower change of lesion size between pre- and post-treatment MRI (HR=1.024, $P=0.002$), presence of lymphovascular invasion (HR=10.194, $P<0.001$), and triple negative cancer (HR=4.820, $P=0.006$), were independent factors associated with poor disease-free survival.

CONCLUSION

BPE of contralateral breast is significantly associated with long-term outcome of patients with unilateral invasive breast cancer who had undergone NAC. This study suggests that higher BPE at pretreatment DCE-MRI may have potential as a predictor for relatively poor outcome in breast cancer patients who undergo NAC.

CLINICAL RELEVANCE/APPLICATION

Higher BPE at pretreatment DCE-MRI may have potential as a predictor for relatively poor outcome in breast cancer patients who undergo NAC

SSE01-06 Baseline DCE-MRI and PET-CT as a Predictor of Pathologic Response in Patients Treated with Neoadjuvant Chemotherapy (NAC) for Locally Advanced Breast Cancer

Monday, Nov. 30 3:50PM - 4:00PM Location: Arie Crown Theater

Participants

Loic Colleter, MD, Paris, France (*Presenter*) Nothing to Disclose

Emmanuelle Cauderlier, Caen, France (*Abstract Co-Author*) Nothing to Disclose

Marine Bricout, MD, Angers, France (*Abstract Co-Author*) Nothing to Disclose

Constance de Margerie-Mellon, Paris, France (*Abstract Co-Author*) Travel support, Guerbet SA

Marion Chapellier, Paris, France (*Abstract Co-Author*) Nothing to Disclose

Marcela Albiter, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose

Eric De Kerviler, MD, Paris, France (*Abstract Co-Author*) Research Consultant, Galil Medical Ltd; Speaker, Guerbet SA

Cedric M. De Bazelaire, MD, PhD, Paris, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate DCE-MRI analysis and PET-CT at baseline for prediction of pathological response to neoadjuvant chemotherapy (NAC) in patients with locally advanced breast cancer.

METHOD AND MATERIALS

88 patients with locally advanced breast cancer treated with NAC followed in DCE-MRI at 1.5T and PET-CT were included in this retrospectively study. Perfusion parameters (Ktrans, Kep, Ve) and SUVmax were measured at baseline of the NAC. Imaging datas were compared with tumoral and nodal pathologic response and histopathological tumor characteristics (SBR, Ki67, Hormonal Receptors (HR), HER2, and p53).

RESULTS

Response were observed in 54 patients (61%) and non-response in 34 patients. Low Ve and high SUVmax were significantly associated with tumoral response to NAC (Ve, t-test, $p = 0,0035$; SUVmax, t-test, $p = 0,0265$). Other perfusion parameters were not significantly associated to pathological response. Low Ve and high SUVmax were significantly associated with histopathological aggressivity markers (SBR III, Ki67 > 15%, negative HR, p53 muted). Only low Ve was associated with nodal response (t-test, $p = 0,048$).

CONCLUSION

Ve and SUVmax before NAC were associated with tumoral response and histopathological aggressivity markers.

CLINICAL RELEVANCE/APPLICATION

Ve and SUVmax before NAC can predict tumoral response and histopathological aggressivity markers.

SSE10

ISP: Genitourinary (GU Intervention)

Monday, Nov. 30 3:00PM - 4:00PM Location: E351



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

FDA Discussions may include off-label uses.

Participants

Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose
Cary L. Siegel, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose

Honored Educators

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

Douglas S. Katz, MD - 2013 Honored Educator
Douglas S. Katz, MD - 2015 Honored Educator

Sub-Events

SSE10-01 Genitourinary Keynote Speaker: Renal Tumor Ablation-Current Status and Future Directions

Monday, Nov. 30 3:00PM - 3:10PM Location: E351

Participants

Ronald J. Zagoria, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

SSE10-02 Real-time MR-guided Renal Cryoablation: Technical Feasibility, Complications and Outcomes

Monday, Nov. 30 3:10PM - 3:20PM Location: E351

Participants

Georgia Tsoumakidou, MD, Strasbourg, France (*Presenter*) Nothing to Disclose
Herve Lang, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Guillaume Koch, MD,MSc, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Julien Gamon, MD, Strasbourg, France (*Abstract Co-Author*) Proctor, Galil Medical Ltd
Xavier Buy, MD, Bordeaux, France (*Abstract Co-Author*) Proctor, Galil Medical Ltd
Afshin Gangi, MD, PhD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

At present, major improvements in device development, as well as modern special designed MR-suites (with MR-compatible life support and anesthesia equipment) have made the performance of MR-guided percutaneous procedures not only feasible, but also attractive. We retrospectively reviewed our single institution experience with percutaneous MR-guided cryoablation of renal tumours for technical feasibility, complications and outcomes (oncologic, renal function).

METHOD AND MATERIALS

Between April 2009 and March 2015, 68 patients underwent percutaneous MR-guided renal cryoablation. All procedures were performed in an MR-interventional unit, using a 1.5T large bore, supra-conductive system. Real-time BEAT IRTTT (3-simultaneous-plane sequence) and high-resolution T2-Blade/HASTE sequences were used for probe positioning and ice-ball monitoring.

RESULTS

A total of 79 lesions in 68 patients were treated. Four patients were excluded because of less than 3 month follow-up. Twenty-one patients had a history of renal cancer (15 and 2 treated with total and partial nephrectomy, respectively, 4 with cryoablation). Mean maximal tumour diameter was 22mm (min 5, max 42). Biopsy results were available in 61 patients. Procedure related data (time, number-type of cryoprobes, ice ball size) were collected. Two freeze-thaw cycles were systematically performed. Hydrodissection was used in 37 patients. All procedures were technically successful. Local recurrent tumour was identified in six patients during the first six months of imaging follow-up. The local primary tumour control rate was 92%. One patient developed a late local recurrence at 3 years follow-up. Five out of six early and the late recurrence were treated percutaneously. Peri-operative major complication rate was 4.6% (one active bleeding necessitating embolization, one asymptomatic subcapsular hematoma, and one urothelial damage treated with ureteric catheter insertion). There was no procedural related death. Mean follow-up was 18 (3-70) months.

CONCLUSION

Percutaneous renal cryoablation can be performed with high technical and clinical success under MR-guidance. The real-time probe placement, high soft tissue contrast, multi-planar imaging, and the lack of ionizing radiation are some of the advantages of MR vs the CT-guidance.

CLINICAL RELEVANCE/APPLICATION

Percutaneous cryoablation of T1a renal tumours can be performed safely and with high technical success under MR-guidance.

SSE10-03 Single Institution Review of Percutaneous Cryoablation in the Horseshoe Kidney: An Initial

Experience

Monday, Nov. 30 3:20PM - 3:30PM Location: E351

Participants

Junjian Huang, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Thomas D. Atwell, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Anil N. Kurup, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Stephen Boorjian, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Robert Thompson, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Grant D. Schmit, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To present the initial case series of percutaneous cryoablation of tumors in a horseshoe kidney.

METHOD AND MATERIALS

This is a single center retrospective review of 5 consecutive patients with a renal mass in a horseshoe kidney treated with percutaneous image-guided cryoablation from June of 2006 to August of 2013. Patient and tumor characteristics were extracted from the electronic medical record. Oncologic outcomes were defined using standardized criteria.

RESULTS

Average age of patient was 59 years old (4M, 1F), tumor size was 3cm (\pm 1cm), and serum creatinine was 1.1 ± 0.4 . Of the 5 patients, 4 patients had biopsy proven clear cell renal cell carcinoma, and 1 patient had biopsy proven carcinoid. Technical success was achieved in all patients. The median follow-up duration is 19 months. There were no major complications. Transient elevation of creatinine, not requiring dialysis, occurred following treatment in one patient which has since normalized to baseline. A single patient had inguinal nerve pain that resolved within 3 months. Mean creatinine at follow-up was 1.1 ± 0.3 . All patients remain free of local tumor progression. Two patients expired 46 months and 24 months after ablation due to unrelated disease.

CONCLUSION

There is a paucity of data with regard to the safety, efficacy, and long term outcome of percutaneous cryoablation in the horseshoe kidney. From our initial series it seems that cryoablation is relatively safe in the treatment of small renal tumors, without impact on renal function. This is the first reported series of cryoablation in the horseshoe kidney and, in select patients, may present an alternative to surgical management.

CLINICAL RELEVANCE/APPLICATION

Percutaneous cryoablation represents an alternative treatment modality in patients with a small renal mass on a horseshoe kidney.

SSE10-04 Placement of Essure Tubal Occlusion Coils by Fluoroscopy; An Option when Hysteroscopic Placement Fails

Monday, Nov. 30 3:30PM - 3:40PM Location: E351

Participants

Amy S. Thurmond, MD, Portland, OR (*Presenter*) Nothing to Disclose

PURPOSE

Nonsurgical tubal occlusion by Essure coils was FDA (Food and Drug Administration) approved in 2002 for hysteroscopic placement by gynecologists. Occasionally hysteroscopic placement of one or both coils is not possible--or the coil perforates or is expelled from the tube. Fluoroscopic fallopian tube catheterization has been used since 1987 as a nonsurgical method for unblocking proximal tubal occlusion in women with infertility. The feasibility of fluoroscopic fallopian tube catheterization for placement of Essure coils was explored.

METHOD AND MATERIALS

Women were referred by their gynecologists because of complications after hysteroscopic placement of the Essure device. No pre-medication, sedation, or anesthesia was given. Commercially available equipment was used to perform hysterosalpingogram, fallopian tube catheterization, and Essure placement. Equipment consisted of a 9 Fr balloon catheter for use in the cervix and uterus (Cook Medical), a 5 Fr catheter and 0.035 inch diameter hydrophilic guidewire for use in the fallopian tube (Cook Medical), and the Essure device and delivery system (Bayer Pharmaceutical).

RESULTS

Twelve women had attempt at fluoroscopic Essure placement in 14 tubes. Procedure was successful in 12/14 tubes (86%), including 5 tubes where hysteroscopic placement had failed, 2 tubes where hysteroscopic placement resulted in perforation, 3 tubes in which device was expelled after hysteroscopic placement, and 2 tubes with hydrosalpinx. Fluoroscopic placement failed in 2 tubes, in one because of severe tubal spasm which was also the reason for hysteroscopic failure, and in one tube (in which device had been expelled) because of pain during the procedure attributed to severe endometriosis. There were no complications. Six women have had post-procedure confirmation hysterosalpingograms required by the FDA and all 6 tubes with devices placed fluoroscopically were occluded (100%).

CONCLUSION

Ten of 12 high risk women (83%) who had failed Essure placement by hysteroscopy on one or both sides had subsequent successful fluoroscopic procedures allowing them to rely on the Essure devices for tubal occlusion. Twelve of 14 tubes (86%) were amenable to fluoroscopic placement of the Essure device.

CLINICAL RELEVANCE/APPLICATION

Ten of 12 women (83%) who would have been considered Essure failures and referred for tubal ligation, were converted to Essure successes by fluoroscopic placement of the device.

SSE10-05 Percutaneous Embolization of Varicocele By Steel and Platinum Coils

Monday, Nov. 30 3:40PM - 3:50PM Location: E351

Participants

Faiq Syed Muhammad, MBBS, Karachi, Pakistan (*Presenter*) Nothing to Disclose
Khair Muhammad, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose
Waseem A. Mirza, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The goal of this study was to present our experience with percutaneous treatment of male varicocele in view of procedural, clinical aspects in adult population.

METHOD AND MATERIALS

45 male with clinical moderate to severe varicocele associated with scrotal swelling with "bag of worms" or discomfort in testes, such as heaviness or dull pain after standing all day, referred from urology outpatient department to Radiology Department, where Doppler ultrasound was done which confirms the grade and patient underwent percutaneous varicocele embolization with coil.

RESULTS

The procedural success rate for spermatic vein occlusion was 93%. Follow-up, achieved of every patient after 6 month in urology outpatient department. Forty two patients (93%) reported disappearance of varicocele and as well as pain relief. In two patients percutaneous embolization procedure failed due to internal jugular vein approach and congenital venous abnormality. None of patients reported a reappearance of their varicocele. No significant complications occurred in 42 patients except pain in two patients and hematoma in two patients at femoral punctured site: none had any 6 months sequelae

CONCLUSION

Percutaneous embolization of varicocele carried out as outpatient procedure under local anesthesia and is more beneficial to patient in comparison to surgery. It has high procedural success rates, less recurrence rate, when performed by experience interventional radiologist. We believed primary therapy for varicocele treatment should be embolization if we compared various risk factors associated with surgery.

CLINICAL RELEVANCE/APPLICATION

Procedural and clinical success in elimination of varicocele by steel or platinum coils with low rate of failure and reappearance up to 6 month. High failure rate was seen in our study through internal jugular vein approach for venous access. We believed primary therapy for varicocele treatment should be embolization if we compared various risk factors associated with surgery.

SSE10-06 Hysterosalpingo-foam Sonography (HyFoSy): A Prospective Observational Cohort Study of an Innovative, Radiation Free, Safe and Effective, Non(Embryo) Toxic Technique, to Visualize Tubal Patency in an Outpatient / Office Setting

Monday, Nov. 30 3:50PM - 4:00PM Location: E351

Participants

Anurag Singh, MBBS,MD, Sharjah, United Arab Emirates (*Presenter*) Nothing to Disclose
Tejashree Singh, Dubai, United Arab Emirates (*Abstract Co-Author*) Nothing to Disclose
Kiran C. Patil JR, MD, Jalgaon, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study was conducted to evaluate the efficacy and safety of HyFoSy as a first step routine office procedure for tubal patency testing.

METHOD AND MATERIALS

A prospective observational cohort study was conducted in a medical center from 26/11/2014 - 4/4/2015. 46 patients with subfertility were examined. The mean age of patients was 31 years. The mean duration of subfertility was 2.2 years. The patients were asked to report for the test, on days 7-9 of their menstrual cycle. All patients were at low risk for tubal disease and had no history of tubal surgery. A non(embryo) toxic foam was created by rigorously mixing 10 ml hydroxymethylcellulose glycerol gel (88.25% water) with 10 ml purified water to give a mixture containing 94.10% water in a 20 ml syringe, and was introduced into the uterine cavity with the help of a disposable 5F single balloon catheter. This foam had low viscosity and was sufficiently stable to show echogenicity for at least 5 minutes. Tubal patency was determined by transvaginal ultrasound demonstration of echogenic dispersion of foam through the Fallopian tubes and the peritoneal spillage. The tubal contour, length and relation of spill with respect to ipsilateral ovary, were also noted. The pain score was calculated. No precautions with regard to pregnancy were advised.

RESULTS

In 45/46 (98%) patients (except 1 case of cervical stenosis), a successful procedure was performed. In these cases, there was no further need for a hysterosalpingogram (HSG). 42 patients (94%) had bilateral patent tubes and 3 patients (6%) had unilateral patent tubes. Only 1 patient (1/45; 2%) had mild vasovagal discomfort during the procedure that resolved spontaneously. The average pain score was 2.2. All procedures were uneventful and no serious side-effects were observed. Furthermore, in 10 patients (22%) conception occurred within a median of 3 months after the procedure. Review of literature found our results comparable with other similar studies.

CONCLUSION

Thus, HyFoSy is a successful, less painful and radiation free technique, easily performed in an office setting as a first step test for tubal patency. Comparison with other tubal patency tests was done as per the literature evaluation and our old experiences. It showed excellent findings in favor of HyFoSy.

CLINICAL RELEVANCE/APPLICATION

HyFoSy is a radiation free, less painful, non(embryo) toxic, effective alternative to HSG and definitely has a potential to be the new generation patient friendly first step office test for tubal patency.

SSE07

Gastrointestinal (CT Technique and Contrast)

Monday, Nov. 30 3:00PM - 4:00PM Location: E353A



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

Participants

Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Moderator*) Grant, Guerbet SA; Support, Siemens AG; Support, Koninklijke Philips NV; Grant, Bayer AG; Consultant, Bayer AG; Grant, General Electric Company; Support General Electric Company; Grant, STARmed Co, Ltd; Grant, RF Medical Co, Ltd; Grant, Toshiba Corporation; Grant, Dong-Seo Medical Industrial Co, Ltd
Avinash R. Kambadakone, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSE07-01 Objective Image Quality of Best Arterial and Best Portal Venous Phase Images Calculated from Low Dose Dynamic Volume Perfusion CT Datasets in Comparison To Standard Arterial and Portal Venous CT Datasets in Patients with Hepatocellular Carcinoma

Monday, Nov. 30 3:00PM - 3:10PM Location: E353A

Participants

Xuan Wang, MD, Beijing, China (*Presenter*) Nothing to Disclose
Thomas Henzler, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Steffen J. Diehl, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim, Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Zheng Yu Jin, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Huadan Xue, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Arman Smakic, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively compare objective image quality of best temporal arterial and portal venous (PV) images generated from low dose dynamic volume perfusion CT (dVPCT) datasets with standard 120-kVp arterial and portal venous datasets in patients with hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

21 dVPCT and standard CT datasets of 13 patients with HCC were analyzed in this study. The scan protocol included a 70kVp/220mAs (n=14) or 80kVp/190 or 200mAs (n=7) dVPCT acquisition for quantitative evaluation of HCC perfusion over 60s with an interscan delay of 2.5s. In addition, the patients underwent a standard dual-energy (90/150 kVp) arterial and PV acquisition 15 minutes after the dVPCT. The 3-5 single phases from all dVPCT datasets in which the abdominal aorta (AA) or the main portal vein (MPV) showed best contrast were manually selected by reviewing all dVPCT datasets. Best temporal arterial and PV images were then reconstructed from the 3-5 single phases to one best arterial and best PV temporal dataset. The standard 120-kVp images were generated from dual-energy CT data. Image noise, SNRs of the liver, AA and MPV as well as CNRs of AA and MPV were measured and compared to the 120 kVp datasets. The results were analyzed using paired-samples t-test.

RESULTS

Best temporal arterial and PV images were superior to standard 120-kVp arterial and venous images for all quantitative measurements (all $p < 0.05$) except for image noise within the MPV in the PV phases, which showed no significant differences between the two groups. The SNRs of AA (arterial phase), liver and MPV (PV phase) were 25.4, 5.0 and 7.2 within the best temporal images, which were significantly higher compared to the standard 120-kVp images (8.8, 3.7 and 4.6 respectively) (all $p < 0.01$). Similarly, best temporal images showed higher CNRs of AA (arterial phase; 17.8 vs. 4.7, $P = 0.018$) and MPV (PV phase; 3.2 vs. 1.6, $P < 0.001$) compared to 120-kVp images.

CONCLUSION

Best temporal images calculated from low-dose dVPCT datasets can replace additional standard CT acquisitions in patients with HCC that undergo quantitative dVPCT.

CLINICAL RELEVANCE/APPLICATION

Low-dose dVPCT datasets can be used to calculate standard arterial and PV phase CT images with even superior image quality when compared to standard 120 kVp arterial and PV images.

SSE07-02 Single-Energy Metal Artifact Reduction Algorithm: Utility for Improvements of Image Quality and Anatomical Assessment on Dynamic Contrast-enhanced CT in Patients with Surgical or Endovascular Treatment for Hepatocellular Carcinoma

Monday, Nov. 30 3:10PM - 3:20PM Location: E353A

Participants

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PURPOSE

To determine the utility of a single-energy metal artifact reduction (SEMAR) algorithm for image quality improvement on dynamic contrast-enhanced CT (CE-CT) in patients who underwent surgical or endovascular treatment for hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

This prospective study was IRB-approved, and written informed consent was obtained. Fifty-eight patients (48 men, 10 women; mean age, 68 years; age range, 23-85 years) with metal implants were imaged at dynamic CE-CT. CT data were reconstructed with and without SEMAR algorithm on axial and coronal planes. To evaluate the metal artifact reduction, CT number and artifact index values within the liver segments, which were affected by metallic artifact, were determined by ROI measurement. Two readers independently evaluated image quality of the liver and pancreas by means of 5-point visual score. To evaluate quantitative image quality improvement on CE-CT with and without SEMAR technique mean CT number and artifact index within liver were compared by t-test. To assess qualitative image quality between two methods, a linear-weighted κ statistic and Wilcoxon signed rank test were performed.

RESULTS

The mean CT number and artifact index within the liver on CT with SEMAR were significantly lower compared that without SEMAR on both planes ($p < 0.0001$). Inter-observer agreements of image quality assessment of liver and pancreas were substantial or almost perfect ($0.61 < \kappa < 0.84$). Image qualities of the liver and pancreas was significantly improved on CT with SEMAR as compared with that without SEMAR in both planes ($p < 0.0001$).

CONCLUSION

SEMAR is considered as useful for image quality improvement on dynamic CE-CT in patients who had surgical or endovascular treatment for HCC.

CLINICAL RELEVANCE/APPLICATION

SEMAR is considered as useful for image quality improvement on dynamic CE-CT in patients who had surgical or endovascular treatment for HCC.

SSE07-03 Quantification of Liver Fibrosis in Human Specimens using Grating-based Phase Contrast Computed Tomography

Monday, Nov. 30 3:20PM - 3:30PM Location: E353A

Participants

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PURPOSE

To evaluate the potential of grating-based phase contrast computed tomography (gbPCCT) for the quantification of fibrosis in human liver specimens and to correlate with histological diagnosis.

METHOD AND MATERIALS

IRB approval was obtained. Thirty human liver specimens with varying degrees of fibrosis were prospectively collected during autopsy at the institute of forensic medicine. Tissue samples were fixed in 4% formalin solution and imaged using a Talbot-Lau interferometer with a rotating-anode X-ray tube and a photon-counting detector. Phase-contrast and attenuation-contrast image sets were visually graded according to fibrotic stage using a 5-point scale. Additionally, a software-based method was used for tissue decomposition and quantification. Specimens were sliced and stained for histological analysis including classification of fibrosis. Results of visual and software-based staging of hepatic fibrosis were compared to histology.

RESULTS

In phase-contrast images fibrous tissue shows high signal intensity and delineates from surrounding liver tissue. Visual evaluation and software-based tissue decomposition correlated with the histological grading. On the contrary, attenuation-contrast images did not allow quantification of liver fibrosis.

CONCLUSION

Grating-based phase contrast computed tomography allows ex vivo quantification of liver fibrosis in human specimens.

CLINICAL RELEVANCE/APPLICATION

In a clinical setup a gbPCCT scanner may have the potential to improve diagnostics and therapy monitoring of chronic liver disease.

SSE07-04 Evaluation of the Recently Transplanted Liver with Computed Tomography Perfusion Imaging and Correlation with Clinical Outcome

Monday, Nov. 30 3:30PM - 3:40PM Location: E353A

Participants

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Ashley S. Shaw, MBBCh, Cambridge, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The integrity of vascular anastomoses performed during liver transplantation is critical to the proper function of the graft. In particular, hepatic arterial stenosis or thrombosis has major impact on patient morbidity and mortality. Standard assessment of vascular supply relies upon ultrasound and angiography (both conventional and by computed tomography (CT)), however these may not detect vascular abnormality until graft function has already been compromised. In this study we evaluate a CT perfusion technique to measure blood flow in recently implanted liver grafts.

METHOD AND MATERIALS

Patients with a recent liver transplant were imaged between 10-14 days post transplantation with a perfusion CT sequence. A dual-input single-compartment pharmacokinetic model was applied to the tissue uptake curve and the arterial and portal venous input functions to yield standard perfusion indices (total blood perfusion, arterial fraction, mean transit time and distribution volume).

RESULTS

34 complete datasets were obtained. Mean total perfusion was 159ml/min/100ml +/- 32, arterial fraction was 17% +/- 14.2, mean transit time was 14.9s +/- 5.8 and distribution volume was 22.5% +/- 2.9. In comparison with previously published data from native normal livers, there was a significant difference in mean transit time and distribution volume ($p < 0.001$). In subgroup analysis, there was no significant difference in results for patients with and without biopsy proven acute rejection. In 6 patients that developed hepatic artery stenosis or thrombosis there was a decreased arterial fraction (mean 7.3%, $p < 0.06$). In 8 patients who developed cholangiopathy the arterial fraction was also decreased (mean 10.1%, $p < 0.11$).

CONCLUSION

This study shows that perfusion CT can produce reproducible results in a group of patients post liver transplant. There was a trend of decreased arterial fraction for patients that subsequently developed hepatic artery stenosis or thrombosis; increased recruitment and clinical follow-up is awaited. Further refinement of the technique may provide useful prognostic information for graft arterial function, allowing diagnosis of potentially serious complications at an earlier time point.

CLINICAL RELEVANCE/APPLICATION

Development of CT perfusion may allow early prediction of complications following liver transplantation, particularly for problems involving the hepatic artery.

SSE07-05 Noninvasive Liver Iron Content Determination by Dual-Source Dual-Energy CT: Initial Results in Patients Suspected of Liver Iron-overload

Monday, Nov. 30 3:40PM - 3:50PM Location: E353A

Participants

Xianfu Luo, Yangzhou, China (*Presenter*) Nothing to Disclose
Jingtao Wu, Yangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively assess the feasibility of dual-source dual-energy (DSDE) CT for evaluation of liver iron content (LIC) in patients suspected of liver iron-overload and to compare its accuracy with magnetic resonance (MR) imaging.

METHOD AND MATERIALS

Fifty-eight subjects with elevated ferritin and suspected of liver iron-overload were enrolled in our study. Upper abdomen DSDE CT and MR were then performed. Hepatic attenuation difference between 80 kVp and 140 kVp (ΔH) was calculated. Hepatic R2* and LIC determined by Ferriscan (F-LIC) were obtained. The correlations between CT measurement (ΔH) and MR measurements (R2* and F-LIC) were analyzed. Diagnostic performance of ΔH in discriminating different LIC thresholds (1.8, 3.2, 7.0, 15.0mg/g dry tissue) was evaluated by receiver operating characteristic (ROC) analysis.

RESULTS

F-LIC was from 0.20 to 39.59mg Fe/g. ΔH was correlated well with F-LIC and the Spearman's coefficient was 0.975. ΔH showed perfect linear positive with LIC ($r^2 = 0.925$, $P < 0.001$). For discriminating clinically significant LIC thresholds (1.8, 3.2, 7.0, 15.0mg/g dry tissue), ROC analysis revealed that the corresponding optimal cutoff value of ΔH was 3.15, 3.40, 5.38, 12.50 HU, respectively. With the cutoff value of $\Delta H = 5.38$ HU, the highest sensitivity (100%) and specificity (100%) were obtained at LIC threshold of 7.0mg Fe/g dry tissue.

CONCLUSION

DSDE CT can accurately quantify liver iron content with similar diagnosis performance with MR for grading clinically significant iron accumulation.

CLINICAL RELEVANCE/APPLICATION

DSDE CT can accurately grade patients with clinically significant hepatic-iron accumulation. It might be used to guide iron chelation therapy and to monitor chelation effect.

SSE07-06 Characterization of Portal Venous Thrombus (Bland vs Neoplastic) on CT Using Software Based Textural Analysis

Monday, Nov. 30 3:50PM - 4:00PM Location: E353A

Participants

Rodrigo Canellas, MD, Boston, MA (*Presenter*) Nothing to Disclose

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Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Consultant, Allena Pharmaceuticals, Inc

PURPOSE

To investigate the role of textural analysis (CTTA) in distinguishing bland thrombus from neoplastic thrombus in the portal venous system.

METHOD AND MATERIALS

In a IRB approved analysis, CECT scans of 63 patients with reference standard verified PV thrombus (30 bland and 33 neoplastic) were processed for texture features using the CTTA software (TexRAD Ltd). This software works of the DICOM data to generate various parameters: Mean gray-level pixel intensity, Entropy, SD of pixel intensity, mean of positive pixels (MPP), Kurtosis and Skewness. Independent Sample T Test was applied for statistical significance.

RESULTS

There were statistically significant differences between MPP of bland (mean 47.2 ± 12.8) and neoplastic (mean 71.6 ± 16.8) thrombus ($P=0.001$) and between Mean gray-level pixel intensity of bland (mean 45.4 ± 11.8) and neoplastic (mean 71.2 ± 16.2) thrombus ($P=0.001$). Other parameters such as SD and Entropy were also statistically different between the two thrombi.

CONCLUSION

A simple software based texture analysis can reliably stratify bland and neoplastic thrombus in the portal venous system on CECT images.

CLINICAL RELEVANCE/APPLICATION

Portal venous thrombus impacts treatment decision and prognosis. Advanced imaging studies such as multiphasic CT or MRI can reliably characterize the venous thrombi into benign and malignant but portal venous CT is less effective. Software based thrombus texture parameter MPP can fulfill this important clinical need thereby potentially eliminating additional imaging studies and interventions.

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SSE11

Genitourinary (Renal Stone Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: E353B



AMA PRA Category 1 Credit™: 1.00
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FDA Discussions may include off-label uses.

Participants

Naoki Takahashi, MD, Rochester, MN (*Moderator*) Nothing to Disclose
Parvati Ramchandani, MD, Merion Station, PA (*Moderator*) Nothing to Disclose

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Naoki Takahashi, MD - 2012 Honored Educator

Sub-Events

SSE11-01 In Vitro Imaging of Kidney Stones in Pig Kidneys Using Ultra-short Echo-time (UTE) MRI

Monday, Nov. 30 3:00PM - 3:10PM Location: E353B

Participants

El-Sayed H. Ibrahim, PhD, MSc, Ann Arbor, MI (*Presenter*) Nothing to Disclose
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Jamie G. Giesbrandt, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
James C. Williams, PhD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
William E. Haley, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ultra-short echo-time (UTE) MRI provides echo times (TE) in the range of tens of microseconds, which allows for effective imaging of tissues that have rapid signal decay, e.g., kidney stones. In this study, we investigate the imaging performance of UTE MRI for stones embedded within their usual milieu, the kidney, thus mimicking the in vivo situation.

METHOD AND MATERIALS

24 kidney stones passed/extracted from patients were obtained. The stones represented 8 different types (confirmed by micro CT): calcium oxalate monohydrate (COM), calcium oxalate dehydrate (COD), brushite, apatite, uric acid (UA), struvite, cystine, and mixed-composition. Each stone type was represented by 3 stones in a range of sizes: small (2-3 mm), medium (4-6 mm), and large (7-10 mm). A total of 8 pig kidneys, purchased from a local meat store, were used in the experiments. Using small cuts, three stones (large, medium, and small) of the same type were inserted into each kidney, each into a different calyx (Fig 1a). The kidneys were arranged in a small plastic container filled with water and covered with a sealed lid (Fig 1b), and then imaged on a Siemens 3T MRI scanner using an 18-channel body surface coil and an optimized 3D UTE pulse sequence.

RESULTS

All stones were successfully visualized. The resulting images clearly showed the stones' shapes with high resolution (Fig 1c). Although efforts were made to expunge air bubbles throughout the pre-scan process, air gaps still existed inside some of the kidneys, which resulted in some artifacts. Using the body surface coil and large FOV did not adversely affect stone visualization, which is promising for future in vivo imaging.

CONCLUSION

This study confirms the potential of MRI for in vitro imaging of stones in kidneys using the body surface coil, which is one step closer to in vivo imaging than phantom experiments with head or knee coils. If successful for true in vivo imaging, the UTE technique could serve as an alternative to CT for imaging patients for whom minimization of radiation exposure is desirable. The sequence could be also added to abdominal MRI protocols for comprehensive evaluation of the genitourinary system.

CLINICAL RELEVANCE/APPLICATION

Although CT is the modality of choice for imaging kidney stones, UTE MRI may provide an effective alternative when there are concerns about radiation exposure.

SSE11-02 Low-dose Abdominal Computed Tomography for Urinary Stone Disease - Impact of Additional Spectral Shaping on Image Quality and Dosage

Monday, Nov. 30 3:10PM - 3:20PM Location: E353B

Participants

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Sebastian Fischer, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Ralf W. Bauer, MD, Frankfurt, Germany (*Abstract Co-Author*) Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Boris Schulz, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate a novel tin filter based abdominal CT technique for urolithiasis in terms of image quality and radiation exposure.

METHOD AND MATERIALS

130 consecutive patients with suspected urolithiasis underwent non-enhanced CT in our department with various techniques: 48 patients were examined with a novel tin filtration (150kV Sn) method (group 1) on a third-generation dual-source-CT, 33 patients were examined with automated kV-selection (80-140kV) based on the scout view with the same CT-device (group 2) and 49 patients were examined on a second-generation dual-source-CT (group 3) also with automated kV-selection (80-140kV) based on the scout view. Automated exposure control was active in all groups. Image quality was subjectively evaluated on a 5-point-likert-scale by two radiologists and interobserver agreement as well as signal-to-noise-ratio (SNR) was calculated. Dose-Length-Product (DLP) and volume based CT weighted Dose Index (CTDI_{vol}) were used to analyze radiation exposure.

RESULTS

Image quality was rated in favour for the tin filter protocol with an excellent interobserver agreement (ICC=0.86-0.91). SNR was significantly better in group 1 and 2 compared to second-generation DSCT ($p<0.001$). On third-generation dual-source CT, there was no significant difference in SNR between the 150 kV Sn and the CAREkV protocol ($p=0.5$). DLP of group 1 was significantly lower in comparison to group 2 and 3 by 23% and 27% (93 vs. 122 vs. 127mGycm; $p<0.002$). CTDI_{vol} of group 1 was significant lower compared to group 2 (-36%) and 3 (-32%) (1.95 vs. 3.09 vs. 2.87 mGy; $p<0.001$).

CONCLUSION

Additional shaping of a 150kV spectrum by a tin filter substantially lowers patient exposure while improving image quality on abdominal Computed Tomography for urinary stone disease.

CLINICAL RELEVANCE/APPLICATION

The novel tin filtered technique reduces radiation exposure and improves image quality in comparison to standard low-dose abdominal CT, thus serving to benefit the patient.

SSE11-03 Predictive Value of Low Dose and Dual-Energy CT for Successful Stone Disintegration in Shock Wave Lithotripsy: An in-Vitro Study

Monday, Nov. 30 3:20PM - 3:30PM Location: E353B

Participants

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PURPOSE

Shock wave lithotripsy (SWL) represents the golden treatment for urinary stone disease. Failure of stone disintegration results in repeated treatments or alternative procedures, thereby not only increasing medical costs. The ability to predict successful SWL will improve the selection of patients suitable for SWL. This study investigates single energy computed tomography (SECT) and dual-energy computed tomography (DECT) to predict numbers of shock waves to stone disintegration in an in-vitro setting.

METHOD AND MATERIALS

A total of 33 human urinary calculi (10 uric acid, 8 hydroxyapatite, 6 calcium oxalate monohydrate, 5 cysteine, 3 struvite, 1 brushite stones, mean size 6 ± 3 mm) were scanned using a 128-slice DECT machine (Somatom Force, Siemens Healthcare, Forchheim, Germany) with single- (120kVp) and dual-energy settings (80/150, 100/150kVp) resulting in 6 different SECT and DECT data sets. Calculi were disintegrated using an electromagnetic Dornier DL50 lithotripter (Dornier MedTech, Wessling, Germany) over a 2-mm mesh until successful disintegration.

RESULTS

All stones were successfully disintegrated by applying a median of 72 shock waves (interquartile range 343). Regarding logistic regression analysis, CT numbers significantly ($p<0.01$) predicted fewer or more than median shock waves to successful disintegration and differed among data sets ($p<0.05$), both adjusted for stone composition ($p<0.001$) and size ($p<0.001$). Correlation coefficients ranged from $\rho=0.36$ to 0.68 with best correlation for CT numbers and shock waves at 80 kVp ($p<0.001$).

CONCLUSION

Lower CT numbers are significantly associated with fewer shockwaves needed which is independent of stone composition and size. Optimal prediction of SWL success may be facilitated on the basis low-dose CT data which is paralleled by a low radiation dose.

CLINICAL RELEVANCE/APPLICATION

Being able to predict the success of shock wave lithotripsy with low-dose computed tomography would be helpful to determine the optimal management in patients with urinary calculi.

SSE11-04 Feasibility of Split-filter Dual-energy CT for in-Vitro Differentiation of Urinary Stones by Using Dose-neutral (Compared with Single-energy CT) Protocol

Participants

Anushri Parakh, MBBS, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose
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Sebastian T. Schindera, MD, Basel, Switzerland (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Ulrich GmbH & Co KG; Research Grant, Bayer AG

PURPOSE

The study aimed to examine the efficacy of a novel split-filter (using gold and tin filters) single-source dual-energy CT (sf-DECT) in characterizing renal stones as compared to second-generation dual-source dual-energy CT (ds-DECT) in intermediate-sized phantoms using vendor-suggested and dose-neutral (to single-energy CT) protocols.

METHOD AND MATERIALS

Urinary stones (n=65, size: 2.1-6.4mm) of known chemical composition (15 calcium, 15 struvite, 15 cystine and 20 urate) were embedded in a custom-made kidney model and placed in a 30-cm cylindrical water-containing phantom simulating a medium-sized patient. Scans with vendor-recommended and dose-neutral protocols were performed on ds-DECT (SOMATOM Definition Flash, Siemens; protocol A (vendor-suggested) tube A, 100kVp, 210 reference mAs; tube B, Sn140kVp, 162 reference mAs; protocol B (dose-neutral) tube A, 100kVp, 65 reference mAs; tube B, Sn140kVp, 50 reference mAs) and sf-DECT (SOMATOM Definition Edge, Siemens; protocol C (vendor-suggested) AuSn 120kVp, 640 reference mAs; protocol D (dose-neutral) AuSn 120kVp, 235 reference mAs). Stones were assessed by a dedicated post-processing software. Positive (PPV) and negative (NPV) predictive values were calculated. A comparison of radiation doses between both dual-energy techniques was made using CTDIvol parameter.

RESULTS

The CTDIvol (in mGy) for protocols A to D measured 13.7, 4.3, 11.2 and 4.4 respectively. Presence of all stones was detected by the four protocols. The PPV of protocols A-D to characterize urate stones were 95.2, 95.2, 94.1 and 58.6 and for non-urate stones were 100, 100, 93.6 and 96.9, respectively. For clinically significant stones (>4 mm), the PPV for characterizing urate or non-urate stones (100 for both) by protocols A and B was not affected. For the same stone size, PPV of protocols C vs. D were 100 vs 76.9 for urate and 96.4 vs. 96.0 for non urate stones. Dose-neutral sf-DECT was particularly inferior to ds-DECT in characterizing urate stones and stones which were less than 4 mm.

CONCLUSION

While dose-optimization is feasible in differentiation of urate from non-urate stones by ds-DECT for smaller stones, it is accurate for sf-DECT if they are greater than 4 mm in size.

CLINICAL RELEVANCE/APPLICATION

Sf-DECT is a promising new tool for dual-energy evaluation with a benefit of reduced radiation dose as compared to second-generation dual-energy technique.

SSE11-05 Virtual Non-enhanced Images Generated from Spectral CT: Determinants of Detection of Urinary Calculi in the Renal Collecting System

Monday, Nov. 30 3:40PM - 3:50PM Location: E353B

Participants

Yan Chen, Zhengzhou, China (*Presenter*) Nothing to Disclose
Peijie Lv, MMed, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jianbo Gao, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine which features of urinary calculi are associated with their detection on VNE images generated from Spectral computed tomographic (CT) urography.

METHOD AND MATERIALS

This retrospective study was approved by the institutional ethics committee with waiver of informed consent. A total of 53 patients were examined with true nonenhanced (TNE) CT and Spectral CT urography in the excretory phase. The contrast medium was virtually removed from excretory-phase images by using material suppressed iodine (MSI), water-based (WB) and calcium-based (CaB) material decomposition (MD) analysis in the spectral imaging viewer. The sensitivity regarding the detection of calculi on these three groups and the subjective scoring were determined by using true non-enhanced (TNE) images as the reference standard, and interrater agreement was evaluated by using the Cohen k test. By using logistic regression, the influences of image noise, attenuation, and stone size, as well as attenuation of the contrast medium, on the stone detection rate were assessed on VNE images.

RESULTS

169 stones were detected on the TNE images; 149 stones were identified on CaB images (sensitivity, 88.2%), 145 stones on WB images (sensitivity, 85.7%), while 160 stones on MSI images (sensitivity, 94.6%) with significant difference. Compared with the TNE images, the relatively lower subjective scoring of the VNE images ($P > 0.05$) and higher SNR, CNR ($P < 0.05$) were identified. Size (long-axis diameter and short-axis diameter), and attenuation of the calculi, except for the image noise were significantly associated with the detection rate on VNE images ($P < 0.05$). As threshold values on CaB, WB, MSI images, size larger than 2.68 mm, 3.01 mm, 2.03 mm, maximum attenuation of the calculi greater than 223 HU, 312 HU and 203 HU respectively were found.

CONCLUSION

After virtual elimination of contrast medium with material decomposition and MSI, large and high-attenuation calculi can be

After virtual elimination of contrast medium with material decomposition and DECT, large and high attenuation calculi can be detected with high reliability.

CLINICAL RELEVANCE/APPLICATION

VNE images generated at excretory-phase Spectral CT can depict calculi larger than 2.03mm in the presence of contrast medium; however, small and hypoattenuating calculi may be missed.

SSE11-06 Improved Differentiation between Uric Acid and Non-uric Acid Renal Stones Using DECT Monoenergetic Imaging

Monday, Nov. 30 3:50PM - 4:00PM Location: E353B

Participants

Fabio Lombardo, MD, Verona, Italy (*Presenter*) Nothing to Disclose
Matteo Bonatti, MD, Bolzano, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulia A. Zamboni, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Federica Ferro, Bolzano, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Pozzi Mucelli, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Giampietro Bonatti, Bolzano, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate monoenergetic attenuation values of renal stones for discriminating between uric acid and non-uric acid stones.

METHOD AND MATERIALS

IRB-approved retrospective study; need for informed consent was waived. We included in our study 37 patients (23M, 14F; mean age 54y) who underwent CT for symptomatic urolithiasis on our second-generation dual-source scanner. We performed a 120kV single-energy low-dose acquisition of the whole abdomen followed by one or more 100/140kV dual-energy acquisitions limited to the regions in which one or more stones were detected. All patients subsequently underwent stone extraction or they spontaneously expelled the stone within 1 month from the examination; all the obtained stones were analyzed by means of infrared spectroscopy and classified, according to their prevalent composition, as uric acid or non-uric acid stones. When patients had >1 stone, their composition was considered the same for all the stones. Stones largest diameter was noted. One radiologist in training evaluated by means of a round ROI the monoenergetic attenuation values of the stones from 40 to 190 kV. 40/190kV monoenergetic attenuation ratios were calculated. A qualitative analysis on the monoenergetic curves was also performed.

RESULTS

75 stones were detected in 37 patients; 36 stones were located in the urinary calices, 13 in the renal pelvis, 25 in the ureters and 1 in the urinary bladder. Mean diameter was 6.1 mm (range 2-28 mm). At spectroscopy, 16/75 stones were prevalently composed by uric acid and 59/75 by cysteine or calcium oxalates/phosphates. Mean 40/190kV monoenergetic attenuation ratios were 0.82 for uric-acid stones (range 0.30-1.34) and 3.82 for non-uric acid stones (range 2.18-7.35)($p<0.0001$). All uric-acid stones were correctly characterized using a cut-off of 1.5. Qualitative analysis of monoenergetic curves showed a different and easily recognizable shape both for uric acid and non-uric acid stones.

CONCLUSION

40/190 kV attenuation ratios accurately differentiate uric acid from non-uric acid stones. Furthermore, qualitative analysis of monoenergetic curves can be an easy method to rapidly assess stone composition.

CLINICAL RELEVANCE/APPLICATION

40/190 kV monoenergetic attenuation ratio accurately predicts renal stone composition, even in small calculi, leading to a more accurate treatment planning.

SSE02

Breast Imaging (Screening Issues)

Monday, Nov. 30 3:00PM - 4:00PM Location: E450A

BR **DM** **SQ**

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

Participants

Paula B. Gordon, MD, Vancouver, BC (*Moderator*) Stockholder, OncoGenex Pharmaceuticals, Inc ; Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, RealImaging
Etta D. Pisano, MD, Charleston, SC (*Moderator*) Founder, NextRay, Inc CEO, NextRay, Inc Research Grant, Koning Corporation Research Grant, Koninklijke Philips NV Research Grant, Zumatek, Inc Research Grant, FUJIFILM Holdings Corporation Equipment support, Siemens AG Research Grant, Siemens AG Equipment support, Koninklijke Philips NV Research Grant, Koninklijke Philips NV

Sub-Events

SSE02-01 Evolution of a Breast Screening Program: Indicators of Efficacy

Monday, Nov. 30 3:00PM - 3:10PM Location: E450A

Participants

Samantha L. Heller, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sam Dumonteil, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sue Hudson, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Louise S. Wilkinson, MBCh, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

PURPOSE

The purpose of this study is to evaluate how changes in practice and technology have impacted upon indicators of program efficacy in a regional breast screening program, including cancer detection rates (CDR), invasive versus in situ disease detection rates, repeat operation rates, and age adjusted mortality.

METHOD AND MATERIALS

This retrospective audit adheres to local policy on confidentiality.: Breast screening database was interrogated from March 1995 to April 2014. :Number of women screened, recall rates, short term follow-up rates, overall CDR, invasive cancers, in situ cancers, interval cancers, and repeat operation rates were identified and compared for early versus later years of the screening program.

RESULTS

834,201 women were invited for routine screening over the study period, and 587,648 (70%) attended with 5021 cancers detected.: Over study period, national screening age range has broadened (50-70 vs. 50-64) and:many more women are screened per year (39,506 vs. 23,934).: There has been an increase in CDR (0.97% vs. 0.83) with an increase in detection of in situ :disease (0.267% versus 0.167%) and a decrease in interval cancer rate (0.15% versus 0.20%).: There has also been a decrease in repeat operation rate:(15.7% versus 21.7%).: Finally, there has been a decrease in regional age adjusted mortality (16.81/100,000 vs. 26.95/100,000) (see Table 1).:

CONCLUSION

Over the time period of the screening program, multiple improved performance indicators are noted, including increased CDR, decreased interval cancer rate, and decreased repeat operation rate.: This is thought to be multifactorial, secondary to technological and quality assurance factors, including core biopsy versus fine needle aspiration (FNA), adoption of bilateral whole breast ultrasound/bilateral axillary ultrasound in the context of newly diagnosed cancer, use of digital mammography, and vacuum assisted excision versus surgical excision.: We also find an age-adjusted decrease in regional mortality from breast cancer, but it is difficult to prove that this is related to screening alone.:

CLINICAL RELEVANCE/APPLICATION

This study evaluates changing factors contributing to improvements in our breast screening program.: :Results put into question negative evaluations of breast screening's efficacy based only on studies from early days of practice.

SSE02-02 The Inevitable Proportion of Overdiagnosis in the Norwegian Breast Cancer Screening Program

Monday, Nov. 30 3:10PM - 3:20PM Location: E450A

Participants

Solveig S. Hofvind, Oslo, Norway (*Presenter*) Nothing to Disclose
Marta Roman, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
Ragnhild Falk, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To estimate the number of overdiagnosed women, defined as those diagnosed with breast cancer and who die within the lead-time period.

METHOD AND MATERIALS

In this modeling cohort study, we used incidence- and death statistics available online and published estimates of lead-time. Postulated cohorts of screened and not screened women aged 50-51 were followed for a period corresponding to ten biennial screening exams during 20 years, and further ten years, to age 78-79. The increase in breast cancer incidence due to screening was estimated based on lead-time. The proportion of women diagnosed with breast cancer who died within the lead-time period

was assessed based on the differences in the cumulative number of breast cancer diagnosed in the non-screened and screened cohort.

RESULTS

The proportion of overdiagnosed women in screened compared to non-screened cohort was 1.8%. Sensitivity analyses using various assumptions increased the estimates up to a maximum of 4%

CONCLUSION

The proportion of women with breast cancer diagnosed after participation in a screening program and who died within the estimated lead-time period was less than 4%. This inevitable proportion of overdiagnosis, should be emphasized in the definition and communication of the issue.

CLINICAL RELEVANCE/APPLICATION

Approximately 2% of women with breast cancer diagnosed in a screening program are estimated to die within the lead-time period.

SSE02-03 The False Negative Rate of Annual Screening Mammography at an American Academic Institution Using Digital Technology

Monday, Nov. 30 3:20PM - 3:30PM Location: E450A

Participants

Hannah Perry, MD,MS, Boston, MA (*Presenter*) Nothing to Disclose
Jordana Phillips, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Shambhavi Venkataraman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Vandana M. Dialani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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Alexander Brook, PhD, Boston, MA (*Abstract Co-Author*) Spouse, Research Grant, Guerbet SA
Tejas S. Mehta, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The majority of published data on the Breast Imaging medical audit is not based on current American practice and includes programs that screen biennially or used film-screen mammography (MG). Current practice data is needed as performance metrics become more transparent. We determine the false negative rate at an American academic institution that screens annually using digital MG, and evaluate the MG features of these cases.

METHOD AND MATERIALS

Patients diagnosed with breast cancer (BC) between 1/1/12 and 9/30/12 with a negative MG within 15 months prior to diagnosis (index MG) were included. Those with index MGs from outside institutions were excluded. Index MGs were reviewed by three breast imagers in two phases (initially blinded followed by non-blinded) according to the European Guidelines for Quality Assurance in BC Screening and Diagnosis. MGs were classified as true negative (TN) if initially correctly interpreted as negative and included true interval cancers, MG occult cancer, or minimal signs. MGs were classified as false negative (FN) if initially incorrectly interpreted due to reader or technical error and represented missed BC. Abnormalities were recorded as calcifications, mass/focal asymmetry, asymmetry, or distortion.

RESULTS

71 of 220 BC cases met inclusion criteria. Average age was 60.5 years (range 38.5 - 87.6, SD 10.4). 33/71 (46%) had fatty or scattered fibroglandular tissue and 38/71 (54%) were heterogeneous or extremely dense. There were 13/71 (18%) in situ and 58/71 (82%) invasive cancers. 57/71 (80%) were TN and 14/71 (20%) were FN (95% CI: 12-31%). Of the 57 TN, there were 33 (58%) interval cancers, 3 (5%) MG occult cancers and 21 (37%) minimal signs. Of 21 minimal signs, 6 were calcifications, 9 asymmetries, and 6 mass/focal asymmetry. Of the FN, all cases were due to reader error, with 5 calcifications, 2 asymmetries and 7 mass/focal asymmetry. Imaging presentation of the index MG was not different between the TN and FN groups.

CONCLUSION

Our American academic institution annual digital screening mammogram (MG) program had a false negative (FN) rate of 20%, compared to 20-30% reported for film-screen or biennial MG. FN cases had no distinguishing MG features.

CLINICAL RELEVANCE/APPLICATION

Our annual digital screening mammogram (MG) program had a false negative (FN) rate of 20%, compared to 20-30% reported for film-screen or biennial MG. FN cases had no distinguishing MG features.

SSE02-04 Balancing the Benefits and Harms Among Women Targeted by the Norwegian Breast Cancer Screening Program

Monday, Nov. 30 3:30PM - 3:40PM Location: E450A

Participants

Solveig S. Hofvind, Oslo, Norway (*Presenter*) Nothing to Disclose
Marta Roman, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
Sofie Sebuodegard, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
Ragnhild Falk, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The balance between benefits and harms of mammographic screening is debated. Our purpose was to estimate a balance sheet of benefits and harms for the NBCSP.

METHOD AND MATERIALS

Data from published studies using individual level data from the NBCSP were used to assess the reduction in breast cancer mortality

versus over-diagnosis. The program invites all Norwegian women aged 50-69 years to biennial mammographic screening. The mortality reduction in the studies varied from 36.8% to 43.0% among screened women, with an average estimate of 39.9%. Estimates of over-diagnosis ranged from 1.8% to 19.6%, with an estimated average of 10.7%. The cumulative risk of a false positive result was 15.9% for additional imaging and 4.1% for an invasive assessment. The benefit-detriment ratio was computed for different scenarios of mortality reduction and over-diagnosis.

RESULTS

For every 10,000 women screened according to the invitations and followed until age 79 we estimated that 54-63 women are saved from breast cancer death, 11-126 are over-diagnosed, 1590 have a false positive result with non-invasive assessment and 410 have a false positive result with invasive procedures. The benefit-harm ratio between mortality reduction and over-diagnosis was 0.4, 0.8, and 5.7 under the less favorable, average and most favorable estimates, respectively.

CONCLUSION

Using average estimates showed that about one woman is saved from breast cancer death for each woman over-diagnosed. The ratio estimates varied substantially and should be interpreted with care before it is communicated to women targeted by the screening program

CLINICAL RELEVANCE/APPLICATION

Approximately one woman is estimated to be saved from breast cancer death for each woman over-diagnosed in the Norwegian Breast Cancer Screening Program, although estimates varied substantially.

SSE02-05 Is One Prior Enough: Does Comparing with Multiple Prior Examinations Impact Recall Rates at Screening Mammography?

Monday, Nov. 30 3:40PM - 3:50PM Location: E450A

Participants

Jessica H. Hayward, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Kimberly M. Ray, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Dorota J. Wisner, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Edward A. Sickles, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Bonnie N. Joe, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the impact of comparison with multiple prior mammograms on the screening mammography recall rate (RR) relative to comparison with a single prior mammogram.

METHOD AND MATERIALS

We performed a retrospective search of our institutional mammography database for screening mammograms performed at our facility between 6/14/2010 and 3/3/2015. This yielded a dataset of 46,317 consecutive screening mammograms performed in 22,792 women. We collected data on patient age, dates of mammograms recorded as comparisons in the clinical report and recommendations for recall. Generalized estimating equation logistic model was used to determine the relative odds of recall as a function of the number of comparison exams without and with adjustment for age as a confounding variable.

RESULTS

A total of 3,845 screening mammograms were interpreted with no prior comparison mammograms, 5,749 exams were interpreted with a single prior and 36,723 exams were interpreted with two or more priors. Screening recall rates for mammograms interpreted with no priors, one prior and two or more priors were 16.6%, 7.8%, and 6.3%, respectively. The unadjusted odds ratio (OR) of recall for mammograms compared with multiple priors versus one prior was 0.789 (95% CI: 0.711, 0.877; $p < 0.0001$). After adjusting for patient age, the OR of recall for the multiple prior group relative to the single prior group was 0.864 (95% CI: 0.776, 0.962; $p = 0.0074$).

CONCLUSION

Comparison with two or more prior mammograms resulted in a statistically significant 14% reduction in the screening mammography recall rate relative to comparison with a single prior.

CLINICAL RELEVANCE/APPLICATION

Comparison with multiple prior mammograms is a more effective strategy for reducing the screening mammography recall rate than comparison with a single prior.

SSE02-06 Is it Necessary to Perform Standard (Implant-full) Views in Screening Mammography for Women with Breast Implants?

Monday, Nov. 30 3:50PM - 4:00PM Location: E450A

Participants

Gun Ha Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hak Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joo Hee Cha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hee Jung Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Young Chae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Jung Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the necessity of standard (implant-full) views in screening mammography for women with breast implants.

METHOD AND MATERIALS

1441 mammograms with 838 silicone and 603 saline breast implants performed between January 2009 and September 2014 were evaluated by two radiologists in consensus. Of the 1441 mammograms, 1328 were screening mammograms. Implant ruptures and breast cancer with regard to the incidence, detection rate by implant-displaced (ID) and implant-full (IF) views, mean age of ruptured implants, mean average glandular dose were assessed. Implant ruptures were confirmed by US, MRI or surgery and breast cancer were proven by pathology.

RESULTS

In 1328 screening mammograms, implant ruptures were found in 14 (14/1328, 1%); 12 were intracapsular and the remaining two were extracapsular ruptures. Intracapsular ruptures were detected with indirect sign in 7 (7/12, 58.3%) on IF views and 1 (1/12, 8.3%) on ID views. All extracapsular ruptures (2/2, 100%) were demonstrable on both views. Incidental detection of implant ruptures on mammograms which could not be demonstrable on US or MRI was absent. The mean age of the ruptured implants was 16 years (range, 6 - 30 years). Breast cancer were found in 3 (3/1328, 0.2%); two cases were found only on ID views and the other one was demonstrable on both views. The mean average glandular dose per breast was 3.42 mGy for IF views and 1.88 mGy for ID views.

CONCLUSION

The diagnostic gain of IF views in screening of implant ruptures and breast cancer was low. The mean average glandular dose for IF views was 1.8 times higher than for ID views. Considering clinical low impact and cumulative radiation, routine performance of IF views for screening mammography need to be reconsidered.

CLINICAL RELEVANCE/APPLICATION

The number of women with breast augmentation is increasing, but there are no widely accepted imaging guidelines. Routine performance of IF views for screening mammography need to be reconsidered.

SSE14

Musculoskeletal (Foot and Ankle)

Monday, Nov. 30 3:00PM - 4:00PM Location: E450B

MK MR

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

Participants

Cree M. Gaskin, MD, Keswick, VA (*Moderator*) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc; ;
Kathryn J. Stevens, MD, Menlo Park, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSE14-01 Frondiform Ligament, Sinus Tarsi Bursa and Fluid about the Extensor Digitorum Longus Tendon: MRI Evaluation with Cadaveric Correlation

Monday, Nov. 30 3:00PM - 3:10PM Location: E450B

Participants

Ignacio Rossi, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
Zehava S. Rosenberg, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Chimere Mba-Jonas, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jonathan S. Zember, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Jenny T. Bencardino, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe the association between fluid in the sinus tarsi and fluid about the extensor digitorum longus tendon (EDL) based on MRI and cadaveric studies. The frondiform ligament (FL, also called stem of inferior extensor retinaculum) exits the sinus tarsi to form a sling around the EDL. The sinus tarsi bursa extends between the inferior extensor retinaculum and the dorsolateral talar neck and may communicate with the EDL sheath. We hypothesize that fluid can advance from the sinus tarsi, via the frondiform ligament or sinus tarsi bursa, and surround the EDL, simulating tenosynovitis.

METHOD AND MATERIALS

Patient's MRI studies: All ankle MRIs with key phrases "extensor digitorum longus tenosynovitis" and "sinus tarsi ganglion" as well as 100 consecutive ankle MRIs were retrospectively reviewed. All cases with history of EDL or anterior ankle pathology were excluded. Cadavers: 2 fresh frozen cadaveric ankle specimen underwent MRI after injection, under ultrasound guidance, of saline solution into EDL tendon sheath and of Gadolinium solution into the sinus tarsi fat.

RESULTS

Patients' MRI studies: Review of 258 MRIs revealed 31 cases (11 males, 20 female, age range 29-83, mean age 54), with sinus tarsi fluid, (15 encapsulated fluid sinus tarsi bursae, 16 non-encapsulated fluid), extending along FL toward EDL. In 30 cases (97%), fluid exited sinus tarsi, along FL, only partially surrounding the EDL. In 1 case fluid encircled the EDL. Most common associated findings included ligamentous injury (n= 10), posterior tibial tendon dysfunction (PTTD) (n = 9), flat-foot (n=6), osteoarthritis (n= 4). Cadavers: There was no MR evidence of communication between the EDL tendon sheath, FL or sinus tarsi after saline injection into the tendon sheath. Contrast was noted to exit the sinus tarsi dorsally, along FL, up to the EDL (n=1) and near EDL (n=1) on MRI images obtained after sinus tarsi injection.

CONCLUSION

Fluid within the sinus tarsi can advance via the FL or sinus tarsi bursa and partially or completely surround the EDL. This phenomenon, often seen with ligament injury or PTTD, should not be mistaken for tenosynovitis of EDL.

CLINICAL RELEVANCE/APPLICATION

Learning point: Before making the diagnosis of EDL tenosynovitis, the radiologist should ensure that the fluid is not originating from the sinus tarsi and extending along the FL or sinus tarsi bursa, to simulate tenosynovitis.

Honored Educators

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

Zehava S. Rosenberg, MD - 2014 Honored Educator
Jenny T. Bencardino, MD - 2014 Honored Educator

SSE14-02 Early Findings of Charcot Arthropathy on MR Imaging

Monday, Nov. 30 3:10PM - 3:20PM Location: E450B

Participants

Lodewijk J. van Holsbeeck, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc
Noam Belkind, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Viviane Khoury, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively identify early ligamentous, tendinous, and osseous injuries predictive of joint deformity characteristic of Charcot arthropathy.

METHOD AND MATERIALS

The MR imaging reports database was searched for the word "Charcot"; the resultant patient list was reviewed for the following inclusion criteria: 1) documented early Charcot arthropathy by clinical exam; or 2) follow-up imaging showing evolution into classic Charcot arthropathy. From the imaging perspective, only feet were included that had at least two MRI studies, with one study antedating the onset of clinical or imaging evidence of neuropathic deformity. Images were reviewed by a musculoskeletal radiologist with 20 years of experience in consensus with a musculoskeletal fellow for location of Charcot, as well as marrow, articular, ligamentous, tendinous and soft tissue findings on the initial MR exam. Findings on follow-up were documented.

RESULTS

Thirteen feet in twelve patients were identified with MR imaging preceding Charcot arthropathy. Six of the neuropathic changes were located at the Lisfranc joint, three at the Chopart joint, one at the metatarsophalangeal joints, and two at a combination of these joints. Findings that preceded the Charcot changes included subchondral bone marrow edema in 10/13, subchondral fracture in 3/13, tear of a supporting ligament in 8/13, and tendinopathy in 3/13. Interestingly, of the 7 patients with eventual Charcot arthropathy at the Lisfranc joint, none had Lisfranc ligament tears on earlier MRI imaging. In general, the pattern of bone marrow edema and ligamentous/tendinous tears demonstrated on early MRI studies predicted the location of eventual Charcot arthropathy.

CONCLUSION

Paying close attention to subchondral and subtle ligamentous findings in diabetic feet can help detect neuropathic changes early, at a stage when these injuries are still manageable conservatively.

CLINICAL RELEVANCE/APPLICATION

Identification of initial ligamentous injuries preceding Charcot arthropathy in the diabetic population could assist surgeons in early intervention and prevention of late deformity.

SSE14-03 Accessory Anterolateral Talar Facet in Symptomatic and Asymptomatic Populations: Prevalence and Relevant Associated Findings on Ankle MRI

Monday, Nov. 30 3:20PM - 3:30PM Location: E450B

Participants

Ustun Aydingoz, MD, Ankara, Turkey (*Presenter*) Speaker, AbbVie Inc; Spouse, Stockholder, Edita Medical Writing Editing Ltd; Spouse, Employee, Edita Medical Writing Editing Ltd;

O. Melih Topcuoglu, MD, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose

Aysegul Gormez, MD, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose

Tijen Cankurtaran, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose

Elif D. Topcuoglu, MD, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose

Fatma Bilge Ergen, MD, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the prevalence of and relevant findings associated with the accessory anterolateral talar facet (AALTF), which has been reportedly implicated in talocalcaneal impingement under certain conditions, on ankle MRI in symptomatic and asymptomatic persons.

METHOD AND MATERIALS

This is a case-control study with institutional review board approval. Two observers independently reviewed routine 1.5-T or 3-T MRI (that included --but was not limited to-- sagittal T1W and fat-suppressed T2W sequences) of 110 symptomatic ankles (61 right, 49 left) in 100 consecutive patients (54 females, 46 males; age range, 16-79 years [mean, 41.5]) and limited (sagittal T1W and fat-suppressed T2W sequences) 1.5-T MRI of 104 age-, gender-, and side-matched ankles in 104 asymptomatic volunteers for the presence of AALTF (Figure). Exclusion criteria for both symptomatic and asymptomatic groups included history of acute or chronic fracture and/or operation at the ankle, and the presence of a neoplastic bone or soft tissue mass at the ankle. In the asymptomatic group, an additional exclusion criterion was the presence of any injury (including sprain) to the ankle in the last 30 days. Calcaneal cortical thickness, and talar or calcaneal fibrocystic and/or edema-like bone marrow changes at the critical angle of Gissane were noted.

RESULTS

There was no statistically significant difference between the symptomatic and asymptomatic populations with respect to age (mean and distribution), gender, and ankle side. AALTF was present in 36 symptomatic (32.7%) versus 27 asymptomatic (26.0%) ankles ($P=0.297$). Interobserver agreement was very good ($\kappa=0.851$, 95% CI=0.772-0.929) for the detection of AALTF. Subjacent talar bone marrow edema-like change was significantly more frequent in persons with AALTF ($P<0.0001$), while chronic reactive osseous changes at Gissane angle were not ($P>0.05$).

CONCLUSION

Higher prevalence of AALTF on MRI in symptomatic versus asymptomatic ankles is not statistically significant. AALTF may be associated with subjacent talar bone marrow edema-like change.

CLINICAL RELEVANCE/APPLICATION

Accessory anterolateral talar facet, which has been reported to have a role in talocalcaneal impingement, is identified on MRI in one quarter of asymptomatic persons and may be associated with subjacent bone marrow edema-like change in both symptomatic and asymptomatic populations.

SSE14-04 Association of Superior Peroneal Retinaculum Abnormalities with Lateral Ankle Ligament Injuries

Monday, Nov. 30 3:30PM - 3:40PM Location: E450B

Participants

Connie Y. Chang, MD, Boston, MA (*Presenter*) Nothing to Disclose
Ambrose J. Huang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Corey M. Gill, BS,BA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Frank J. Simeone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Miriam A. Bredella, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Martin Torriani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Inversion stress ankle sprain with injury to the lateral collateral ankle ligament complex is one of the most common sports injuries. The superior peroneal retinaculum has a close anatomic relationship to the lateral collateral ankle ligament complex, and chronic inversion stress also leads to laxity and injury of the superior peroneal retinaculum. Therefore, we sought to evaluate whether there is an association between ankle lateral collateral ligament complex injuries and superior peroneal retinaculum injury.

METHOD AND MATERIALS

Our study was IRB approved and complied with HIPAA guidelines. One hundred consecutive ankle MRI cases were obtained from July to September in 2013 and were evaluated for anterior talofibular ligament (ATFL), calcaneofibular ligament (CFL), posterior talofibular ligament (PTFL), superior peroneal retinaculum (SPR) sprain and tear by two independent readers. If the SPR was torn, peroneus longus (PL) and peroneus brevis (PB) tendons were also evaluated for subluxation. Chi-squared test was used to evaluate for correlation between abnormalities of these structures. Interobserver agreement was also calculated.

RESULTS

Of the 100 cases, 1 was excluded because of prior lateral ankle ligament reconstruction surgery, and 2 were excluded because of motion leading to poor image quality. Of the 97 remaining cases, the mean age was 50 ± 16 (18-90) years, and there were 35 males and 62 females. Inter-reader agreement was very good for all categories. Among the 97 cases, 69 (71%) had an abnormal ATFL, 62 (64%) had an abnormal ATFL and CFL; 28 (29%) had an abnormal ATFL, CFL, and PTFL; and 47 (48%) had an abnormal SPR. There were three SPR sprains with normal lateral collateral ankle ligaments. All other SPR injuries occurred in the setting of both ATFL and CFL injuries; there were no SPR injuries occurring with isolated ATFL injuries. There was a statistically significant correlation between ATFL and SPR abnormalities ($P = 0.0001$), ATFL/CFL and SPR abnormalities ($P < 0.0001$), and ATFL/CFL/PTFL and SPR abnormalities ($P = 0.0003$).

CONCLUSION

Lateral collateral ankle ligament injuries have a statistically significant correlation with superior peroneal retinaculum injuries.

CLINICAL RELEVANCE/APPLICATION

The SPR are common and should be closely evaluated in the setting of lateral collateral ligament complex injuries.

SSE14-05 Bone Bruise vs. Non-displaced Fracture at MRI: A Novel Grading System to Guide Reporting and Predict Return to Play

Monday, Nov. 30 3:40PM - 3:50PM Location: E450B

Participants

Blake Bowden, Philadelphia, PA (*Presenter*) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Peter F. DeLuca, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Johannes B. Roedl, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
James M. McCrossin, MS, Voorhees, NJ (*Abstract Co-Author*) Nothing to Disclose
Sandra Rutigliano, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc

PURPOSE

MRI is the standard of care imaging modality for suspected radiographically occult fracture from direct trauma. To date, MR criteria for bone contusion vs. fracture are not well established. We sought to generate an algorithm using MR to grade traumatic nondisplaced osseous injury in a cohort of athletes with trauma by correlating specific MR findings and imaging patterns with clinical scenarios and return to play (RTP).

METHOD AND MATERIALS

20 MR exams of the lower extremity (1.5T, extremity coil, 16 initial, 4 follow-up) in 15 professional hockey players with direct trauma and normal radiographs were reviewed by 2 MSK radiologists blinded to additional clinical information. Bone marrow edema (BME) was graded as 1=patchy/ill defined, 2=focal and mild, 3=focal and intense, 4=intense throughout bone. Marrow replacement on T1 weighted sequences was observed along with small and large regions of linear or curvilinear hypointensity. Presence and number of cortical breaches were observed as well as microtrabecular disruption, soft tissue contusion and hematoma. Locations of osseous injury were categorized as weight-bearing or not, and subenthelial or not.

RESULTS

MRIs included 9 foot, 6 ankle and 1 proximal tibia. Mean interval from injury to MR was 0.8 days and mean interval to follow-up MR was 10.3 days. Mean RTP for athletes with any linear hypointensity on MR was 10.8 days vs. 7.5 days for those without ($\alpha = .267$ unpaired t-test) and there was no difference in RTP for small vs large or curvilinear hypointensities. Mean RTP for athletes with T1 marrow replacement and grade 3 marrow edema in a weight-bearing location on MRI was 13.5 days vs. 4.2 days those without ($\alpha = .040$). Subenthelial lesions had a slightly longer RTP without statistical significance. 6 subjects had CT and all were observed as normal. No cortical breaches were observed. 3/4(75%) subjects with grade 1 BME had a RTP within 2 days. Soft tissue edema and hematoma did not correlate with RTP.

CONCLUSION

The MRI constellation of T1 marrow replacement, grade 3 BME and weight-bearing location correlates with a longer return to play than other MRI findings including linear hypointensities and microtrabecular disruption, and can be reported as nondisplaced fracture.

CLINICAL RELEVANCE/APPLICATION

With non-displaced traumatic osseous injury, MRI should be interpreted as non-displaced fracture when focal intense subcortical bone marrow edema is accompanied by T1 marrow replacement.

SSE14-06 Association of Tarsal Tunnel Disease with Medial Hindfoot Coalitions

Monday, Nov. 30 3:50PM - 4:00PM Location: E450B

Participants

Catherine N. Petchprapa, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Zehava S. Rosenberg, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jenny T. Bencardino, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ignacio Rossi, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Erin FitzGerald, MD, Bronx, NY (*Presenter*) Nothing to Disclose

PURPOSE

Medial hindfoot coalitions, particularly posterior extra-articular and overlap coalitions, may have large medial and posteromedial osseous excrescences which extend into and produce, in conjunction with flat foot deformity, stretching and mass effect on the tarsal tunnel. Resection of the coalition without addressing pathology of these soft tissue structures can result in surgical failure and continued disability to the patient. Yet, to the best of our knowledge, there is scant information about this topic in the literature. We hypothesize that soft tissue disease in the tarsal tunnel is a frequent phenomenon, in the setting of hindfoot coalitions.

METHOD AND MATERIALS

A search of our ankle MRI data base revealed 88 cases with medial hindfoot coalitions. All cases were independently and retrospectively reviewed by 2 musculoskeletal radiologists for the presence of neuritis, manifested by focally increased nerve caliber and signal, of the posterior tibial nerve and its medial and lateral plantar branches. The posterior tibial (PT), flexor hallucis longus (FHL) and flexor digitorum longus (FDL) were assessed for the presence of tendinosis, tenosynovitis and partial tearing.

RESULTS

The final cohort included 68 cases of medial hindfoot (middle, posterior extra-articular and overlap) coalition (37 men, 31 women, average age 40, range 72-8). Neuritis of the posterior tibial nerve and its branches (n= 18, 26%) was more commonly noted in the medial plantar nerve. Entrapment of FHL by osseous coalition-related posteromedial excrescences was seen in 14 cases (21%). Other tendon disorders such as flattening and stretching against sharp bony edges, tendinosis, partial tearing and tenosynovitis were noted in the FHL (n=30, 44%) and FDL (n=22, 32%). PT tendinosis and tearing was less common (n= 9, 13%).

CONCLUSION

Medial hindfoot coalitions are commonly associated with tarsal tunnel soft tissue abnormalities affecting the posterior tibial nerve and its branches, the FHL tendon and less commonly FDL and PT tendons.

CLINICAL RELEVANCE/APPLICATION

The radiologist should alert the referring physician for the presence of tarsal tunnel abnormalities in the presence of medial hindfoot coalition since these can guide surgical treatment and outcome.

Honored Educators

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

Zehava S. Rosenberg, MD - 2014 Honored Educator
Jenny T. Bencardino, MD - 2014 Honored Educator

SSE08

Gastrointestinal (Gastrointestinal Bleeding and Ischemia)

Monday, Nov. 30 3:00PM - 4:00PM Location: E353C



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

Participants

Tracy A. Jaffe, MD, Durham, NC (*Moderator*) Nothing to Disclose
Joel G. Fletcher, MD, Rochester, MN (*Moderator*) Grant, Siemens AG; ;

Sub-Events

SSE08-01 Diagnostic Yield and Efficacy of Multi-phase CT Enterography (mpCTE) in Patients with Obscure GI Bleeding

Monday, Nov. 30 3:00PM - 3:10PM Location: E353C

Participants

Krishna Pundi, BS, Rochester, MN (*Presenter*) Nothing to Disclose
Parakkal Deepak, MBBS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
David Bruining, MD, Rochester, MN (*Abstract Co-Author*) Research Grant, Given Imaging Ltd Consultant, Bracco Group
Jeff L. Fidler, MD, Rochester, MN (*Abstract Co-Author*) Research Grant, Beekley Corporation
John M. Barlow, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Stephanie Hansel, MD, Rochester, MN (*Abstract Co-Author*) Research support, Given Imaging Ltd; Advisory Board, Medtronic, Inc
Michael L. Wells, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Joel G. Fletcher, MD, Rochester, MN (*Abstract Co-Author*) Grant, Siemens AG; ;

PURPOSE

We sought to estimate the diagnostic yield of multi-phase CT enterography (mpCTE) in patients with obscure GI bleeding (OGIB).

METHOD AND MATERIALS

We retrospectively examined medical records for OGIB patients who underwent mpCTE from 2006 to 2014. mpCTE was performed using IV contrast (with arterial, enteric, and delayed phases) and 1850 cc of neutral oral contrast. Clinical mpCTE reports were reviewed and causes of OGIB (small bowel (SB) mass, vascular lesion, inflammation, hemorrhage, or other pathology) were recorded. mpCTE results were compared to further evaluation (surgery (n=108), balloon-assisted endoscopy (BAE, n=247), capsule endoscopy (n=416), angiography (n=31), and other tests (n=171)). In patients with medical follow-up at 1 year, re-bleeding and continued iron supplementation were recorded.

RESULTS

1087 patients (90% with prior upper and lower endoscopy) underwent mpCTE for OGIB (486 overt, 601 occult). Total diagnostic yield was 31.6% (344/1087), with 269 patients having small bowel findings (24.7%). Positive exams included 126 SB vascular causes, 72 SB masses, 52 with SB inflammation, 7 SB hemorrhage only and 87 other findings. In 344 patients a definitive cause of GI bleeding established by secondary testing, 187 (54%) had concordant mpCTE diagnoses. In this group, positive predictive value varied by etiology (mass 98% (55/56); inflammation 94% (31/33); vascular 82% (44/54); hemorrhage 100% (3/3); other 76% (31/41); Figure 1). The most common cause of non-SB GI bleeding was cecal and rectal vascular lesions (27%; 24/89). For patients with further clinical testing or intervention and 1 year follow-up (n = 205), the rate of re-bleeding or continued iron dependence following positive mpCTE was 43% vs. 69% for those with a negative mpCTE (P < 0.0003).

CONCLUSION

mpCTE has an estimated diagnostic yield of 31.6% and a significantly reduced rate of re-bleed or continued iron dependence following a positive exam. It is a reliable screen for causes of SB bleeding in OGIB patients, and identifies many etiologies of GI bleeding outside of the SB.

CLINICAL RELEVANCE/APPLICATION

mpCTE has an overall diagnostic yield of 31.6% in OGIB patients, and is an effective screen for small bowel and non-small bowel GI bleeding sources not identified on upper and lower endoscopy.

SSE08-02 Clinical Significance of Pneumatosis Intestinalis in the Emergency Department - Correlation of MDCT Findings with Patients' Outcome

Monday, Nov. 30 3:10PM - 3:20PM Location: E353C

Participants

Rafael Duran, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Marc-Olivier Treyvaud, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Jean-Francois Knebel, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Reto A. Meuli, MD, PhD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Sabine Schmidt, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the clinical significance of pneumatosis intestinalis (PI) found on multidetector computed tomography (MDCT) in the emergency department.

METHOD AND MATERIALS

MDCT scans of 149 consecutive emergency patients (53 women, mean age 64) with PI of the stomach (n=4), small (n=68) and/or large bowel wall (n=96) were reviewed by two radiologists. PI extension, distribution and possible association with portomesenteric venous gas (PMVG) were correlated with other MDCT-findings (e.g. bowel wall thickening, mural contrast-enhancement, target sign, luminal dilation), patients' symptoms, risk factors, clinical management, laboratory, histopathology, final diagnosis and outcome.

RESULTS

The most frequent cause of PI (n=80 [53.7%]) was bowel ischemia, followed by infection (n=18 [12.1%]), obstructive (n=12 [8.1%]) and non-obstructive (n=10 [6.7%]) bowel dilatation, unknown aetiologies (n=8 [5.4%]), drugs (n=8 [5.4%]), inflammation (n=7 [4.7%]), and others (n=6 [4%]). Neither distribution nor extension of PI significantly correlated with underlying ischemia. Overall mortality was 41.6% (n=62), mostly related to intestinal ischemia (p=0.003). Associated PMVG or the distribution of PMVG significantly correlated with underlying ischemia (p=0.001 and p=0.004, respectively). Absence of mural contrast-enhancement was the only MDCT-feature significantly associated with ischemia (p=7.484x10⁻⁶). The degree of calcified atherosclerosis, as evaluated by MDCT, significantly correlated with underlying ischemia (p=0.024), unlike other cardiovascular risk factors (p=0.723). Patients with PI due to ischemia had a significantly higher fatal outcome (p=0.003) compared to non-ischemic aetiologies, regardless of their age.

CONCLUSION

PI was caused by various disorders with intestinal ischemia being the most common aetiology with the highest mortality. PMVG and/or absence of mural contrast-enhancement in association with PI may be considered signs of underlying bowel ischemia.

CLINICAL RELEVANCE/APPLICATION

Although intestinal ischemia is the most common aetiology of PI, this sign can be seen with other disorders. Thus it is mandatory to look for other signs such as PMVG and/or absence of mural contrast-enhancement associated with PI to correctly diagnose bowel ischemia in the appropriate clinical context.

SSE08-03 Pneumatosis Intestinalis in Oncology Patients: CT Findings, Clinical Correlates and Outcomes

Monday, Nov. 30 3:20PM - 3:30PM Location: E353C

Participants

Carlton Smith, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

Lei Zheng, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Karen B. Bleich, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Elliot K. Fishman, MD, Owings Mills, MD (*Abstract Co-Author*) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

Pamela T. Johnson, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We have observed oncology patients who develop pneumatosis intestinalis without clinical indicators of an acute abdominal process. This study was designed to evaluate these patients in an attempt to guide management.

METHOD AND MATERIALS

A retrospective search of CT reports from 2004-2014 identified 21 adult subjects undergoing cancer treatment with new pneumatosis on CT. Electronic medical records were reviewed to determine underlying malignancy, medications, presentation, lactate level and course. CT images were reviewed for location of pneumatosis, pneumoperitoneum, mesenteric or portal vein gas and follow up CT findings.

RESULTS

Subjects included 15 men and 7 women with mean age 60 years (range 25-79 years). Four subjects with bowel obstruction were excluded. Chemotherapeutic agents in the remaining 17 were: FOLFOX (5FU, oxaplatin) FOLFOX (5FU, oxaplatin) + bevacizumab imatinib cisplatin +gemcitabine pemetrexed, carboplatin + bevacizumab, then erlotinib + bevacizumab rituximab-CHOP docetaxel + bevacizumab chemoradiation + temozolamide rituximab +methylprednisolone alemtuzumab ara-C + DLI afatinib + metformin everolimus sunitinib carboplatin, 5FU + cetuximab s/p induction with 7+3 and HiDAC in 17 nonobstructed subjects, pneumatosis involved small bowel in 3, small and large bowel in 2, right colon in 10, left colon in 1, entire colon in 1. Nine of 17 (53%) had localized or free pneumoperitoneum and 1 had mesenteric vein gas. One post-op patient who died likely had ischemic bowel, and the diagnosis was equivocal in a 2nd. A 3rd patient's death was attributed to refractory GVHD. These 3 subjects had elevated lactate. Two others underwent surgery, with surgical diagnosis of no small bowel ischemia in 1 and pathologic diagnosis of colon ulceration and mucosal bacterial overgrowth in the 2nd. A benign clinical course and resolution of pneumatosis on CT was documented in 12 observed patients with adequate clinical follow up, ranging from 2-46 months. Lactate was normal in 6/6 tested.

CONCLUSION

In oncology patients, intestinal pneumatosis without bowel obstruction may be self limited. Lactate level was elevated in life threatening causes in this small series.

CLINICAL RELEVANCE/APPLICATION

Management algorithms should consider that pneumatosis may be a nonsurgical complication of chemotherapy rather than bowel ischemia in the oncology patient population.

Honored Educators

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Elliot K. Fishman, MD - 2012 Honored Educator

Elliot K. Fishman, MD - 2014 Honored Educator

SSE08-04 CT Angiography in the Setting of Suspected Acute Mesenteric Ischemia: Prevalence of Ischemic and Alternative Diagnoses

Monday, Nov. 30 3:30PM - 3:40PM Location: E353C

Participants

Frank Oliver G. Henes, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Perry J. Pickhardt, MD, Madison, WI (*Abstract Co-Author*) Co-founder, VirtuoCTC, LLC; Stockholder, Celectar Biosciences, Inc; Research Consultant, Bracco Group; Research Consultant, KIT ; Research Grant, Koninklijke Philips NV
Utaroh Motosugi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Meghan G. Lubner, MD, Madison, WI (*Abstract Co-Author*) Grant, General Electric Company; Grant, NeuWave Medical, Inc; Grant, Koninklijke Philips NV
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard Schon, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Bannas, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the prevalence of ischemic and alternative diagnoses and the diagnostic accuracy of CT angiography (CTA) in the setting of suspected acute mesenteric ischemia (AMI).

METHOD AND MATERIALS

This retrospective study was HIPAA- and IRB-compliant; informed consent was waived. We included 959 patients that underwent CTA for evaluation of suspected AMI. The final clinical diagnosis as determined by the treating clinician was used to determine the prevalence of ischemic and alternative diagnoses. Prevalence of diagnoses by age, sex and admission status was compared using the Cochran-Armitage Trend-Test. The diagnostic accuracy of CTA was calculated using the final clinical diagnosis as standard of reference.

RESULTS

The prevalence was 18.7% (179/959) for AMI and 62.4% (598/959) for a specific alternative diagnosis, in the remaining 20.7% (198/959) no final clinical diagnoses was established. The most frequent type of AMI was occlusive arterial ischemia (53.3%; 88/179), followed by nonocclusive ischemia (40.6%; 67/179), and mesenteric vein thrombosis (6.1%; 10/179). The most frequent alternative diagnoses were small bowel obstruction (11.6%; 62/598), colitis (10.2%; 54/598), cholecystitis (6.8%; 36/598), diverticulitis (6.6%; 35/598), and pneumonia (6.4%; 34/598). The prevalence of AMI was significantly higher in older patients ($P<.001$) and the prevalence of specific alternative diagnoses varied significantly according to both age ($P<.0001$) and admissions status ($P=0.0015$). CTA had a sensitivity and specificity for diagnosis of AMI of 89%/99% and for alternative diagnoses of 87%/86%.

CONCLUSION

In the vital clinical setting of suspected AMI, the prevalence of ischemic and alternative diagnoses varies significantly by age, sex and admission status. CTA provides for rapid and non-invasive diagnosis with high diagnostic accuracy, allowing for triage of 80% of the patients.

CLINICAL RELEVANCE/APPLICATION

The high diagnostic accuracy for both ischemic and alternative diagnoses demonstrates the high diagnostic yield of CTA and further supports the triage role of CT in the setting of suspected AMI. Knowledge of the prevalence and the demographic distribution of the alternative diagnoses in the setting of suspected AMI may help the radiologist with diagnosis finding and thereby the referring clinicians in their treatment decisions.

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

SSE08-05 Dual-Energy Computed Tomography and Iodine Mapping are Superior to Conventional CT in the Diagnosis of Early and Established Intestinal Ischemia and Infarction

Monday, Nov. 30 3:40PM - 3:50PM Location: E353C

Participants

Pedro Lourenco, MD, Vancouver, BC (*Presenter*) Nothing to Disclose
Ryan Rawski, BSc, MSc, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Mohammed F. Mohammed, MBBS, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Kathryn Darras, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Patrick D. McLaughlin, FFRCSI, Cork, Ireland (*Abstract Co-Author*) Speaker, Siemens AG

PURPOSE

Acute intestinal ischemia and infarction are devastating abdominal emergencies, with mortality rates up to 93%. Clinical presentation is varied, with significant overlap with other acute abdominal disease. CT sensitivity for detection of acute bowel ischemia is poor, with reported values ranging from 60-80%. CT detection of bowel ischemia is challenging given that CT findings are non-specific. Here, we evaluate the utility of dual-energy CT (DECT) and iodine mapping in the diagnosis of acute intestinal

ischemia.

METHOD AND MATERIALS

64 consecutive patients presented to the emergency department of a quaternary hospital with features of acute intestinal ischemia or infarction between 2013 and 2014. Abdominal DECT (100 and 140 keV) with derived iodine maps (Liver VNC algorithm, Siemens) were reconstructed. An iodine map window of 270/160 was determined optimal for assessment of the intestinal mucosa (data not shown). Laboratory, clinical and pathological outcomes were recorded. Two abdominal trained radiologists were blinded to outcomes and independently rated the concordance of conventional CT and iodine maps with pathological outcomes. Qualitative analysis was also performed.

RESULTS

18 of 64 cases were confirmed to represent intestinal ischemia or infarction on surgical pathology, colonoscopy or due to death from intestinal infarction. Conventional 120 keV CT sensitivity, specificity, PPV and NPV for acute ischemia or infarction were 77.8% (95% CI 52.4-93.5), 89.1% (76.4-96.33), 73.7% (48.8-97.8) and 91.1% (78.8-97.5), respectively. Iodine maps were more robust than conventional 120 keV CT in the diagnosis of this disease entity, demonstrating sensitivity, specificity, PPV and NPV of 94.4% (72.6-99.1), 93.5% (82.1-98.6), 85.0% (62.1-96.6) and 97.7% (87.9-99.6), respectively. Quantitative evaluation showed good intra and inter observer reproducibility. Iodine maps increased interpreter confidence by 20%, and interpreters considered iodine maps useful in 83% of cases.

CONCLUSION

DECT iodine mapping increase conspicuity of ischemic bowel and allow for evaluation of intestinal perfusion. Iodine maps are a reliable and reproducible imaging adjunct, which offer a robust increase in sensitivity and specificity in the diagnosis of acute intestinal ischemia or infarction over conventional CT, up to 94.4% and 93.5%, respectively.

CLINICAL RELEVANCE/APPLICATION

DECT iodine maps are superior to conventional CT in the diagnosis of intestinal ischemia.

SSE08-06 Retrospective Evaluation of Small Bowel Gastrointestinal Stromal Tumors: Impact of CT Enterography

Monday, Nov. 30 3:50PM - 4:00PM Location: E353C

Participants

Rogério Vasconcelos, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Steven Dolan, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
John M. Barlow, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Michael L. Wells, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Shannon P. Sheedy, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jeff L. Fidler, MD, Rochester, MN (*Abstract Co-Author*) Research Grant, Beekley Corporation
Thomas C. Smyrk, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Joel G. Fletcher, MD, Rochester, MN (*Abstract Co-Author*) Grant, Siemens AG ;

PURPOSE

Small bowel Gastrointestinal Stromal Tumors (sbGISTs) often have an indeterminate malignant potential and can be discovered in the workup of obscure GI bleeding (OGIB) or incidentally at abdominopelvic CT. We sought to determine the impact of CT enterography for sbGIST detection at our institution in a consecutive series of pathologically proven tumors.

METHOD AND MATERIALS

We retrospectively evaluated all histologically proven sbGISTs from 1998 to 2013. We created a biologic Aggressiveness Score (AS) based on initial histologic grading (low, intermediate, or high grade; or malignant) and clinical follow-up. All low to high grade sbGISTs were upgraded to AS category of malignant if local or distant metastases developed during clinical follow-up. Date and findings at clinical presentation, CT protocol {single-phase CTE [spCTE], multi-phase CTE [mpCTE], and other abdominopelvic CT (oAPCT)} were compared with the AS score.

RESULTS

83 patients with proven sbGISTs had low (n=42), intermediate (n=9), high-grade (n=10), or malignant tumors (n=22) AS. 23 patients (28%) had mpCTE, 15 (18%) had spCTE, and 45 (54%) had oAPCT exams. Mean clinical follow up was 36 months (for CTE and oAPCT exams). Over the time interval, the number of malignant sbGISTs remained constant (1-2 per year), but the number of low and intermediate grade tumors increased substantially (mean 0.7 per year from 1998-2005 to mean 5.8 per year from 2006-2013), as did the total number of sbGISTs. 34 pts with sbGISTs underwent CT for OGIB, with 5/27 (19%) of CTE exams identifying malignant sbGISTs, compared to 4/7 (57%) for oAPCT. CTE exams detecting sbGISTs were predominantly performed for OGIB (27/38; 71%), while oAPCT exams identified sbGISTs incidentally for non-OGIB indications (29/45; 64%). The average size of sbGISTs detected by CTE was 3.9 vs. 7.5 cm for oAPCT.

CONCLUSION

The incidence of sbGISTs appears to be increasing, in large part due to the increased detection of these tumors with CTE, usually performed in OGIB patients. The majority of sbGISTs detected with CTE are not malignant.

CLINICAL RELEVANCE/APPLICATION

The incidence of non-malignant small bowel GIST tumors is increasing dramatically, likely due to the use of CTE in OGIB, while the number of malignant GISTs has remained stable since 1998.

SSE09

Gastrointestinal (Liver Functional Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: E451A

GI **MR**

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

FDA Discussions may include off-label uses.

Participants

Claude B. Sirlin, MD, San Diego, CA (*Moderator*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;
Aliya Qayyum, MBBS, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSE09-01 MR Elastography in Combination with MRI Proton Density Fat Fraction for Prediction of Advanced Hepatic Fibrosis in Adults with Non-Alcoholic Fatty Liver Disease

Monday, Nov. 30 3:00PM - 3:10PM Location: E451A

Participants

Paul Manning, MSc, La Jolla, CA (*Presenter*) Nothing to Disclose
Kang Wang, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Jonathan C. Hooker, BS, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
William Haufe, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Tanya Wolfson, MS, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Anthony Gamst, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Michael S. Middleton, MD, PhD, San Diego, CA (*Abstract Co-Author*) Consultant, Allergan, Inc Institutional research contract, Bayer AG Institutional research contract, sanofi-aventis Group Institutional research contract, Isis Pharmaceuticals, Inc Institutional research contract, Johnson & Johnson Institutional research contract, Synageva BioPharma Corporation Institutional research contract, Takeda Pharmaceutical Company Limited Stockholder, General Electric Company Stockholder, Pfizer Inc Institutional research contract, Pfizer Inc
Richard L. Ehman, MD, Rochester, MN (*Abstract Co-Author*) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc; Research Grant, Resoundant, Inc
Rohit Loomba, MD, MSc, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD, San Diego, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;

PURPOSE

To determine in adults with non-alcoholic fatty liver disease (NAFLD), whether the combination of magnitude MRI (M-MRI)-estimated proton density fat fraction (PDFF) with MR elastography (MRE)-estimated liver stiffness improves the prediction of advanced fibrosis compared to MRE-estimated liver stiffness alone.

METHOD AND MATERIALS

This retrospective analysis included 123 adults with confirmed NAFLD (49 men, mean age 52 yrs, range 19-76 yrs) who underwent M-MRI and MRE within 90 days of liver biopsy. Biopsies were scored based on NASH CRN criteria; 46%, 27%, 14%, 9% and 4% of adults had stage 0, 1, 2, 3, and 4 fibrosis, respectively. Fibrosis stages 3-4 were considered to be advanced fibrosis. PDFF was estimated by M-MRI performed with low flip angle to avoid T1 weighting, and with six nominally in- and out-of-phase echoes to correct for T2*. Stiffness was estimated by each of two MRE methods (3D 40Hz, 3D 60Hz). Logistic regression was performed for each MRE method alone, and for each MRE method in combination with PDFF, to predict advanced fibrosis. AUROCs were calculated for each logistic regression model and compared pairwise using chi-squared tests.

RESULTS

For 3D MRE 40Hz and 3D MRE 60Hz, AUROCs (95% CI) for predicting advanced fibrosis with MRE alone were 0.960 (0.907, 1) and 0.948 (0.881, 1), respectively. AUROCs (95% CI) for predicting advanced fibrosis with MRE in combination with PDFF for these two methods were 0.970 (0.920, 1) and 0.962 (0.906, 1), respectively. Each of these AUROCs was significantly greater than the corresponding AUROC achieved with MRE alone (p-values 0.007 and 0.012).

CONCLUSION

In adults with NAFLD, M-MRI estimated PDFF combined with MRE-estimated liver stiffness provided a small but statistically significant improvement for predicting advanced fibrosis compared to MRE alone.

CLINICAL RELEVANCE/APPLICATION

Estimation of both hepatic PDFF and liver stiffness in a single MR examination may improve prediction of advanced fibrosis in adults with NAFLD, but further study is needed to confirm the results.

SSE09-02 Liver Hemodynamics Quantification with DCE-MRI for Hepatic Reserve Function Assessment in Patients with Post-hepatic Liver Cirrhosis (PHLC)

Monday, Nov. 30 3:10PM - 3:20PM Location: E451A

Participants

Lan Zhang, Zhengzhou, China (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the value of (dynamic contrast-enhanced magnetic resonance imaging, DCE-MRI) for hepatic reserve function assessment in patients with Post-hepatic liver cirrhosis (PHLC)

METHOD AND MATERIALS

Ten normal subjects, ten mild PHLC patients (Child-Pugh score 5-6) and ten moderate PHLC patients (Child-Pugh score 7-9) were prospectively enrolled and underwent DCE-MRI before clinical treatment. All data were calculated with Exchange Model fitting Pharmacokinetic curve and various parameters were measured, including volume transfer constant of the contrast agent (K_{trans}), Reverse reflux rate constant (K_{ep}), Volume fraction of EES (V_e), full perfusion (FP), hepatic arterial perfusion index (HPI), blood volume (BV), blood flow (BF) mean transit time (MTT). All data was assessed with ANOVA and LSD test was used to compare the differences between each two groups. $P < 0.05$ was considered statistically significant.

RESULTS

Compared with normal liver, increases of HPI and FP were found significant in mild PHLC group ($p < 0.05$), as well as in moderate PHLC group ($p < 0.01$). MTT was constant between normal group and mild PHLC group, but increased in moderate PHLC group ($p < 0.05$). BF was found no significant difference between normal and mild PHLC group, but decreased in moderate PHLC group ($p < 0.05$). BV was found no statistical difference between each two groups of three groups. Compared with normal group, K_{trans} , K_{ep} and V_e were found no significant in mild PHLC group ($p > 0.05$), only V_e increased in moderate PHLC group ($p < 0.05$).

CONCLUSION

The quantified DCE-MRI parameters, such as HPI, FP, MTT and V_e could be helpful to evaluate hepatic reserve function of PHLC.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI suggests that it could be used as an important index for the degree of PHLC and hepatic reserve function assessment.

SSE09-03 Biliary Tract Enhancement during the Hepatobiliary Phase in Gadoteric Acid-enhanced MRI: Correlation with Non-invasive Biomarker Associated with Liver Function and Fibrosis

Monday, Nov. 30 3:20PM - 3:30PM Location: E451A

Participants

Yoshifumi Noda, MD, Gifu, Japan (*Presenter*) Nothing to Disclose
Satoshi Goshima, MD, PhD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Haruo Watanabe, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Kawada, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Nobuyuki Kawai, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiromi Ono, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Masayuki Kanematsu, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Kyongtae T. Bae, MD, PhD, Pittsburgh, PA (*Abstract Co-Author*) Patent agreement, Medtronic, Inc; Consultant, Otsuka Holdings Co, Ltd

PURPOSE

To evaluate the correlation between the magnetic resonance (MR) imaging measurements and non-invasive biomarker associated with liver function and fibrosis in gadoteric acid-enhanced MR imaging.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board and written informed consent was waived. One hundred thirty nine consecutive patients (89 men and 50 women, age range 33-87 years, mean age 67 years \pm 12.6 [standard deviation]) with suspected a liver disease or liver tumor underwent gadoteric acid-enhanced MR imaging. Patients were classified into two groups according to the model for end-stage liver disease (MELD) score: MELD group A, MELD score ≤ 10 ($n = 129$); MELD group B, MELD score > 10 ($n = 10$). We calculated the following liver function indices: the biliary tract structure-to-muscle signal intensity ratio (SIR), relative enhancement of the liver and, liver-to-spleen ratio. MR imaging measurements and Child-Pugh score or MELD score were then compared.

RESULTS

Multiple regression analysis showed that SIR of common bile duct and cystic duct were the most significantly correlated with Child-Pugh score ($P < 0.0001$) and MELD score ($P = 0.0017$), respectively. The sensitivity, specificity, and area under the receiver-operating-characteristic curve for the detection of patients with Child-Pugh class B or C, and MELD group B were 74%, 88%, and 0.86 with the SIR of common bile duct and 100%, 87%, and 0.94 with the SIR of cystic duct, respectively.

CONCLUSION

The SIRs of cystic duct and common bile duct can be a non-invasive and valuable imaging biomarker for the estimation of liver function.

CLINICAL RELEVANCE/APPLICATION

Our study demonstrated the SIRs of cystic duct and common bile duct possibly correlate with non-invasive biomarker associated with liver function and fibrosis. This index may be an important quantitative biomarker for the evaluation of liver function and fibrosis.

SSE09-04 Multidisciplinary Evaluation of Congestive Hepatopathy after Fontan Procedure - Preliminary Results

Monday, Nov. 30 3:30PM - 3:40PM Location: E451A

Participants

Nataly d. Horvat, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Rocha Manoel, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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Denise Vezozzo, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Joao Rafael T. Vicentini, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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Angelica Binotto, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Flair J. Carrilho, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Mariana P. Pacheco, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze the frequency of hepatopathy in a group of patients submitted to Fontan Procedure (FP) at our Hospital.

METHOD AND MATERIALS

In this cross-sectional study, 15 patients from our Hospital Cardiology department were evaluated from august 2014 to december 2014. Inclusion criteria were age above 18 years old and at least 5 years after FP. These patients were submitted to laboratorial tests and to different imaging techniques of the liver: 1) CT with iodinated contrast media (ICM), 2) MRI with hepatobiliary contrast, 3) ultrasound (US) and 4) liver ultrasound elastography (Fibroscan® and ARFI). Three patients did not undergo CT because of history of allergic reaction to ICM.

RESULTS

Patients' mean age was 9 years (range 2 - 15) at the time of the final FP and 24 years (range 18 - 31) at the time of this study. No patients had clinical signs of liver disease or laboratorial findings indicating other hepatic disorders. Radiological features of hepatopathy were found in 14 (93%) patients at US, in 7 patients (73%) at CT and in all 15(100%) patients at MRI with overall agreement of 94%. Hepatic nodules were detected in 2 patients at US. Among the 12 patients that underwent CT, 3 presented hepatic nodules (25%), with a total of 12 nodules with mean size of 1.2 cm (range 1.1 - 2.2 cm). All nodules were hypervascular on arterial phase and were also characterized on MRI. Hepatic nodules were detected in 4 patients at MRI (27%) with a total of 13 nodules with mean size of 1.3 cm (range 1.1 - 2.2 cm). All nodules presented isosignal on T1WI, one was hypointense on T2WI, none presented diffusion restriction and all nodules were hypervascular in the arterial and hepatobiliary phases, except one that was hypovascular in these phases. Small hypervascular foci in the hepatobiliary phase MRI was seen in 11 patients (75%). All patients presented increasing liver stiffness at Fibroscan®, mean 20.0 kPa (range 6.7 - 24.0 kPa) and at ARFI, mean 1.96 (range 0.82 - 3.93).

CONCLUSION

Hepatic complications are frequent in patients who underwent FP including hepatic fibrosis, cirrhosis and hepatic nodules.

CLINICAL RELEVANCE/APPLICATION

A proper evaluation in patients submitted to FP is important to allow early recognition and treatment of liver complications. Hepatic nodules have been observed in FP patients but the nature of these nodules remains uncertain, although there are reports of malignancy.

SSE09-05 Measuring Hepatic Functional Reserve Using T1 Mapping with Gadoteric Acid Enhanced 3T MR Imaging: A Preliminary Study Comparing 99mTc GSA Scintigraphy with Indocyanine Green (ICG) Retention

Monday, Nov. 30 3:40PM - 3:50PM Location: E451A

Participants

Tomohiro Namimoto, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masataka Nakagawa, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Kie Shimizu, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masafumi Kidoh, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Nakaura Takeshi, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Daisuke Utsunomiya, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

To test whether T1 mapping of liver parenchyma on gadoteric acid (Gd-EOB-DTPA) enhanced 3T MRI correlates with the parameters of Technetium-99m galactosyl serum albumin (99mTc-GSA) scintigraphy and indocyanine green (ICG) retention for the measurement of liver functional reserve.

METHOD AND MATERIALS

Sixty-six patients (43 HCC, 18 metastasis, 5 CCC) awaiting liver resection or TACE were included in this retrospective study. T1 relaxation times of the liver post-contrast enhancement images were measured using Look-Locker sequences 20 minutes after Gd-EOB-DTPA administration. For 99mTc-GSA scintigraphy, the blood clearance index HH15 and LHL15 was recorded. ICG retention at 15 min was also recorded. Statistical analysis involved Kruskal-Wallis test and Pearson correlation.

RESULTS

The T1 relaxation times for Gd-EOB-DTPA-enhanced MRI showed significant differences between patients with normal hepatic function ($p < 0.01$) or mild hepatic functional damage ($p < 0.05$) and moderate hepatic functional damage defined by HH15. The T1 relaxation times for Gd-EOB-DTPA-enhanced MRI showed a constant increase from normal hepatic function to severe hepatic functional damage (normal, 313 ± 43 ms; mild, 349 ± 89 ms; moderate, 489 ± 143 ms; severe, 491 ± 11 ms). Regression analysis showed a correlation between T1 relaxation times for Gd-EOB-DTPA enhanced MRI and other liver functional parameters (T1 versus HH15, $R^2=0.38$; T1 versus LHL 15, $R^2=0.30$; T1 versus ICG clearance $R^2=0.57$; HH15 versus ICG clearance $R^2=0.48$; LHL 15 versus ICG clearance $R^2=0.45$).

CONCLUSION

The T1 relaxation time for Gd-EOB-DTPA enhanced MRI has the potential to serve as a representative of MRI-based liver functional

reserve. It is strongly correlated with ICG clearance and moderately correlated HH15/LHL15 with 99mTc-GSA.

CLINICAL RELEVANCE/APPLICATION

The T1 relaxation time for Gd-EOB-DTPA enhanced MRI has the potential to serve as a representative of MRI-based liver functional reserve.

SSE09-06 Visual Assessment of Graft Dysfunction in Liver Transplant Recipients Using Gadoteric Acid-enhanced MRI

Monday, Nov. 30 3:50PM - 4:00PM Location: E451A

Participants

Nina Bastati, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Andreas G. Wibmer, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Dietmar Tamandl, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Jacqueline C. Hodge, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Henrik Einspieler, Vienna, Austria (*Presenter*) Nothing to Disclose
Sarah Poetter-Lang, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Ahmed Ba-Ssalamah, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether a qualitative visual scoring system, using specific features of gadoteric acid-enhanced MRI, could be applied to estimate liver graft (OLT) function and survival probability.

METHOD AND MATERIALS

85 patients, 31 females (36.5%) and 54 males (63.5%) with a median age of 54.6 years were examined on a 3 Tesla MR. All patients received a bolus injection of 0.025 mmol/kg body weight of gadoteric acid at 1 mL/sec. Dynamic imaging was subsequently performed, including a 20 minute hepatobiliary phase (HBP). Two readers independently analyzed the unenhanced and HBP-enhanced MR images qualitatively. The degree of contrast parenchymal enhancement, i.e. enhancement quality score EnQS) (0-2) and biliary CM excretion i, e. excretion quality score (ExQS) (0-4) as well as the persistence of signal intensity (SI) in the portal vein, the so-called 'portal vein sign (PVs) quality score (PVsQS) (0-1) on the HBP were assessed. A quantitative measurement on the unenhanced and HBP-enhanced MR images was performed, as well, to measure the relative liver parenchymal enhancement (RLE) at 20 minutes (i.e.HBP). The probabilities of graft survival were calculated by Kaplan-Meier survival estimates and Cox proportional hazard regression models with Firth's correction.

RESULTS

The inter-reader agreement for the qualitative assessment of EnQS, ExQS, PVsQS according to the suggested scale was almost perfect (k: 0.81). Univariate survival analysis showed that the EnQS, ExQS, and PVsQS were independently associated with the probability of graft survival, respectively.

CONCLUSION

Qualitative assessment using PVsQS, EnQS, and ExQS on gadoteric acid enhanced-MRI allows us to estimate the graft survival probability after OLT.

CLINICAL RELEVANCE/APPLICATION

Gadoteric acid-enhanced MRI can be used as a non-invasive imaging biomarker to predict the liver graft survival probability.

SSE06

Emergency Radiology (Emergent Musculoskeletal and Spine Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: N227



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

Participants

Sujit Vaidya, MD, London, United Kingdom (*Moderator*) Nothing to Disclose

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

Honored Educators

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

Bharti Khurana, MD - 2014 Honored Educator

Sub-Events

SSE06-01 CT for Thoracic and Lumbar (T- and L-) Spine Fractures: Can CT Findings Accurately Predict Posterior Ligament Complex (PLC) Disruption?

Monday, Nov. 30 3:00PM - 3:10PM Location: N227

Participants

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

Luciano M. Prevedello, MD, MPH, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

Heidi Miracle, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Erwin Lin, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Steven T. McCormack, MD, Weston, MA (*Abstract Co-Author*) Nothing to Disclose

Christopher M. Bono, MD, Boston, MA (*Abstract Co-Author*) Advisory Panel, UnitedHealth Group; Royalties, Wolters Kluwer nv;

Mitchell A. Harris, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Aaron D. Sodickson, MD, PhD, Wayland, MA (*Abstract Co-Author*) Research Grant, Siemens AG; Consultant, Bracco Group

PURPOSE

To test the ability of secondary CT findings in patients with T- and L- spine fractures to predict disruption of the posterior ligament complex, a crucial determinant of fracture instability.

METHOD AND MATERIALS

105 consecutive ER patients with thoracic or lumbar spine fracture (fx) who had both CT and MRI from 2008-2012 were included. A composite gold standard was based on disruption of any PLC component by MRI or intraoperative exam findings. 3 blinded readers (2 neuroradiology trained emergency radiologists and 1 spine surgeon) graded CT scans for: VBT vertebral body translation/rotation, FJD facet joint subluxation/dislocation, FJW facet joint widening, FPL facet/pedicle/lamina fx, SPF spinous process fx, ISW interspinous distance widening, PEF posterior endplate corner fx. Analysis included interobserver agreement, and univariate and multivariate logistic regressions (performed separately by reader) to test associations between CT findings and gold standard PLC disruption (PLCD).

RESULTS

53 of the 105 patients had PLC disruption by gold standard. Interobserver agreement (averaged across reader pairs) was good for all CT findings, ranging from 92% for VBT to 72% for ISW. In univariate analysis, the strongest predictors of PLCD were FPL (OR 3.9-5.2, $p < 0.001$ for all readers) and ISW (OR 1.8-3.1, all $p < 0.05$). SPF and VBT showed significant results for 2/3 readers. PEF was not associated with PLCD. The overall presence of at least one of the CT findings had 70% average interobserver agreement, and OR 5.4-8.1 (all $p < 0.002$) for PLCD, with sensitivity 75-90%, specificity 37-63%. Multivariate regression analysis showed similar results, with FPL as the most predictive individual CT finding, with sensitivity 30-57%, specificity 75-92%.

CONCLUSION

Several secondary CT findings can substantially increase suspicion for PLC disruption, with any abnormal CT finding increasing the odds of disruption by 5.4 or greater across all readers.

CLINICAL RELEVANCE/APPLICATION

Close attention to secondary CT findings in patients with T- or L- spine fractures may help radiologists predict PLC disruption and expedite appropriate management.

Honored Educators

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

Bharti Khurana, MD - 2014 Honored Educator

Aaron D. Sodickson, MD, PhD - 2014 Honored Educator

SSE06-02 Accuracy of the NEXUS-criteria for CT

Monday, Nov. 30 3:10PM - 3:20PM Location: N227

Participants

R. S. Smit, MD, Almelo, Netherlands (*Presenter*) Nothing to Disclose
Jb Egbers, Almelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose
A. F. Hoogerwaard, Almelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose
J. J. van Netten, Almelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose
D. van der Velde, Almelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose
M Kraai, Almelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose
J. op den Akker, Almelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Purpose: The NEXUS-criteria** are validated criteria to identify adult patients who need conventional radiography of the cervical spine after blunt trauma. Despite the fact that CT is internationally seen as the 'golden standard' when cervical spine injury is suspected, the NEXUS-criteria have never been validated for CT. We tested the accuracy of the NEXUS-criteria for CT with simultaneously implementation of the Dutch guidelines for blunt trauma (CBO, 2009) of the cervical spine after high-energy trauma. **Hoffman et al. NEJM 2000:94-99

METHOD AND MATERIALS

Methods: A retrospective observational study in the period January 1st 2012 to December 31st 2013, including all patients aged 15 years and older with a high-energy-trauma (HET). We evaluated the NEXUS-criteria against the outcome of a fracture or no fracture of the cervical spine determined by CT.

RESULTS

Results: A total of 875 patients were included, from which 599 patients had a positive- and 276 patients had a negative NEXUS-screening. In the group with the positive NEXUS-criteria 35 fractures were found. One patient with a negative NEXUS-screening had a fracture. This leads to a sensitivity of 0,972 (95% CI: 0,837-0,998) and a negative predictive value of 0,996 (95% CI: 0,976-0,999) of the NEXUS criteria.

CONCLUSION

Conclusion: The NEXUS-criteria have a good sensitivity as well as a good negative predictive value for CT of the cervical spine when injury of the cervical spine is suspected in patients with a high-energy-trauma aged 15 years and older.

CLINICAL RELEVANCE/APPLICATION

Daily practice at the emergency room.

SSE06-03 Comparison of Radiation Dose-equivalent Radiography, Multidetector Computed Tomography and Cone Beam Computed Tomography for Fractures of the Wrist

Monday, Nov. 30 3:20PM - 3:30PM Location: N227

Participants

Jakob Neubauer, MD, Freiburg, Germany (*Presenter*) Nothing to Disclose
Carolin Reidelbach, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Elmar C. Kotter, MD, MSc, Freiburg, Germany (*Abstract Co-Author*) Editorial Advisory Board, Thieme Medical Publishers, Inc
Mathias F. Langer, MD, PhD, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Fiebich, Giessen, Germany (*Abstract Co-Author*) Nothing to Disclose
Johannes M. Voigt, Giessen, Germany (*Abstract Co-Author*) Nothing to Disclose
Sebastian Goerke, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic quality of radiography, to radiography equivalent dose multidetector computed tomography (RED-MDCT) and to radiography equivalent dose cone beam computed tomography (RED-CBCT) for wrist fractures in phantoms.

METHOD AND MATERIALS

As phantoms we chose 10 cadaveric hands from body donors. Distal radius, distal ulna and carpal bones were artificially fractured in a random order. Radiation dose was calculated with Monte Carlo simulations. RED-MDCT and RED-CBCT scans of the wrist were performed with the same radiation dose as combined dorsopalmar and lateral radiographs of the wrist. The gold standard was evaluated by a combination of fracturing protocol and high-dose MDCT. 3 independent raters evaluated the images for fractures, joint involvement and fracture displacement. Raters scored the certainty of their findings on a 5-point Likert Scale. Statistical analysis was performed with calculation of pooled sensitivity, pooled specificity and receiver operating characteristic (ROC). Interrater correlation for all modalities was evaluated by Kendall's coefficient of concordance W. False discovery rate was controlled according to Benjamini and Yekutieli.

RESULTS

Pooled sensitivity for fractures was 87% for RED-MDCT, 78% for RED-CBCT and 58% for radiography, being significantly different only between RED-MDCT and radiography (P=0.01). Although sensitivity for joint involvement and fracture displacement was higher in RED-MDCT and RED-CBCT compared to radiography, these differences were not significant. No significant differences were detected concerning the modalities' specificities. Raters' certainty was higher in RED-MDCT and RED-CBCT compared to radiography (P<0.001). The area under the ROC curve for fracture detection was higher for RED-MDCT and RED-CBCT compared to radiography, although this was significant only for one of the three raters. Interrater correlation was 0.93, 0.87 and 0.94 for radiography, RED-MDCT and RED-CBCT, respectively.

CONCLUSION

In this study, the diagnostic quality of RED-MDCT and RED-CBCT for wrist fractures proved to be similar and in some parts even

higher compared to radiography.

CLINICAL RELEVANCE/APPLICATION

RED-MDCT and RED-CBCT scans have a sufficient potential to improve the diagnostic quality for wrist fractures without raising radiation dose and should be tested in a clinical setting.

SSE06-04 Diagnosis of Acute Fractures of the Thoracic Spine Using Bone Marrow Edema Detected by Dual-Energy CT

Monday, Nov. 30 3:30PM - 3:40PM Location: N227

Participants

Dennis Parhar, BSc, Vancouver, BC (*Presenter*) Nothing to Disclose
Teresa I. Liang, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Ismail T. Ali, MBChB, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Patrick D. McLaughlin, FFRCSI, Cork, Ireland (*Abstract Co-Author*) Speaker, Siemens AG
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The assessment of bone marrow edema is limited in conventional CT. Dual-energy CT (DECT) with virtual non-calcium (VNCa) images allows subtraction of bone mineral to better reveal the fluid attenuation of bone marrow. The purpose of this study is to describe our clinical experience with DECT VNCa images for the detection of bone marrow edema in acute fractures of the thoracic spine.

METHOD AND MATERIALS

In this retrospective study, 397 thoracic vertebral bodies from 36 consecutive patients were assessed for the presence of bone marrow edema in acute fractures. Each of these patients underwent DECT of the thoracic spine (100kV-Sn140kV, 255refmAs, 40x0.6mm) using a dual source 128-slice CT scanner (Definition FLASH, Siemens Healthcare, Germany) between November 9, 2014 and March 31, 2015. The DECT data was post-processed using a 3-tissue algorithm to create VNCa images on a multimodality CT workspace. Each vertebral body was independently evaluated by two readers for the presence or absence of abnormal bone marrow edema on greyscale and color-coded maps. Attenuation of each of the vertebral bodies was then obtained. This data was then subjected to receiver operating characteristic (ROC) curve analysis to determine the sensitivity, specificity, and accuracy of using bone marrow edema to diagnose acute fractures of the thoracic spine.

RESULTS

Vertebrae positive for acute fracture demonstrated a statistically significant increase in the attenuation of abnormal bone marrow edema (114.2 ±15.06HU in acute fractures compared to -2.118 ±1.699HU in non-fractures, p<0.0001). Inter-observer agreement for the presence of abnormal bone marrow edema was excellent (k=0.865). The ROC analysis of the CT attenuation values demonstrated an area under curve (AUC) of 0.987 with an optimal cutoff value of 43.5 HU. This resulted in a sensitivity of 100%, specificity of 93.8%, and an accuracy of 92.9% for detection of acute fractures of the thoracic spine.

CONCLUSION

Findings from this study show that bone marrow edema and using a cut-off value of 43.5HU in virtual non-calcium images reconstructed from dual-energy CT can be useful in the diagnosis of acute fractures of the thoracic spine.

CLINICAL RELEVANCE/APPLICATION

Virtual non-calcium images derived from DECT allow detection of bone marrow edema and, therefore, provide a convenient and accurate modality for detection and characterization of acute fractures.

SSE06-05 Diagnostic Value of CT in Patients with Suspected Thoracic Spine Fractures Due to Minor Trauma

Monday, Nov. 30 3:40PM - 3:50PM Location: N227

Participants

Murat Karul, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Amelie Hoffmann, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Jin Yamamura, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the accuracy of biplane radiography in the detection of thoracic spine fractures in patients with minor trauma using computed tomography (CT) as the reference.

METHOD AND MATERIALS

130 consecutive patients (71 males; 59 females; mean age 69 ± 22.7 years; range 18-95 years) with minor trauma of the thoracic spine and low to moderate back pain on physical examination were included retrospectively. All had undergone biplane radiography first, followed by a CT scan in a time frame of 4 days because of aggravation of their symptoms. A contingency table and the Chi-square test (X²) were used to compare both diagnostic methods.

RESULTS

CT revealed 95 fractures in 71/130 patients (54.6%). Most fractures were diagnosed in the thoracolumbar junction (n=27). Biplane radiography was true positive in 42/130 patients (32.3%), false positive in 20/130 patients (15.4%), true negative in 42/130 (32.3%), and false negative in 26/130 patients (20%), showing a sensitivity of 61.8%, a specificity of 67.7%, a positive predictive value of 67.7%, and a negative predictive value of 61.8%. None of the fractures missed on biplane radiography was unstable. Presence of a fracture on biplane radiography was highly statistical significant, if this was simultaneously proven by CT (X² = 11.3; p= 0.00077).

CONCLUSION

Sensitivity and specificity of biplane radiography in the diagnosis of thoracic spine fractures in patients with minor trauma are low.

CLINICAL RELEVANCE/APPLICATION

Considering the wide availability of CT that is usually necessary for taking significant therapeutic steps, indication for x-ray in minor trauma patients should be very restrictive.

SSE06-06 140kVp Spectral Filtration CT of the Cervical Spine: Reduced Artifact and Reduced Radiation Dose in the Emergency Setting

Monday, Nov. 30 3:50PM - 4:00PM Location: N227

Participants

Dennis Parhar, BSc, Vancouver, BC (*Presenter*) Nothing to Disclose

Luck J. Louis, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

Tim O'Connell, MD, Meng, Vancouver, BC (*Abstract Co-Author*) President, Resolve Radiologic Ltd; Speake, Siemens AG

Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

Patrick D. McLaughlin, FFRRCSI, Cork, Ireland (*Abstract Co-Author*) Speaker, Siemens AG

PURPOSE

Attempts to reduce radiation exposure at the cervical spine are frequently and negatively limited by beam hardening artifact and photon starvation at the cervicothoracic junction. The purpose of this study is to compare image quality and radiation dose of conventional 120kVp CT versus a novel spectral filtration CT (SFCT) mode, which uses 140kVp and an added tin filter to produce small quantities of highly penetrating photons, in acute trauma patients.

METHOD AND MATERIALS

20 consecutive patients underwent SFCT of the cervical spine (Sn140kV, 450refmAs, 40x0.6mm) using a dual source 128-slice CT system (Definition FLASH; Siemens Healthcare, Forchheim, Germany) and were compared to 20 patients who underwent conventional 120kVp CT. Attenuation was measured by placing circular regions of interest on the spinal cord at the C2, C5, and C7 levels. Statistical analysis of this data was performed using Mann-Whitney U tests. Image quality was graded by 2 readers using a semi-objective 4-point scoring system at the same spinal levels. These results were subjected to Wilcoxon Signed-Rank Test for statistical analysis.

RESULTS

The findings show a statistically significant decrease in the radiation dose when using SFCT versus conventional 12-kVp CT. SFCT reduced the computed tomography dose index (CTDI) by 47.4% (-12.5, $p < 0.0022$) and the dose length product (DLP) by 43.3% (-246.7, $p < 0.0022$). Moreover, subjective analysis of image quality demonstrated a statistically significant improvement in image quality at both the C5 and C7 level due to reduction of bone hardening artifact (median=3, $p < 0.0313$).

CONCLUSION

The findings show a significant objective decrease in radiation dose as well as a significant subjective improvement in image quality through reduction of bone hardening artifact in spectral CT versus conventional CT. These results indicate that spectral filtration CT shows great promise in imaging of the cervical spine.

CLINICAL RELEVANCE/APPLICATION

Given the large number of C-Spine imaging referrals, a young patient base, and the potentiality of serious injury, there is a necessity for high-quality, reduced-dose C-Spine imaging in the ER setting

SSE17

Neuroradiology (Parkinson Disease)

Monday, Nov. 30 3:00PM - 4:00PM Location: N228



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

Participants

Christopher P. Hess, MD, PhD, Mill Valley, CA (*Moderator*) Research Grant, General Electric Company; Research Grant, Quest Diagnostics Incorporated; Research Grant, Cerebrotech Medical Systems, Inc;
Jay J. Pillai, MD, Baltimore, MD (*Moderator*) Medical Advisory Board, Prism Clinical Imaging, Inc; Author with royalties, Springer Science+Business Media Deutschland GmbH; Author with royalties, Reed Elsevier

Sub-Events

SSE17-01 A Voxel-based Evaluation of Parkinson's Disease Using Quantitative Susceptibility Mapping and Neuromelanin Imaging

Monday, Nov. 30 3:00PM - 3:10PM Location: N228

Participants

Hiroto Takahashi, MD, Suita, Japan (*Presenter*) Nothing to Disclose
Yoshiyuki Watanabe, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisashi Tanaka, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Masashi Mihara, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Yi Wang, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroki Kato, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsuko Arisawa, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Chisato Matsuo, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Tian Liu, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hideki Mochizuki, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess dopaminergic neurodegeneration with iron deposition of the substantia nigra pars compacta (SNpc) in patients with Parkinson's disease (PD) in a quantitative and reproducible fashion.

METHOD AND MATERIALS

This study included 14 patients with PD (Group A) and 14 normal controls (Group B) who underwent quantitative susceptibility mapping (QSM), neuromelanin (NM) imaging and three-dimensional (3D) T1W imaging on a 3T magnetic resonance imager. Both QSM and NM values of the SNpc were calculated using a region of interest (ROI) based automated segmentation system with the voxel-based morphometric technique. Images were preprocessed as follows (Figure): All QSM and NM images were coregistered with 3D T1-weighted structural images and were spatially normalized using Statistical Parametric Mapping, thus allowing voxel-based measurement with automatic setting of the ROI encompassing the SNpc. The spatially normalized images of all subjects were smoothed. Finally, the SNpc ROI was set on the QSM-NM fused image. Signal to noise ratio (SNR) of the SNpc in the NM images was calculated on the basis of mean value of the automatically segmented background region (tegmenum in the midbrain). The significance of intergroup differences in each QSM value and NM area of higher SNR than that of the background region was tested using Mann-Whitney's U test.

RESULTS

For mean QSM value of the SNpc, no significant difference was shown between both groups [Group A/B: mean value (ppb) = 75.72/64.62, SD = 21.24/27.75]. But when comparing the highest 5% of QSM values in each group, the mean in Group A was significantly larger than that in Group B [Group A/B: mean value (ppb) = 175.21/133.33, SD = 45.44/41.75] ($P < 0.05$). The NM area of higher SNR in Group A was significantly less than that in Group B [Group A/B: mean value (pixel) = 85.79/104.07, SD = 13.66/13.56] ($P < 0.05$).

CONCLUSION

An automatic measurement system for structural and functional changes in the SNpc with voxel-based analysis can provide clinically useful information in the diagnosis of PD.

CLINICAL RELEVANCE/APPLICATION

SNpc is a small region, but can be assessed quantitatively and reproducibly with voxel-based analysis in the diagnosis of Parkinson's disease.

SSE17-02 Drug-induced Parkinsonism versus Idiopathic Parkinson's Disease: Diagnostic Utility of Nigrosome 1 MRI at 3T

Monday, Nov. 30 3:10PM - 3:20PM Location: N228

Participants

Min Ju Jung, Incheon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Eung Yeop Kim, MD, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byong Ho Goh, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Hee Seong, MD, Incheon, Japan (*Abstract Co-Author*) Nothing to Disclose
Young Noh, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Discrimination between drug-induced parkinsonism (DIP) and idiopathic Parkinson's disease (IPD) is challenging because they may be clinically indistinguishable. Dopamine transporter imaging can help differentiate them, but it is expensive and imposes radiation on patients. We hypothesized that the nigrosome 1 is not affected in patients with DIP unlike in those with PD. The aim of this study was to investigate whether nigrosome 1 imaging at 3T can help differentiate PD from DIP.

METHOD AND MATERIALS

We enrolled 20 patients with DIP (16 female; mean age, 74) who showed normal activity on 18F-FP-CIT PET (CIT PET), 29 patients with IPD (10 female; mean age, 71; HandY stage ≤ 2) who showed abnormality on CIT PET, and 18 healthy subjects (10 female; mean age, 66). All participants underwent 3D multi-echo gradient-recalled echo imaging (number of echoes, 6) covering the midbrain parallel to the plane from the posterior commissure and top of the pons (spatial resolution, $0.5 \times 0.5 \times 1$ mm). Two independent reviewers assessed nigrosome 1 on three slices: an upper slice at the lower tip of red nucleus, and two successive lower slices by comparing the signal intensity of the central portion of the nigrosome 1 with that of the white matter lateral to decussation of the superior cerebellar peduncles. Relative hypointensity in either side of nigrosome 1 was considered abnormal. Interobserver agreement, diagnostic sensitivity, specificity, and accuracy were analyzed.

RESULTS

Inter-rater agreement was excellent ($\kappa = 0.821$). All 29 patients with IPD and three of 18 healthy subjects were rated as abnormal on nigrosome 1 MRI (sensitivity, 100%; specificity, 83.3%; accuracy, 93.6%; positive predictive value [PPV], 90.6%; negative predictive value [NPV], 100% between the patients with IPD and healthy subjects). Three of 20 patients with DIP were considered abnormal on nigrosome 1 MRI (sensitivity, 100%; specificity, 85%; accuracy, 93.9%; PPV, 90.6%; NPV, 100% between the patients with IPD and DIP). Abnormality on MRI was significantly more frequent in patients with IPD ($P < 0.0001$).

CONCLUSION

Nigrosome 1 imaging at 3T can differentiate IPD from DIP with accuracy of 93.9%.

CLINICAL RELEVANCE/APPLICATION

High diagnostic accuracy and perfect NPV of nigrosome imaging at 3T between patients with IPD and DIP can help manage them properly and may reduce dependence on dopamine transporter imaging.

SSE17-03 The Pattern of Iron Deposition in the Progression of Parkinson's Disease by Quantitative Susceptibility Mapping

Monday, Nov. 30 3:20PM - 3:30PM Location: N228

Participants

Xiaojun Guan, Hangzhou, China (*Presenter*) Nothing to Disclose
Min Xuan, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Quanquan Gu, MD, PhD, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Chunlei Liu, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Peiyu Huang, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Xu Xiaojun, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Wei Luo, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Minming Zhang, MD, PhD, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The influence of iron on the pathophysiological progression of Parkinson's disease (PD) and the pattern of iron accumulation in the subregions of substantia nigra (SN) were unclear. In the present cross-section study, we aimed to clarify the potential pattern of iron deposition in the subcortical nuclei, especially in the SN, among the controls and PD subgroups, thus the possible underlying iron-related pathogenesis of PD.

METHOD AND MATERIALS

Forty-eight PD patients (H-Y stage ≤ 2.5 , $n=16$, belonged to mild subgroup; H-Y stage ≥ 3 , $n=32$, belonged to severe subgroup), and 47 gender-, age-, duration- matched healthy controls were included in our study. All subjects participated in the 3D-enhanced T2 star weighted angiography (ESWAN) scanning. The phase images of ESWAN data were processed to generate quantitative susceptibility mapping (QSM). Then, we measured the iron content within the ROIs and the relevant clinical assessments of these patients.

RESULTS

After controlling for age as a covariant (Bonferroni corrected), QSM values within the medSNc and latSNc increased significantly in both PD subgroups compared with controls respectively (both $p < 0.01$), while QSM values within medSNr ($p < 0.01$) and latSNr ($p < 0.05$) only increased in the severe subgroup of PD. More interestingly, medSNc had higher iron content in the severe group of PD than the mild one ($p < 0.05$), while that could not observe in the latSNc. Further, in the severe subgroup iron content within medSNr ($p < 0.01$) and latSNr ($p < 0.05$) elevated greatly compared with the mild subgroup.

CONCLUSION

Due to the limitation of present study, which recruited symptomatic patients, we didn't observe the presymptomatic or early changes in the latSNc between 2 PD subgroups. After all, we had investigated the dynamic pattern of iron deposition in the SN during the progression of PD, which was perfectly consistent with the work of Fearnley JM (Brain 1991). As the disease proceeding, the iron deposition accumulated first in the latSNc (Martin W.R. et al., 2008), and then involved the medSNc, finally reached the medSNr and latSNr.

CLINICAL RELEVANCE/APPLICATION

Firstly, present work would help understand the possible pathogenesis of PD indirectly; secondly, the pattern of iron deposition would indicate the imaging biomarker of early diagnosis of PD.

SSE17-04 Participants

Resting State Functional Connectivity in Parkinson's Patients with Implanted Deep Brain Stimulation Electrodes

Monday, Nov. 30 3:30PM - 3:40PM Location: N228

Subhendra N. Sarkar, PhD, RT, Boston, MA (*Presenter*) Nothing to Disclose
Neda I. Sedora-Roman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael D. Fox, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ron L. Alterman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Fernando A. Barrios, PhD, Juriquilla, Mexico (*Abstract Co-Author*) Nothing to Disclose
David B. Hackney, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rafeeqe A. Bhadelia, MD, Chestnut Hill, MA (*Abstract Co-Author*) Nothing to Disclose
Rafael Rojas, MD, Chestnut Hill, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

rs-fcMRI, if performed within MR safety limits, could help evaluate electrode placement and the effects of DBS on brain connectivity for Parkinson's patients. However, fMRI traditionally requires high speed and high field MRI violating RF and gradient safety for DBS (1).

METHOD AND MATERIALS

10 PD patients with DBS electrodes were imaged within MR safety limits (SAR <0.1 W/kg, dB/dT <20 mT/S, B₀=1.5T) by single-shot EPI (TR/TE/Voxel/# brain volumes = 3-4s/50ms /4x4x5mm³ /interleaved/100-120 volumes/ scan time 6 min). 5 PD patients prior to DBS implantation were imaged at high SAR (>0.8 W/kg, 3T) by a single-shot EPI (TR/TE/Voxel/whole brain volumes = 2s/30ms /3.4x3.4x3.4mm³ /interleaved/100-140 volumes/ scan time 3-4 min/2-3 runs). Motion corrected, normalized images were co-registered with 3D MPRAGE using SPM. Several resting state networks were computed (default mode/DMN, executive control/ECN and sensory motor/SMN) using common seed regions and CONN rs-fMRI processing algorithm(2). The networks for low and high SAR groups were averaged and objectively compared by two independent readers.

RESULTS

The group average network images at low SAR were similar to those imaged pre-DBS at high SAR. The spatial correlation coefficients between the high and low SAR for each network were: DMN 0.70, ECN 0.64 and SMN 0.64, supporting the maps similarities. Zhang et al (3) have shown that PD patients with Tremor show increased centrality in rs networks in frontal, parietal and occipital lobes that are supported by our results although low SAR maps were weaker perhaps due to the susceptibility from electrodes. Anticorrelations among networks were also preserved at low SAR even after using global regressors that are quite acceptable (4).

CONCLUSION

High quality rs fc-MRI images can be safely obtained at 1.5T at about 10% of routine SAR at high fields. Abnormal brain connectivity may be used to modulate DBS settings. Resting state fc-MRI is promising toward understanding and manipulating the stimulation effects on brain cognition and motor control in refractory PD. Reference(1) Kahan et al Brain Feb 2014; (2) Whitfield-Gabrieli et al Neuroimage 2011; (3) Zhang et al Front. Aging Neurosci 2015; (4) Chai et al Neuroimage 2012

CLINICAL RELEVANCE/APPLICATION

High quality resting state fc images can be obtained for DBS patients within MR safety margin, with device programming and understanding stimulation effects on brain connectivity in refractory PD.

SSE17-05 Chemical Exchange Saturation Transfer Signal of the Substantia Nigra as Imaging Biomarker for Assessing Progression of Parkinson's Disease

Monday, Nov. 30 3:40PM - 3:50PM Location: N228

Participants
Chunmei Li, MD, Beijing, China (*Presenter*) Nothing to Disclose
Na X. Zhao, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jinyuan Zhou, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Min Chen, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate chemical-exchange-saturation-transfer (CEST) signal of the substantia nigra (SN) in Parkinson's disease (PD) patients, as well as their relationship to clinical progression.

METHOD AND MATERIALS

CEST MR imaging of 26 normal controls and 61 PD patients [18 early stage (disease duration ≤ 1 year), 19 mid stage (disease duration 2~5 years) and 24 late stage (disease duration ≥ 6 years)] were acquired on a Philips 3 Tesla MRI system. Magnetization transfer spectra with 31 different frequency offsets (-6 to 6 ppm) were acquired at the slice of the SN. The FLAIR image was used as the anatomical reference to draw regions of interest. MTR_{asym}(3.5ppm) and MTR_{total} (the integral of the MTR_{asym} spectrum in the range of 0 to 4 ppm) of the total SN were measured. Clinical measures were obtained for PD patients, such as the Hoehn and Yahr (HandY) scale and the unified Parkinson's disease rating scale (UPDRS), etc. One-way ANOVA was used to compare the CEST signal differences between normal controls and PD patients of all stages. Correlation analysis was made for the CEST signal of SN and clinical progression.

RESULTS

Compared to normal controls, the MTR_{asym}(3.5ppm) and MTR_{total} values of the SN were significantly lower in PD patients of all stages. Both the MTR_{asym}(3.5ppm) and MTR_{total} values of the SN strongly associated with HandY scale, UPDRS, UPDRS-3 and disease duration.

CONCLUSION

CEST signal of the SN has the potential to serve as imaging biomarker for assessing progression of PD.

CEST signal of the SN has the potential to serve as imaging biomarker for assessing progression of PD.

CLINICAL RELEVANCE/APPLICATION

CEST signal could provide information additional to conventional MR imaging and potentially serve as imaging biomarker in the progression assessment of PD.

SSE17-06 Multivariate Pattern Analysis of Paroxysmal Kinesigenic Dyskinesia Using Diffusion Tensor Imaging

Monday, Nov. 30 3:50PM - 4:00PM Location: N228

Participants

Lei Li, Chengdu, China (*Presenter*) Nothing to Disclose
Xinyu Hu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Du Lei, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Xueling Suo, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoqi Huang, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Dong Zhou, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Qiyong Gong, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Paroxysmal kinesigenic dyskinesia (PKD) is a rare movement disorder. Available researches using diffusion tensor imaging (DTI) have shown that PKD is accompanied by abnormalities in white matter (WM). However, results of those publications were based on average differences between groups, which permitted little use in clinical practice. Multivariate pattern analysis (MVPA) approach is a promising analytical technique which allows the classification of individual observations into distinct classes. Thus, in current study, we aimed to (i) apply MVPA approach known as Support Vector Machine (SVM) for investigating whether fractional anisotropy (FA) of WM can be used to discriminate between patients with PKD and healthy control subjects (HCS) at the level of the individual; (ii) explore which WM regions contributed to such discrimination.

METHOD AND MATERIALS

DTI data were acquired from 48 PKD patients and 48 demographically matched HCS using a 3T MRI system. Differences in FA values of WM were used to discriminate between PKD patients and HCS using leave-one-out cross-validation with SVM based on Probid software (<http://www.brainmap.co.uk/probid.htm>), and to find a spatially distributed pattern of regions with maximal classification weights. We also drew a receiver operating characteristic (ROC) curve to help evaluate the performance of the classifier.

RESULTS

SVM applied to FA images correctly identified PKD patients with a sensitivity of 91.67% and a specificity of 87.50% resulting in a statistically significant accuracy of 89.58% ($P < 0.001$). This discrimination was based on a distributed network including anterior thalamic radiation temporoparietal junction, inferior fronto-occipital fasciculus, inferior longitudinal fasciculus, corpus callosum, and cingulum.

CONCLUSION

The present study demonstrates subtle and spatially distributed WM abnormalities in individuals with PKD, indicating neuroanatomical basis for the involvement of the basal ganglia-thalamocortical pathway in PKD, and provides preliminary support for the suggestion that SVM approach could be used to aid the identification of individuals with PKD in clinical practice.

CLINICAL RELEVANCE/APPLICATION

The current study illustrated that the application of SVM to FA images could allow accurate discrimination between PKD patients and HCS, which indicated its potential diagnostic value in helping detecting this disease.

ISP: Musculoskeletal (MR Evaluation of Nerves)

Monday, Nov. 30 3:00PM - 4:00PM Location: E451B



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

Participants

Gustav Andreisek, MD, Zurich, Switzerland (*Moderator*) Grant, Holcim Ltd; Grant, Siemens AG; Speaker, Mepha Pharma AG; Speaker, Guerbet SA; Travel support, Guerbet SA; Consultant, Otsuka Holdings Co, Ltd; Travel support, Otsuka Holdings Co, Ltd; Institutional Research Grant, Bayer AG; Institutional Research Grant, Guerbet AG; Institutional research collaboration, Siemens AG; Institutional research collaboration, Koninklijke Philips NV; Speaker, General Electric Company; Speaker, Koninklijke Philips NV; Speaker, Siemens AG; ;
Anne Cotten, MD, Lille, France (*Moderator*) Nothing to Disclose

Sub-Events**SSE15-01 Musculoskeletal Keynote Speaker: MRI Evaluation of Nerves-Application and Implementation**

Monday, Nov. 30 3:00PM - 3:20PM Location: E451B

Participants

Sandip Biswal, MD, Stanford, CA (*Presenter*) Co-founder, SiteOne Therapeutics Inc; Research Grant, General Electric Company; Stockholder, Atreus Pharmaceuticals Corporation

ABSTRACT

MR imaging of the peripheral nerves and brachial/lumbosacral plexi has become an important tool in the evaluation and workup of the chronic pain patient. High-quality imaging of these structures is now consistently possible due to technical improvements in field strength, coil, and pulse sequence technology. This imaging approach is able to highlight inflammatory (e.g. neuritis) and physical (e.g. impingement, mass lesions) changes in the nerves. We will review the technical requirements for imaging the peripheral nervous system, discuss the imaging findings nerve injury/inflammation and provide examples of normal and pathologic cases.

SSE15-03 MR Neurographic Orthopantomogram: Ultra-short Echo-time (UTE) Imaging of Mandibular Bone and Teeth Complemented with High-resolution Morphological and Functional MR Neurography

Monday, Nov. 30 3:20PM - 3:30PM Location: E451B

Participants

Andrei Manoliu, MD, PhD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Micheal Ho, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Evelyn Dappa, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Nanz, PhD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Andreas Boss, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Gustav Andreisek, MD, Zurich, Switzerland (*Abstract Co-Author*) Grant, Holcim Ltd; Grant, Siemens AG; Speaker, Mepha Pharma AG; Speaker, Guerbet SA; Travel support, Guerbet SA; Consultant, Otsuka Holdings Co, Ltd; Travel support, Otsuka Holdings Co, Ltd; Institutional Research Grant, Bayer AG; Institutional Research Grant, Guerbet AG; Institutional research collaboration, Siemens AG; Institutional research collaboration, Koninklijke Philips NV; Speaker, General Electric Company; Speaker, Koninklijke Philips NV; Speaker, Siemens AG; ;
Felix P. Kuhn, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Panoramical radiographs or cone-beam CT images are the current standard-of-care to assess teeth, mandibular, and mandibular canal pathologies, but do not allow assessment of the mandibular nerve itself nor of its branches. Most recent MR technologies allow cortical bone imaging as well as dedicated MR neurography of the peripheral nerves. We propose a technique for "MR neurographic orthopantomograms" exploiting UTE imaging of bone and teeth complemented with high-resolution morphological and functional MR neurography.

METHOD AND MATERIALS

IRB approved study in 10 healthy volunteers. The whole mandibles were imaged at 3.0T (Skyra, Siemens Healthcare) using a 64-channel head coil with isotropic spatial resolution (0.9x0.9x0.9mm) for subsequent multi-planar reformatting. Bone images were acquired using a 3D UTE PETRA sequence (echo time, 0.07ms; acquisition time, 4:56min). Morphological nerve imaging was accomplished with a 3D PSIF sequence with diffusion-based suppression of small blood vessel signals (4:16min) and with a 3D SPACE STIR sequence (9:23 min). Functional MR neurography was accomplished using a new accelerated diffusion tensor imaging technique (2D RESOLVE multiband prototype sequence = diffusion-weighted and readout-segmented echo planar imaging with blipped CAIPIRINHA and simultaneous two-slice acquisitions) (9:34min). Qualitative and quantitative image analysis was performed.

RESULTS

Image acquisition and subsequent post-processing into 'MR neurographic orthopantomogram' by overlay of morphological and functional images were feasible in all 10 volunteers without artifacts. All teeth, mandibular bones and mandibular nerves were assessable and normal. Fiber tractography with quantitative evaluation of physiological diffusion properties of mandibular nerves yielded the following mean±SD values: FA, 0.43±0.05; mean diffusivity (mm²/s), 0.0043 ±0.0003; radial diffusivity, 0.0034±0.0002, and axial diffusivity, 0.0021±0.0001.

CONCLUSION

The proposed technique of 'MR neurographic orthopantomogram' exploiting UTE imaging complemented with high-resolution

The proposed technique of MR neurographic orthopantomogram exploring the imaging complemented with high resolution morphological and functional MR neurography was feasible and allowed comprehensive assessment of teeth, bones and nerves.

CLINICAL RELEVANCE/APPLICATION

'MR neurographic orthopantomograms' may allow to assess various mandibular pathologies in a single examination and provide quantitative information on the integrity of the nervous microarchitecture.

SSE15-04 Clinical Impact of Brachial Plexus MRI Neurography on Diagnosis and Treatment

Monday, Nov. 30 3:30PM - 3:40PM Location: E451B

Participants

Stephen Fisher, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Christine Manthuruthil, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Jonathan Cheng, MD, FACS, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, Dallas, TX (*Abstract Co-Author*) Research Consultant, Siemens AG; Consultant, ICON plc

PURPOSE

The use of MR neurography (MRN) is widely accepted as useful and accurate for the evaluation of traumatic, inflammatory and infectious pathologies of the brachial plexus. However, little exists documenting the effect on diagnosis, treatment, and outcomes. Brachial plexus lesions are often difficult to diagnose and treat, many times requiring electromyography (EMG), which is limited due to deep location of nerves. Physicians frequently face management challenges in terms of whether patients should undergo surgery, pursue further workup, treat neuropathy conservatively, or institute treatment for diagnoses unrelated to neuropathy. Currently, the added value of MRN of the brachial plexus in addition to clinical standard of care including EMG results is unknown. We hypothesize that brachial plexus MRN significantly impacts diagnostic thinking and therapeutic management.

METHOD AND MATERIALS

All consecutive brachial plexus MRN examinations performed at 1.5T using a uniform protocol at our institution between 6/1/2013 and 10/31/2014 were examined retrospectively. Relevant clinical data were collected. Effects on the pre-imaging clinical diagnosis and therapeutic management were classified as no change, mild change, or substantial change. A separate disease etiology, significant and previously unknown incidental findings, or marked deviation from expected degree of severity were classified as substantial changes. Changes in management from conservative to surgical and vice versa were classified as substantial.

RESULTS

Of 122 consecutive studies, substantial alteration of the pre-imaging clinical impression was found in 30 cases (24.6%). The therapeutic management was likewise affected substantially in 27 cases (22.1%).

CONCLUSION

No consecutive series of brachial plexus MRN findings this large has been reported. We show that this examination can significantly impact diagnostic evaluation and clinical treatment of patients with upper extremity neurologic lesions.

CLINICAL RELEVANCE/APPLICATION

MRN significantly alters diagnosis and treatment in patients with suspected brachial plexopathies.

SSE15-05 MR Neurography (MRN) of the Long Thoracic Nerve: Retrospective Review of Clinical Findings and Imaging Results at Our Institution over 5 Years

Monday, Nov. 30 3:40PM - 3:50PM Location: E451B

Participants

Swati Deshmukh, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Shivani Ahlawat, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively review high-resolution MRNs of the long thoracic nerve in patients with clinical suspicion of long thoracic neuropathy performed at our institution over the past 5 years.

METHOD AND MATERIALS

IRB approval was obtained. A keyword search for 'long thoracic nerve' was performed to identify MRN studies performed at our institution for evaluation of the long thoracic nerve. Clinical presentation, electrodiagnostic studies and MRNs of 18 subjects (mean age, 38±13 years; 22%(4/18) female) were reviewed. MRN consisted of cervical spine (3D T2W, TE/TR=1000/97, 1mm slice thickness), brachial plexus (bilateral sagittal STIR; TE/TR/IR=3400/18/220, slice thickness 3mm) and chest (axial STIR; TE/TR/IR=4000/18/220, 4mm slice thickness), coronal T2FS(TE/TR=4940/49, 5mm slice thickness), axial T1W (TE/TR=800/12, 3mm slice thickness)) imaging. One observer reviewed MRNs for long thoracic nerve signal intensity on T1 and STIR, size, course, architectural distortion, presence or of mass, and secondary findings including serratus anterior, trapezius and rhomboid muscle denervation and scapular winging. C-spine disease (presence and degree of C4-5, C5-6, C6-7, C7-T1 central and foraminal stenosis) and brachial plexus pathology were also recorded. Descriptive statistics were reported.

RESULTS

Clinical indications included trauma (n=4), hereditary neuropathy (n=1), pain (n=7), winged scapula (n=5), Parsonage Turner syndrome (n=1) and mass (n=1). The long thoracic was not confidently identified in all exams in the anterior scalene triangle, retroclavicular space or lateral chest wall. In 3/18, electrodiagnostic studies showed evidence of denervation in the serratus anterior muscle while MRN revealed denervation in the serratus anterior (44%(8/18)), trapezius (22%(4/18)) and rhomboid (5%(1/18)) muscles. In 5%(1/18) subjects, there was denervation in both trapezius and serratus muscles. In 5%(1/18), an osteochondroma simulated a winged scapula and in 2/18(10%) MRN showed scapular winging. Concomitant C-spine disease (22%(4/18)) and brachial plexus pathology (22%(4/18)) were also detected.

CONCLUSION

Despite high resolution MRN, the long thoracic nerve is not confidently identified, though secondary signs including denervation are detected and add to EMG findings.

CLINICAL RELEVANCE/APPLICATION

MRN can serve as an adjunct clinical tool to electrodiagnostic testing for the evaluation of secondary signs of long thoracic neuropathy.

SSE15-06 Diffusion Weighted Imaging(DWI) and Neurography(DWN) of Human Lumbar Nerve Roots: Quantitative and Morphological Assessments of Nerve Roots Compression in Lumbar

Monday, Nov. 30 3:50PM - 4:00PM Location: E451B

Participants

Qingwei Song, MD, Dalian, China (*Presenter*) Nothing to Disclose
Meiyu Sun, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Li Na Zhang, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Bin Xu, BA, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Ailian Liu, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Ziheng Zhang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the application of DWI in the assessment of lumbosacral nerve root ganglia compression in lumbar intervertebral disc herniation through structural visualization, morphological analysis and the computed quantitative ADC values.

METHOD AND MATERIALS

This prospective study was approved by our Institutional Review Board and the written informed consent of each attendee was obtained. 30 lumbar intervertebral disc herniation patients (mean age=49.9 years, range=17-78 years; 20 male: 10 female), with low back pain and confirmation from the conventional MR imaging were recruited. The original DW images and the reconstructed 3D maximum intensity projection (MIP) images of the L4/L5 and L5/S1 lumbosacral nerve ganglia were blindly reviewed by two experienced radiologists. The morphologic parameters, i.e. nerve ganglia length, midpoint width and areas, of L4/L5 and L5/S1 were measured from the 3D MIP images and the ADC values of nerve ganglia were measured from the ADC maps generated by workstation, Functool 4.4. All the measured values of the compressed nerve roots and ganglia were statistically compared with the contralateral using t-test.

RESULTS

The high performance of DWI on showing the lumbosacral nerve roots, dorsal ganglia, and especially the postganglionic nerves of L4/L5 and L5/S1 assured the assessment of the interrelation between the nerve roots and the herniated intervertebral disc. No significant difference was observed from the values of the two sides of the L4 nerve ganglia's length, midpoint width, area and ADC for L3/L4 herniation. However, for L5/S1 herniation, the length and area of the compressed nerve ganglia of L5 and S1 were significantly bigger than the contralateral ($t=10.39$, $p<0.05$), and the ADC values of L5 and S1 were significantly higher than the contralateral ($t=13.06$, $P<0.05$).

CONCLUSION

DWI can clearly display the lumbosacral nerves roots and ganglia. The qualitative morphological analysis through 3D MIP reconstruction and the quantitative measurements of the ADC value of nerves ganglia were substantially contributed to the evaluation of the compression of nerve roots and ganglia for the patients with lumbar intervertebral disc herniation.

CLINICAL RELEVANCE/APPLICATION

DWI should be in the setting of the scanning protocol for the diagnosis of the nerve roots and ganglia disorders

SSE25

Vascular/Interventional (The Latest Techniques in Dialysis Interventions)

Monday, Nov. 30 3:00PM - 4:00PM Location: N226



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

Discussions may include off-label uses.

Participants

Himanshu Shah, MD, Zionsville, IN (*Moderator*) Consultant, Cook Group Incorporated ; Consultant, C. R. Bard, Inc
Scott A. Resnick, MD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

SSE25-01 Transjugular Access for the Endovascular Management of Non-matured Autogenous Arteriovenous Fistulas

Monday, Nov. 30 3:00PM - 3:10PM Location: N226

Participants

Seulgi You, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Yoolim Baek, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Je Hwan Won, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jino Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of our study is to evaluate the feasibility and safety of transjugular access for the management of non-matured autogenous arteriovenous fistulas (AVF).

METHOD AND MATERIALS

We retrospectively reviewed fifty-four patients who underwent transjugular endovascular treatment for non-matured AVFs from August 2013 to February 2015. The internal jugular vein ipsilateral to the AVF was accessed under ultrasound guidance. After catheterization of the arterial limb of the fistula, fistulography was performed to identify stenotic lesions which were subsequently treated by percutaneous transluminal angioplasty (PTA). On occasions when directional guidance was necessary, venography was performed through a 23 gauge scalp needle placed distally in the outflow vein to facilitate catheterization. We assessed the types of autogenous fistulas treated, time to catheterization of the AVF from the transjugular access, and total procedure time. The technical and clinical success rates, complications rate, and primary and secondary patency rates were also evaluated. Patency following PTA was estimated using the Kaplan-Meier method.

RESULTS

Eighteen patients had brachiocephalic fistulas (33.3%) and thirty-six patients had radiocephalic fistulas (66.7%). The mean time to catheterization of the AVF was 9.8 minutes and the mean total procedure time was 36.6 minutes. Venography via a scalp needle in the distal outflow vein was required in 35.2% of the cases (19 of 54 procedures) to facilitate catheterization. Technical and clinical success were achieved in 98.1% (53 of 54 AVFs) and 92.6% of patients (50 of 54 AVFs), respectively. Minor complication (oozing at the scalp needle puncture site) occurred in one patient. There were no major complications. Primary patency rates were 78.7% at 6 months and 57.5% at 1 year, respectively. Secondary patency rates were 87.7% at 6 months and 82.5% at 18 months, respectively.

CONCLUSION

Transjugular access for PTA of non-matured autogenous AVF is feasible and safe. This alternative route tackles potential problems of conventional techniques in PTA of non-matured fistulas such as difficult cannulation of non-matured outflow veins and hematomas following direct access into outflow veins.

CLINICAL RELEVANCE/APPLICATION

Endovascular management through transjugular access can be the first management modality in the salvage of non-matured autogenous AVF, as lowers the complication rate of conventional transvenous access.

SSE25-02 Outcomes of Fluoroscopic and Ultrasound Guided Placement versus Laparoscopic Placement of Peritoneal Dialysis Catheters

Monday, Nov. 30 3:10PM - 3:20PM Location: N226

Participants

Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (*Presenter*) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc
Amr S. Moustafa, MBBCh, MSc, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Peter Morad, MBBCh, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Asmaa Mokhtar, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Islam H. Shawali, BSc, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Timothy M. Beasley, PhD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Maysoon Hamed, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A variety of Peritoneal dialysis catheter (PDC) placement techniques are available including laparoscopic placement by surgeons,

and percutaneous placement by Interventional Radiologists. The aim of this study was to compare our one-year outcomes of PDC placement using fluoroscopy and ultrasound guidance with those placed using the laparoscopic technique.

METHOD AND MATERIALS

We retrospectively reviewed the medical records of 201 patients who had their first PDC placed between January 2005 and October 2014. A total of 100 patients were included in the study. We compared the survival outcomes of the PDC placed using fluoroscopic and ultrasound guidance by interventional radiology (radiologic group, n=29), with the PDC placed using laparoscopic technique by surgeons (laparoscopic group, n=61). Survival analyses were performed with the primary outcome being complication-free PDC survival at 365 days. Secondary outcomes were complication-free PDC survival at 90 days, overall catheter survival, median days-to-first complication and median days-to-catheter removal.

RESULTS

In the radiologic group, the complication-free PDC survival at 90 and 365 days were 62% and 55% respectively, compared to 64% (p=0.99) and 38% (p=0.17) respectively, in the laparoscopic group. Catheter malfunction was the only complication that was statistically significantly higher in the laparoscopic group (41%) compared to the radiologic group (14%, p=0.05). The overall catheter survival was 83% and 72% in the radiologic and laparoscopic groups respectively (p=0.31). Further analysis of the PDC with complications and subsequent removal revealed that the median days-to-first complication and the median days-to-catheter removal were 31 and 14 respectively in the radiologic group which was significantly less, compared to 98 (p=0.0036) and 179 (p=0.0006) respectively, in the laparoscopic group.

CONCLUSION

The fluoroscopic and ultrasound guided placement of a PDC offers a clinically effective alternative to laparoscopic placement with similar one-year survival and complication rates. Subsequent PDC complications and removal occurred earlier in the radiologic group compared to the laparoscopic group.

CLINICAL RELEVANCE/APPLICATION

Peritoneal dialysis is an increasingly utilized dialysis modality due to its cost-effectiveness and patient survival equivalency compared to traditional in-center hemodialysis.

SSE25-03 Same-day versus Delayed Arteriovenous Dialysis Graft Declotting: Does Timing Affect Procedural Success and Graft Patencies?

Monday, Nov. 30 3:20PM - 3:30PM Location: N226

Participants

Mark Winkler, Durham, NC (*Presenter*) Nothing to Disclose

Waleska M. Pabon-Ramos, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

Gemini L. Janas, RT, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

Michael J. Miller JR, MD, Chapel Hill, NC (*Abstract Co-Author*) Speaker, Cook Group Incorporated Speaker, Boston Scientific Corporation Advisory Board, Boston Scientific Corporation Advisory Board, C. R. Bard, Inc Speaker, Kimberly-Clark Corporation

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

Charles Y. Kim, MD, Durham, NC (*Abstract Co-Author*) Research Grant, Galil Medical Ltd; Consultant, Kimberly-Clark Corporation; Consultant, Cryolife, Inc

PURPOSE

To prospectively determine whether the interval between prosthetic arteriovenous graft (AVG) thrombosis and declotting affects procedural success, postintervention primary patency, or postintervention secondary patency.

METHOD AND MATERIALS

From March 2012 to March 2014, 94 adult patients who were referred for AVG declotting were recruited prospectively. Patients were interviewed prior to the procedure to determine the date the patient or the dialysis unit detected AVG thrombosis. Patients were categorized into two groups: those whose procedure was performed the same day that AVG thrombosis was detected (same-day), or those whose procedure was performed later (delayed). Data regarding post-procedure AVG interventions and AVG failure was collected from electronic medical records, and by calling patients and their dialysis centers. Fisher's exact test was used to compare the groups' procedure success rates. The primary patency and secondary patency were estimated using the Kaplan-Meier technique and compared using the log rank test. Univariate and multivariate Cox regression models were used to determine factors associated with the primary and secondary patencies. Factors assessed were: age, sex, inpatient vs outpatient status, graft age, graft configuration, history of prior ipsilateral tunneled dialysis catheter, number of prior graft interventions, indwelling stent, procedure time, and patient category (same-day vs delayed).

RESULTS

There were 2/26 (8%) unsuccessful procedures in the same-day group, and 3/68 (4%) in the delayed group (p=0.6). The median primary patency was 125 days (95%CI 118-292) for the same-day group, and 58 days (95%CI 82-167) for the delayed group (p=0.06). The median secondary patency was 327 days (95%CI 264-481) for the same-day group, and 300 days (95%CI 292-431) for the delayed group (p=0.9). On multivariate regression only, inpatient status (HR=2.6, 95%CI 1.3-5.3, p=0.01) and delayed declotting (HR=2.3, 95%CI 1.2-4.5, p=0.01) were independently associated with an increased risk of re-intervention.

CONCLUSION

Declotting thrombosed AVG the same day thrombosis is detected versus on a later day does not affect procedure success, primary patency, or secondary patency.

CLINICAL RELEVANCE/APPLICATION

Timing of declotting thrombosed AVG (on the same-day thrombosis is detected vs later) does not affect procedure success, primary patency, or secondary patency.

SSE25-04 Five-years Clinical Experience with Paclitaxel-coated Balloon Angioplasty for Stenoses Causing Dysfunction of Dialysis Arteriovenous Fistula and Synthetic Grafts

Monday, Nov. 30 3:30PM - 3:40PM Location: N226

Participants

Stavros Spiliopoulos, MD, Patra, Greece (*Presenter*) Consultant, C. R. Bard, Inc; Research funded, C. R. Bard, Inc
Panagiotis Kitrou, Rio, Greece (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Katsanos, MD, London, United Kingdom (*Abstract Co-Author*) Consultant, Medtronic, Inc; Consultant, C. R. Bard, Inc
Panagiotis Papadimitos, MD, Rio, Greece (*Abstract Co-Author*) Nothing to Disclose
Andreas Valsamos, MD, Rio, Greece (*Abstract Co-Author*) Nothing to Disclose
Dimitris Siablis, PhD, Rion, Greece (*Abstract Co-Author*) Nothing to Disclose
Dimitrios Karnabatidis, MD, PhD, Patra, Greece (*Abstract Co-Author*) Consultant, C. R. Bard, Inc; Research funded, C. R. Bard, Inc

PURPOSE

This was an audit performed to evaluate the long-term safety and efficacy of paclitaxel-coated balloon (PCB) angioplasty of dysfunctional dialysis vascular access.

METHOD AND MATERIALS

From May 2010 to August 2014, we analysed 62 patients (40 male; mean age: 60±14 years) treated with PCBs due to dysfunctional arteriovenous fistulas (AVF; n=37) or grafts (AVG; n=25). Follow up period terminated on March 2015. Eighty eight procedures were performed (28 in AVGs, 60 in AVFs) to treat 88 lesions (38 de novo, 43.18%) with 97 PCBs (mean diameter: 5.9 ± 1.1mm, mean length: 67±24mm). In 26/88 cases (29.5%) post-dilation was necessary. Primary outcome measure was target lesion primary patency (TLPP). Secondary outcome measures included the identification of factors influencing TLPP and complications rates.

RESULTS

According to Kaplan-Meier analysis, TLPP was 70.3%, 28.6%, 8.9% and 5.9% at follow up 6, 12, 18 and 24 months, respectively. Cox multivariate regression analysis identified restenotic lesions (HR: 2.54; 95%CI: 1.42-4.56, p=0.002), previous stroke (HR: 3.11; 95%CI: 1.56-6.18, p=0.001) and thrombosed vascular access at presentation (HR: 2.67; 95%CI: 1.25-5.72, p=0.01) were independent predictors of decreased TLPP. Access age <3 years was correlated with superior TLPP (HR: 0.38; 95%CI: 0.20-0.70, p=0.002). Major complication rate was 1.1% (one cephalic vein rupture managed intra-procedurally with stent graft deployment).

CONCLUSION

In this series, Paclitaxel-coated balloon angioplasty of dysfunctional dialysis access was safe and provided very satisfactory primary patency rates. Treatment of de novo lesions was correlated with significantly better patency.

CLINICAL RELEVANCE/APPLICATION

PCB angioplasty of dysfunctional dialysis access is safe and yields superior long-term patency outcomes than those reported for plain balloon angioplasty.

SSE25-06 Complications and Tip-point Location of Hemodialysis Catheter Scheduled into Superior Vena Cava: Findings on HR-MRCP and HR-T2WI

Monday, Nov. 30 3:50PM - 4:00PM Location: N226

Participants

Yigang Pei, MD, Changsha, China (*Presenter*) Nothing to Disclose
Wenzheng Li, MD, PhD, Changsha, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the performance of displaying the tip-location and relative complications of double lumen dialysis catheter scheduled into superior vena cava(SVC) using high resolution MRCP(HR-MRCP) and T2WI(HR-T2WI).

METHOD AND MATERIALS

The study protocol was approved by the local Research Ethics Committee. Informed consent was obtained from all subjects. Forty two consecutive hemodialysis patients with suspicion of related complications were scanned by HR-MRCP and HR-T2WI using peripheral pulse wave and respiration gated technique after each catheter lumen installed with 5 ml saline. All images were assessed by two experienced radiologists in order to show the catheter tip-location and relative complications such as fibrin sheaths(FS), thrombus(Th) and intraluminal clot(ILC). All subjects would be taken chest X-ray within 1-3 days. For those patients with relative complications would be withdraw the catheter within 3-10 days. The tip location on X-ray was as the gold standard and was only in SVC and right atrium as normal.

RESULTS

40 out of 42 subjects were undergone successfully MRI. 12 subjects showed normal with "double-eyes" sign on HR-T2WI and "double track" sign on HR-MRCP. For the tip-point location, 6 patients showed abnormal including inside of the right ventricle (n=2), right brachiocephalic vein (n=2), inferior vena cava (n=1), right subclavian vein (n=1). The accuracy rate of HR-MRCP displaying catheter tip-point was 95% (38/40) in comparison with X-ray. For related complication, abnormal findings were detected in 28 (70%) subjects including FS (n=17; 42.5%), Th (n=8; 20%) and ILC (n=5; 12.5%). ILC was determined using the "single eye" sign displayed on HR-T2WI and "single track" on HR-MRCP when one catheter lumen was filled with blood clot (n=3), and the absence of "eye sign" on HR-T2WI when both lumens were obstructed (n=2). 28 subjects with relative complications had catheter's surgical withdraw where the findings were FS (n=10), Th (n=5), ILC (n=4), and died (n=2) due to pulmonary embolism.

CONCLUSION

HR-MRCP and HR-T2WI are excellent methods for visualizing catheter tip-point and related complications in patient with dialysis catheter scheduled into SVC, which is helpful to avoid pulmonary embolism and adjust the treatment plan.

CLINICAL RELEVANCE/APPLICATION

The evaluation of relative complications and tip-point of dialysis catheter is vital for hemodialysis patients and is helpful to adjust

the tip-location for further dialysis and surgical withdraw.

MSMI24

Molecular Imaging Symposium: Case-based MI

Monday, Nov. 30 3:30PM - 5:00PM Location: S405AB

CA **NR** **VA** **MI** **RO**

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

FDA Discussions may include off-label uses.

Participants

Vikas Kundra, MD, PhD, Houston, TX (*Moderator*) License agreement, Introgen Therapeutics, Inc
Jeffrey T. Yap, PhD, Salt Lake City, UT (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify molecular imaging. 2) Comprehend the basis of aspects of molecular imaging. 3) Describe molecular imaging performed in a radiology setting.

ABSTRACT

This course will describe molecular imaging, identify the mechanisms of some aspects of molecular imaging, and give examples of molecular imaging in oncology. Cases will include those from current practice. Mechanisms and scientific basis of examples will be discussed. Sample applications will be discussed and illustrated. Translational examples, including those that have good potential for clinical application, will be used to illustrate interesting aspects of molecular imaging in oncology.

Sub-Events

MSMI24A Oncology

Participants

Vikas Kundra, MD, PhD, Houston, TX (*Presenter*) License agreement, Introgen Therapeutics, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI24B Neurology

Participants

Rathan M. Subramaniam, MD, PhD, Baltimore, MD, (rsubram4@jhmi.edu) (*Presenter*) Travel support, Koninklijke Philips NV

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI24C Cardiology

Participants

Robert J. Gropler, MD, Saint Louis, MO (*Presenter*) Advisory Board, Bracco Group Advisory Board, GlaxoSmithKline plc Advisory Board, Pfizer Inc Advisory Board, Bayer AG Research Grant, GlaxoSmithKline plc Research Grant, Pfizer Inc Research Grant, Clinical Data, Inc Research Grant, Lantheus Medical Imaging, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI24D Vascular Inflammation

Participants

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

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI24E Instrumentation

Participants

Jeffrey T. Yap, PhD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMC24

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

Monday, Nov. 30 3:30PM - 5:30PM Location: S406A



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

Participants

Pamela K. Woodard, MD, Saint Louis, MO (*Director*) Research Consultant, Bristol-Myers Squibb Company; Research Grant, Astellas Group; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Bayer AG; Research agreement, Siemens AG; Research Grant, Actelion Ltd; Research Grant, Guerbet SA; ; ;

David A. Bluenke, MD, PhD, Bethesda, MD (*Moderator*) Research support, Siemens AG

Vincent B. Ho, MD, MBA, Bethesda, MD (*Moderator*) In-kind support, General Electric Company

LEARNING OBJECTIVES

1) To understand the clinical indications for retrospective ECG gated cardiac CT. 2) To illustrate methods to assess myocardial function from cine cardiac CT images. 3) To illustrate methods to assess normal and abnormal valvular function from cine cardiac CT images.

ABSTRACT

The mentored case review provides the opportunity for the attendees to learn the image acquisition, post-processing, and diagnosis for a wide variety of cardiac diseases commonly encountered in CT.

Sub-Events

MSMC24A Coronary Artery Disease and Incidental Noncardiac Findings

Participants

Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Presenter*) Research Grant, Toshiba Corporation;

LEARNING OBJECTIVES

1) To review coronary CTA principles, including details related to image acquisition. 2) Demonstrate examples of CAD as depicted by CT. 3) Discuss strategies to assess the hemodynamic significance of individual coronary lesions. 4) Illustrate non-cardiac findings on coronary CTA images.

ABSTRACT

CT Angiography (CTA) is a guideline endorsed strategy to assess symptomatic patients with low to intermediate risk of coronary artery disease in both the non-emergent and emergent settings. Coronary CTA uses ECG gating to freeze cardiac motion and enables assessment of the lumen for stenosis. Coronary CTA has a high negative predictive value, but suffers when a lesion is detected with a moderate stenosis. Emerging CT methods are also exploring the role of CT to assess individual lesions, including ones that have been problematic, for hemodynamic significance. The clinical relevance relates to the fact that only lesions that are hemodynamically significant should undergo intervention, for example with balloon angioplasty and stenting. In addition, each coronary CTA should include images reconstructed "skin to skin" over the entire craniocaudal field of view that encompasses the heart. Thus, incidental lesions can and should be reported for all coronary CTA studies.

MSMC24B Congenital Heart Disease

Participants

Dianna M. Bardo, MD, Seattle, WA (*Presenter*) Speaker, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Author, Thieme Medical Publishers, Inc

LEARNING OBJECTIVES

1) Recognize the most common congenital heart disease (CHD) findings found in adults with unsuspected CHD. 2) Recognize and understand findings of CHD in patients with known CHD and the findings which may trigger surgical intervention. 3) Recognize the CT findings of commonly performed surgical procedures for palliation of CHD. 4) Develop an organized pattern for search and reporting of CHD findings. 5) Understand why CT is chosen as the advanced imaging modality over MR.

ABSTRACT

Adults with congenital heart disease (CHD) now outnumber children with CHD two to one. This phenomenon is due to the success of surgical palliation and medical management of patients with even the most severe forms of CHD. Surgical intervention is often performed at the time of diagnosis and in patients with residual hemodynamic lesions is often required throughout life. Though echocardiography is typically the initial imaging modality of choice, diagnosis and imaging surveillance of complex hemodynamic and anatomic CHD lesions is now most often accomplished with CT and MR. CT and CTA imaging techniques may be used to show detailed anatomic and functional images of the heart, postoperative changes and long term consequences of CHD. An organized, reproducible approach to identify cardiac anatomy of CHD lesions and surgical palliation should be adopted in order to accurately and thoroughly describe findings.

MSMC24C Coronary Atherosclerosis and Bypass Grafts

Participants

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

LEARNING OBJECTIVES

1) Identify focal areas of stenosis in the coronary arteries on CT. 2) Describe the appearance of bypass graft stenosis on coronary CT. 3) Review the diagnosis of aneurysms in the native coronary arteries and in bypass grafts.

ABSTRACT

Honored Educators

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

Gautham P. Reddy, MD - 2014 Honored Educator

MSCT22

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

Monday, Nov. 30 3:30PM - 5:00PM Location: S100AB

CH **VA** **ER**

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

Participants

Diana Litmanovich, MD, Haifa, Israel (*Director*) Nothing to Disclose

Sub-Events

MSCT22A Airway Disorders

Participants

Diana Litmanovich, MD, Haifa, Israel (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the current imaging technique for evaluating of airway disorders in adult population, with an emphasis on radiation dose reduction. 2) Learn important clinical aspects and characteristic imaging features (both static and dynamic) of various airways abnormalities . 3) Discuss key imaging findings which allow differentiation among various airway disorders, as well as alternative imaging modalities such as thoracic MRI.

ABSTRACT

MSCT22B Pulmonary Arteries and Aorta

Participants

Charles S. White, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

To review pathology of the pulmonary arteries and aorta, focusing on cross-sectional imaging.

MSCT22C Thoracic Civil and Military Trauma

Participants

John P. Lichtenberger III, MD, Bethesda, MD, (john.lichtenberger@usuhs.edu) (*Presenter*) Author, Reed Elsevier

LEARNING OBJECTIVES

1) Incorporate up-to-date epidemiological understanding of thoracic trauma into clinical practice. 2) Identify key imaging features of thoracic trauma in modern civilian and military settings with an emphasis on those features which alter clinical management. 3) Describe the pathogenesis of blast lung injury, its imaging appearance and prognosis.

ABSTRACT

Thoracic trauma is a key component of clinical practice, and radiological evaluation of trauma patients is integral to their surgical management. The medical understanding of civilian thoracic trauma has historically been informed by experiences in military combat. In turn, the development of modern imaging technology in the civilian sector has revolutionized triage and operative planning of trauma patients in both civilian and military settings. This complex interplay between civilian and military trauma care continues today, particularly with the advent of urban warfare. One example of the applicability of military thoracic trauma to the civilian sector is blast injury, a hallmark of modern combat trauma that has increased significantly in the civilian developed world. Most radiologists will care for thoracic trauma patients in medical treatment facilities equipped with modern imaging and surgical capabilities in a civilian setting and with civilian patterns of injury. However, in addition to conventional trauma radiology, exposure to modern combat-specific trauma cases will continue the educational and mutually beneficial interaction between civilian and military trauma medicine and ultimately benefit patient care.

Hot Topics in MR Safety (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Monday, Nov. 30 3:30PM - 5:00PM Location: S105AB



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

ParticipantsKendra Huber, RT, BS, Castle Rock, CO (*Moderator*) Nothing to DiscloseSteven P. DeColle, Edmonton, AB (*Moderator*) Nothing to Disclose**Sub-Events****MSAS24A Safety of the Gadolinium Chelates****Participants**Val M. Runge, MD, Bern, Switzerland (*Presenter*) Research Grant, Siemens AG**LEARNING OBJECTIVES**

1) List the minor adverse reactions that occur with Gd chelate administration, and their incidence. 2) Describe the known interactions of the weaker chelates with laboratory tests. 3) Formulate a strategy for contrast use in renal failure patients, considering the impact of NSF. 4) Describe the phenomenon of dentate hyper intensity, and its link to the weaker chelates. 5) Critique the available agents in terms of overall safety.

ABSTRACT

The gadolinium based MR contrast agents (GBCAs) consist of transition metal Gd ions (Gd³⁺) bound very tightly by chelating agents to form a stable complex (minimizing dissociation in vivo), mitigating the substantial natural toxicity of the free metal ion. MR contrast media, specifically the gadolinium chelates, are in general very safe and lack the nephrotoxicity associated with IV administration of the iodinated agents. Nausea, hives, and taste disturbance are the most frequent adverse reactions caused by GBCAs. All of the available GBCAs have the same incidence of these minor adverse reactions, which is substantially less than with the iodinated agents. It should be noted, however, that life-threatening anaphylactoid reactions - although extremely rare - can occur after IV injection of any contrast agent. The GBCAs can, however, be differentiated on the basis of chelate stability, with important implications for clinical use. Nephrogenic systemic fibrosis (NSF) is a serious late adverse reaction associated with exposure to GBCAs in patients with renal insufficiency. In this situation, release of free Gd³⁺ is more likely to occur due to the extended presence of GBCAs within the body. Due to the advent of NSF, administration of three agents (Omniscan, Optimark, and Magnevist) is now contraindicated in several clinical situations (by both the FDA and the EMA), including specifically chronic severe kidney disease. In the last year, administration of multiple doses of Omniscan, in patients with normal renal function, has also been shown to be associated with changes in the globus pallidus and dentate nucleus, raising further questions regarding this agent, the least stable of the GBCAs. Use of only the most stable agents (the macrocyclics) is strongly recommended (Dotarem, Gadovist, and ProHance), with marked preferential use of these agents in developed countries.

MSAS24B Performing MRI Exams on Patients with Implant Devices**Participants**William H. Faulkner JR, BS, RT, Ooltewah, TN (*Presenter*) Speakers Bureau, Bracco Group; Consultant, Bracco Group; Consultant, Medtronic, Inc ; Speaker, General Electric Company; Consultant, Metrasens Ltd; Consultant, Aspect Imaging; Speaker, Siemens AG;**LEARNING OBJECTIVES**

1) List and define the 3 approved labels for implants and devices as it relates to MRI. 2) Name common safety issues as it relates to B0, B1 and time-varying gradient magnetic fields. 3) Describe the benefit of using B1+rms vs. SAR as it relates to heating of implants and devices. 4) Describe how static field relates to heating of implants and devices.

ABSTRACT

When performing an MR exam on patients with implants and devices there are many factors to consider as it relates to safety. One must first positively identify the device and then determine the MR labeling and thus the conditions of use. The static (B0) magnetic field can produce torque and translational forces on ferromagnetic objects. Additionally Lenz forces may be encountered with conductive metals. The time-varying gradient magnetic fields have been shown to adversely affect some types of active devices. Radio frequency (B1) fields can result in significant heating and severe burns. It's important for those who are exposing patients to these powerful magnetic fields understand their effects.

Special Interest Session: Comparative Effectiveness Research: Payment and Policy Impact

Monday, Nov. 30 4:30PM - 6:00PM Location: S505AB

HPAMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 0**Participants**Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Moderator*) Nothing to DiscloseAlvin Mushlin, MD, New York, NY, (aim2001@med.comell.edu) (*Presenter*) Nothing to DiscloseJ. Sanford Schwartz, MD, Philadelphia, PA (*Presenter*) Research Consultant, Bayer AG; Research Consultant, Blue Cross and Blue Shield Associations; Research Consultant, Takeda Pharmaceutical Company Limited;C. Craig Blackmore, MD, MPH, Seattle, WA, (craig.blackmore@vmmc.org) (*Presenter*) Royalties, Springer Science+Business Media Deutschland GmbH**LEARNING OBJECTIVES**

1) To enhance the imaging community's understanding of the impact of comparative effective research on payment, policy, and research funding decisions.

ABSTRACT

The Washington State Health Technology Assessment Program determines if specific medical technologies will be covered for individuals enrolled in Washington State Health Plans, representing about 25% of the individuals in the state. The program is designed to determine coverage explicitly based on evidence, rather than on political considerations or lobbying, and the decision of the committee are binding. The program has reviewed a substantial number of radiology technologies to date, with a mixed record of approval and non-approval. The greatest barrier to approval of coverage for radiology interventions is lack of evidence for effectiveness, safety, and cost-effectiveness. Evidence based policy decisions from groups like the Health Technology Assessment Program can potentially improve care quality and lower costs through non-coverage of ineffective interventions. However, use of evidence to drive coverage decisions highlights the limitations of the existing literature both in terms of the topics explored, and the methods deployed, and speaks to the great need for technology assessment and comparative effectiveness research.

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Ruth C. Carlos, MD, MS - 2015 Honored Educator

RCC25

Technologies for Creating Educational Content and Teaching Files

Monday, Nov. 30 4:30PM - 6:00PM Location: S501ABC



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

Participants

LEARNING OBJECTIVES

Sub-Events

RCC25A Podcasting and Screencasting for Teaching

Participants

Mahesh M. Thapa, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the utility of podcasts and screencasts. 2) List major software packages available for creating podcasts and screencasts. 3) Understand the steps required to create a podcast or screencast.

RCC25B e-Publishing: Why and How to Do It

Participants

Michael L. Richardson, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Know the pros and cons of publishing electronic books. 2) Know the two main formats for publishing electronic books. 3) Be aware of several strategies for converting one's book to electronic form. 4) Know the pros and cons of several software packages used for electronic book conversion.

Honored Educators

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Michael L. Richardson, MD - 2013 Honored Educator

Michael L. Richardson, MD - 2015 Honored Educator

RCC25C Lecturing 2.0: Innovative Tools and Techniques to Improve the Way We Teach and Learn

Participants

Harprit S. Bedi, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify techniques to incorporate mobile technology into your teaching program. 2) Appraise your current teaching practices in light of the new pedagogical approaches introduced in the lecture.

RCB25

Basic DICOM with Horos/Osiris and dcm4che (Hands-on)

Monday, Nov. 30 4:30PM - 6:00PM Location: S401CD



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

Participants

Marc D. Kohli, MD, Indianapolis, IN (*Presenter*) Research Grant, Siemens AG

Simon Rascovsky, MD, MSc, Bogota, Colombia (*Presenter*) Officer, eDx Tecnologia en Salud SAS

LEARNING OBJECTIVES

1) Describe basic DICOM object metadata structure. 2) Demonstrate familiarity with Osiris/Horos DICOM viewer functions including image display, and measurements. 3) Use Osiris/Horos to send/receive DICOM objects. 4) Name several common dcm4che toolkit tools, and describe their purpose.

Special Interest Session: A New Model of Patient Care: Value over Volume

Monday, Nov. 30 4:30PM - 6:00PM Location: S402AB

OTAMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**Participants**

Mary C. Mahoney, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose
Jennifer L. Kemp, MD, Denver, CO, (jkemp@divrad.com) (*Presenter*) Nothing to Disclose
James V. Rawson, MD, Augusta, GA (*Presenter*) Nothing to Disclose
Christine Zars, MS, Saint Charles, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the mission and goals of RSNA's Radiology Cares: The Art of Patient-centered Practice and ACR's Imaging 3.0 campaigns. 2) To assess your radiology practice model and realign it to focus on value over volume. 3) To learn tactics to put the concepts of patient-centeredness and value vs. volume into practice. 4) To understand your patients' perspectives as they navigate through the healthcare continuum, especially as it relates to radiology.

ABSTRACT

In many healthcare facilities and institutions, the culture and actual practice of radiology have marginalized the patient. Today the call to practice patient-centered care is one of the primary drivers of change within the radiology community. The benefits include improved patient care, improved communication between radiologists and their patients and referring physicians, and greater awareness of the essential role that radiologists play in patients' overall healthcare. The RSNA's Radiology Cares and ACR's Imaging 3.0 campaigns were launched to provide tools to move the radiology profession to focus on patient-centeredness and to help transform the way radiology is practiced. This session will offer insights into the radiology patient mindset and describe tools to bring the concept of patient-centeredness into practice.

SPSI25

Special Interest Session: Entrepreneurship in Radiology: From Napkin to IPO

Monday, Nov. 30 4:30PM - 6:00PM Location: E451A

OT

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

Participants

Steve H. Parker, MD, Englewood, CO (*Presenter*) Stockholder, Kaleo, Inc; Stockholder, Cayenne Medical, Inc; Stockholder, Cianna Medical, Inc; Partner, Salt Creek Medical Device Development; Stockholder, Vertos Medical, Inc; Stockholder, SonoCine, Inc; Board Member, SonoCine, Inc; Stockholder, Avenu Medical, Inc; Chairman, Avenu Medical, Inc;
Thomas R. Mackie, PhD, Madison, WI (*Presenter*) Consultant, Accuray Incorporated; Chairman of the Board, HealthMyne
Richard L. Ehman, MD, Rochester, MN (*Presenter*) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc; Research Grant, Resoundant, Inc

LEARNING OBJECTIVES

1) Describe the rationale and historical perspective and ethical basis of medical entrepreneurship, the role of patents, and the effect of the Bayh Dole legislation. 2) Describe the areas of greatest opportunity for innovation in radiological sciences, how to pick the right problems to solve, to translate ideas to prototype, and to prove the clinical value of prototype technology. 3) Describe practical aspects of commercializing medical technology, licensing, start-up companies, finding help, setting realistic goals, and appropriate roles for inventors.

SPDL21

RSNA Diagnosis Live™: Chest and Abdomen

Monday, Nov. 30 4:30PM - 6:00PM Location: E451B



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

Participants

Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated
Gregory L. Katzman, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Neety Panu, MD, FRCPC, Thunder Bay, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

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

RCA25

National Library of Medicine: Online Images and Datasets: Options for Research and Presentations (Hands-on)

Monday, Nov. 30 4:30PM - 6:00PM Location: S401AB



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

Participants

Holly Ann Burt, MLIS, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify freely available online image databases and data archives including those with online case studies. 2) Use basic searching skills across a variety of databases. 3) Locate copyright options for literature images and radiology datasets .

ABSTRACT

In this hands-on workshop, explore radiographic images and data available online. The National Library of Medicine (NLM) is only one of many agencies which support freely available online image databases and data archives. Topics include searching for journal images, identifying copyright options, and finding case studies or images specifically for patients and families. Use search engines and portals offering a radiology option; discover public data archives and how to search and access datasets; and identify available imaging tools. Learn which databases may be the best starting point for your research.

SPSI21

Special Interest Session: Radiology and Radiation Oncology: A Partnership Made in Heaven

Monday, Nov. 30 4:30PM - 6:00PM Location: E351



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

Participants

Sarah S. Donaldson, MD, Palo Alto, CA (*Moderator*) Nothing to Disclose
Peter R. Mueller, MD, Boston, MA (*Moderator*) Consultant, Cook Group Incorporated

LEARNING OBJECTIVES

1) To understand the role of interventional radiologists in the care of patients with cancer. 2) To understand the increasing role of imaging in radiation oncology. 3) To learn which aspects of oncology must be taught to interventional radiologists in order to enable them to care for cancer patients appropriately. 4) To understand the overlap between radiation oncology and interventional oncology, and how these disciplines can become stronger by collaborating with each other.

Honored Educators

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

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

Sub-Events

SPSI21A **Interventional Oncology: The Fourth Pillar of Cancer Care**

Participants

Andreas Adam, MD, London, United Kingdom, (andy.adam@kcl.ac.uk) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI21B **It Takes More than Technology to Be an Oncologist: What Interventional Radiologists Can Learn from Radiation Oncology**

Participants

Lizbeth Kenny, MD, Herston, Australia (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI21C **Image Targeted Oncology: The Birth of a New Specialty**

Participants

Anthony L. Zietman, MD, Boston, MA (*Presenter*) Editor, Reed Elsevier

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI22

Special Interest Session: Radiology and Pathology Diagnostics: Examples in Practice

Monday, Nov. 30 4:30PM - 6:00PM Location: E352

BQ

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

Participants

Mitchell D. Schnall, MD, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Explain the concepts of integrated radiology and pathology reports. 2) Outline how computers can extract information from pathology and radiology images to improve cancer diagnosis. 3) Develop integrated diagnostic pathways.

Honored Educators

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Mitchell D. Schnall, MD, PhD - 2013 Honored Educator

Sub-Events

SPSI22A Integrated Diagnostic Pathways

Participants

Mitchell D. Schnall, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Honored Educators

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Mitchell D. Schnall, MD, PhD - 2013 Honored Educator

SPSI22B Combined Radiology/Pathology Phenotype Biomarkers

Participants

Anant Madabhushi, MS, Piscataway, NJ (*Presenter*) Research partner, Siemens AG Research partner, General Electric Company Research partner, F. Hoffmann-La Roche Ltd Founder and President, IbRiS, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI22C Integrated Pathology and Radiology Reporting Tool

Participants

Patricia Goede, PhD, Salt Lake City, UT, (pgoede@xifin.com) (*Presenter*) Employee, XIFIN, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Clinical collaboration across multidisciplinary teams from radiology, pathology and oncology has a significant role in the diagnostic and treatment planning process. Specialists and sub-specialists rely on the ability to view imaging and findings together for diagnosis, clinical correlation and treatment planning. The following paper proposes a patient centric model and tools for image management, collaboration and a use case for integrated continuity of care (CCD) reporting.

SPSI22D Integrated Radiology and Pathology Reporting

Participants

Dieter R. Enzmann, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

MSRO29

BOOST: Head and Neck-eContouring

Monday, Nov. 30 4:45PM - 6:00PM Location: S104B



AMA PRA Category 1 Credits™: 1.25
ARRT Category A+ Credits: 1.50

Participants

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

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

Clifton D. Fuller, MD, PhD, Houston, TX (*Presenter*) In-kind support, General Electric Company; Research Grant, Elekta AB; ; ;

LEARNING OBJECTIVES

- 1) Review the pertinent anatomy of the upper aerodigestive tract.
- 2) Discuss the spread patterns of various head and neck tumors.
- 3) Illustrate the important of multimodality imaging for tumor contouring.

ABSTRACT

This e-contouring session will be given by a head and neck radiologist and radiation oncologist. This session will review the pertinent anatomy of the upper aerodigestive tract, discuss the spread patterns of various head and neck tumor and Illustrate the importance of multimodality imaging for tumor contouring.