

Sunday

PS10

Opening Session: Digital Revolution in Radiology - the Good and the Bad

Sunday, Nov. 27 8:30AM - 10:15AM Room: Arie Crown Theater



AMA PRA Category 1 Credits™: 1.75
ARRT Category A+ Credit: 1.00

Participants

Richard L. Baron, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Bruce H. Curran, MEng, Richmond, VA, (Bruce.Curran@vcuhealth.org) (*Presenter*) Nothing to Disclose
Jonathan B. Strauss, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Sub-Events

PS10A Presentation of the Outstanding Educator Award

Participants

Kristen K. DeStigter, MD, Burlington, VT (*Presenter*) Medical Advisory Board, Koninklijke Philips NV; Luminary, McKesson Corporation; Research collaboration, Koninklijke Philips NV;

PS10B Presentation of the Outstanding Researcher Award

Participants

Clifford R. Jack JR, MD, Rochester, MN (*Presenter*) Stockholder, Johnson & Johnson; Research Consultant, Eli Lilly and Company; ;

PS10C Dedication of the 2016 RSNA Meeting Program to the Memory of Herbert L. Abrams, MD (1920-2016)

Participants

PS10D President's Address: Beyond Imaging: Ensuring Radiology Impact in Clinical Care and Research

Participants

Richard L. Baron, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Mitchell E. Tublin, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

Abstract

Radiologists have remarkably impacted radiology and medical care through their participation in developing and advancing the modern day imaging modalities of US, CT, MRI, Nuclear Medicine, and Interventional image-guided therapies. Modern digital advances go beyond the amazing images themselves. The introduction of digital imaging communication and storage systems has enabled timely and impactful distribution of images that has put medical imaging and radiologists at the forefront of clinical care 24 hours a day. At the same time, this rise of information technology in medicine limits personal interactions between radiologists and clinicians, making collaboration between physicians difficult. While technologic imaging innovation continues to advance, the key to continuing radiology's success will lie in our dedication to delivering the best possible care to every patient. To do so, radiologists must think beyond the images they see in practice and stay abreast of advancing subspecialty medical knowledge and more actively collaborate with referring physicians to improve patient outcomes. Meaningful continuing education and interactive training will be necessary to ensure radiologists are proficient at the subspecialty level required by an ever-increasing subspecialty approach in the medical community at large. We must reach beyond imaging in radiologic research, building truly multidisciplinary teams to develop multicenter, multi-investigator prospective trials that impact outcomes for entire populations. Today's research will become tomorrow's clinical practice, requiring radiologists to develop and lead impactful clinical imaging research that will position us as an essential part of clinical care teams. And above all, we must look beyond imaging to gain a broader perspective on the patient experience. We have entered a new era in radiology and healthcare at large driven by changes to reimbursement models and an emphasis on value in patient care delivery. Radiologists must produce examination reports that provide the solutions sought by patients and referring physicians rather than simply describe findings. Ultimately, we should strive to consistently deliver the right examination at the right time by the right radiologist with the quality of the process and the report matching what we would expect for us or our family members. In doing so, we will better serve our patients and our specialty as we navigate an ever-changing healthcare environment.

PS10E When Machines Think: Radiology's Next Frontier

Participants

Keith J. Dreyer, DO, PhD, Boston, MA (*Presenter*) Medical Advisory Board, IBM Corporation
Richard L. Baron, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Abstract

As computers outperform humans at complex cognitive tasks, disruptive innovation will increasingly remap the familiar with waves of creative destruction. And in healthcare, nowhere is this more apparent than at the crossroads of Radiology and the emerging field of Clinical Data Science. As leaders in our field, we must shepherd the innovations of cognitive computing by defining its role within diagnostic imaging, while first and foremost ensuring the continued safety of our patients. If we are dismissive, defensive or self-motivated - industry, payers and provider entities will innovate around us achieving different forms of disruption, optimized to serve their own needs. To maintain our leadership position, as we enter the era of machine learning, it is essential that we serve our patients by directly managing the use of clinical data science towards the improvement of care—a position which will only strengthen our relevance in the care process as well as in future federal, commercial and accountable care discussions. In this

session, we will explore the state of clinical data science in medical imaging and its potential to improve the quality and relevance of radiology as well as the lives of our patients.

PS10F Hope, Hype, and Harm as Medicine Enters the Digital Age: Lessons From (and For) Radiology

Participants

Robert M. Wachter, MD, San Francisco, CA (*Presenter*) Scientific Advisory Board, PatientSafe Solutions, Inc; Stock options, PatientSafe Solutions, Inc; Scientific Advisory Board, EarlySense; Stock options, EarlySense; Scientific Advisory Board, QPID Health, Inc; Stock options, QPID Health, Inc; Scientific Advisory Board, Amino Inc; Stock options, Amino Inc; Scientific Advisory Board, Twine Health, Inc; Stock options, Twine Health, Inc; Author with royalties, Wolters Kluwer nv ; Speaker, Wolters Kluwer nv ; Author with royalties, The McGraw-Hill Companies; Speaker, The McGraw-Hill Companies; Author with royalties, John Wiley & Sons, Inc; Speaker, John Wiley & Sons, Inc ; Investor, Smart Patients, Inc;
Richard L. Baron, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Abstract

While radiology went digital nearly two decades ago, the wholesale switch from paper to computer in the rest of healthcare is a relatively recent phenomenon. While computerization has helped improve safety and quality, it has also had unanticipated consequences, many of them quite negative. Studies have shown, for example, that physician burnout has never been higher – and much of this is attributable to the electronic health record. Other studies have documents new types of medical errors, sometimes known as “e-iatrogenesis”.

Dr. Robert Wachter spent a year studying the digitization of healthcare in researching his 2015 book, *The Digital Doctor: Hope, Hype and Harm at the Dawn of Medicine’s Computer Age*. In this talk, he’ll describe what we got right – and wrong – in our journey, and why radiology was, to a large degree, a canary in the digital coal mine. Ultimately, it’s a hopeful story; the experience from other industries tells us that it often takes a decade or more to obtain the promised benefits from automation – and that these improvements emerge only after the technology improves and the work has been reimagined for a digital environment. Wachter is Professor and Interim Chairman of the Department of Medicine at the University of California, San Francisco, where he also directs the Division of Hospital Medicine. Author of 250 articles and 6 books, he coined the term “hospitalist” in 1996 and is generally considered the “father” of the hospitalist field, the fastest growing specialty in the history of modern medicine. He is past president of the Society of Hospital Medicine and past chair of the American Board of Internal Medicine. In 2015, *Modern Healthcare* magazine ranked him as the most influential physician-executive in the U.S., his eighth consecutive year in the top 50. *The Digital Doctor* was a *New York Times* science bestseller. In its review, the *Times* said, “Janus is the god of medicine these days, and it is the great strength of Wachter’s eloquent new book that it has captured every one of these conflicting emotions, all powerfully felt and intelligently analyzed... Most previous authors have chosen sides, either mourning the old or hailing the new. Wachter is unusual for his equipoise. He is old enough to remember the way things used to work (or fail to work), young enough to be reasonably technology friendly... He is also an exceptionally good, fluent writer.” He is currently heading a national review of IT strategy for England’s National Health Service.

SPIO11

Oncodiagnosis Panel: Liver Cancer

Sunday, Nov. 27 10:45AM - 12:15PM Room: E353C



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

Participants

Kathryn J. Fowler, MD, Chesterfield, MO (*Moderator*) Nothing to Disclose

Sub-Events

SPIO11A Pretreatment Imaging Evaluation of Liver Cancer

Participants

Ihab R. Kamel, MD, PhD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG

SPIO11B Surgical Intervention for Liver Cancer

Participants

Sam G. Pappas, MD, FACS, Maywood, IL (*Presenter*) Nothing to Disclose

SPIO11C Interventional Radiology Procedures for Liver Cancer

Participants

Sandeep Vaidya, MD, Seattle, WA (*Presenter*) Nothing to Disclose

SPIO11D Radiotherapy for Liver Cancer and Post-RT Evaluation of Response

Participants

Michael I. Lock, MD, FRCPC, London, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how to distinguish normal post radiation image changes versus recurrence. 2) Review an approach to liver image interpretation post radiation.

ABSTRACT

Radiation for liver is becoming common. However, the literature reveals a large variation in practice and outcome. This review of the data will provide an organized summary of the evidence and an understanding of the various methods of radiating liver cancers. The primary objective is to review an approach to liver image interpretation post radiation. The presentation will cover expected imaging changes with time after radiation, provide predictive imaging tools to identify i) which patients will progress ii) when patients will progress and iii) which patients will survive.

URL

none

SSA01

Science Session with Keynote: Breast Imaging (Multimodality Screening)

Sunday, Nov. 27 10:45AM - 12:15PM Room: Arie Crown Theater

BR **DM**

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

FDA Discussions may include off-label uses.

Participants

Rachel F. Brem, MD, Washington, DC (*Moderator*) 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
Maxine S. Jochelson, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSA01-01 Breast Imaging Keynote Speaker: Multimodality Screening Part 1

Sunday, Nov. 27 10:45AM - 10:55AM Room: Arie Crown Theater

Participants

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

SSA01-02 A Prospective Blind Evaluation of a 3D Functional Infrared Imaging for Risk Assessment in Women at High Risk for Breast Cancer

Sunday, Nov. 27 10:55AM - 11:05AM Room: Arie Crown Theater

Participants

Miriam Sklair-Levy, MD, Tel -Hashomer, Israel (*Presenter*) Nothing to Disclose
Eitan Friedman, MD, ramat gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Anat Shalmon, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Arie Rudnstein, MD, TelHashomer, Israel (*Abstract Co-Author*) Nothing to Disclose
Yael Servadio, MD, ramat gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Michael Gotlieb, MD, ramat gan, Israel (*Abstract Co-Author*) Nothing to Disclose
David Izhaky, PhD, Airport City, Israel (*Abstract Co-Author*) Employee, Real Imaging Ltd

PURPOSE

Three-dimensional functional infrared imaging (3DIRI) has been shown before to provide high accuracy risk assessment for the likelihood of breast cancer based on multiparametric evaluation of metabolic imaging biomarkers. In this prospective, blind study, of high risk women, 3DIRI is added twice yearly to a screening program which includes annual breast MRI and breast ultrasound or mammography surveillance. This study evaluates the diagnostic accuracy of 3DIRI's risk assessment in the screening program and population of high risk women.

METHOD AND MATERIALS

Following IRB approval, 226 female at high risk for breast cancer due to genetic predisposition, mainly known carriers of BRCA 1/2 mutation signed informed consent for this study. They underwent one, two or three rounds of screening during 24 months. Screening included 3DIRI scan and MRI or breast Ultrasound or Mammography (FFDM). All examinations were read by one of 5 breast radiologists. Women with a negative screening mammography or ultrasound, but positive 3DIRI's risk assessment score (e.g. likelihood for cancer), were referred to MRI. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were analyzed.

RESULTS

226 women completed one, two or three rounds of screening for a total of 378 valid 3DIRI examinations over a period of two years. In 8 women a total of 8 histology confirmed cancers were detected. 3DIRI's risk assessment was positive (likelihood for cancer) in seven of these women, yielding a sensitivity, specificity, PPV and NPV of 87.5%, 84.32%, 10.77% and 99.68% respectively. In three women, cancer was missed by mammography and ultrasound, however, correctly classified as suspicious by 3DIRI and was detected by a subsequent MRI.

CONCLUSION

3DIRI can provide risk assessment for the likelihood of cancer with high accuracy in a population of women that are at high risk for breast cancer. Additional studies are necessary to evaluate its clinical utilization as adjunct to mammography in women that are at high risk for breast cancer.

CLINICAL RELEVANCE/APPLICATION

1. A novel imaging system for assessing the likelihood of breast cancer was developed with high efficacy for correctly classified women with breast cancer. 2. Assessing the likelihood for breast cancer non-invasively can assist in risk-stratified screening programs

SSA01-03 The Added Value of Mammography in an Intermediate and High Risk Breast Cancer Screening Program

Sunday, Nov. 27 11:05AM - 11:15AM Room: Arie Crown Theater

Participants

Suzan Vreemann, MSc, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose

Jan Van Zelst, MD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Albert Gubern-Merida, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Shareholder, Matakina Technology Limited Consultant, QView Medical, Inc Shareholder, QView Medical, Inc Director, ScreenPoint Medical BV Shareholder, ScreenPoint Medical BV

Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research agreement; Siemens AG; Research agreement, Seno Medical Instruments, Inc

PURPOSE

Women at increased risk for breast cancer are regularly screened with MRI. In the Netherlands, guidelines state that supplemental mammography is recommended from the age of 30 in these women. The purpose of this study is to investigate the added value of mammography when breast MRI is available.

METHOD AND MATERIALS

An IRB approved, retrospective review of our intermediate and high risk breast cancer screening program was performed, analyzing 9582 screening breast MRI examinations and 6555 screening mammograms from 2776 women screened in the period from January 2003 to January 2014. Screening indication and age were obtained from patient records. These data were linked to the Netherlands Cancer Registry to identify all breast cancers. Of the cancers identified, imaging records were evaluated for mode and modality of detection.

RESULTS

In total 179 cancers were identified, of which 137 cancers were screen detected. Thirteen out of 137 were detected by mammography alone (detection rate of 2/1000 screening mammograms). Of those, eight (62%) were found to be ductal carcinoma in situ (DCIS). The median age at detection was 55 ± 9.84 years. Twelve (92%) of the breast cancers detected with mammography alone were detected above the age of 40. Three (23%) were detected in BRCA mutation carriers (5% of all screen detected cancers in BRCA mutation carriers). Two of those cancers were diagnosed as DCIS in women above the age of 50.

CONCLUSION

The added value of mammography in high risk screening is very limited: only 13/137 (9%) of the screen detected cancers were detected by mammography alone and most are DCIS. Mammography is especially questionable in women under the age of 40 and in BRCA mutation carriers. Consequently, the age to start mammography in intermediate and high risk screening needs to be reconsidered.

CLINICAL RELEVANCE/APPLICATION

There is no ground for mammography on top of MRI for early detection of breast cancer in women at increased risk below the age of 40. In older women the added value is still very limited.

SSA01-04 Interobserver Variability in Detection of Architectural Distortion: Comparison of Digital Mammography and Digital Breast Tomosynthesis

Sunday, Nov. 27 11:15AM - 11:25AM Room: Arie Crown Theater

Awards

Trainee Research Prize - Fellow

Participants

Elizabeth H. Dibble, MD, Providence, RI (*Presenter*) Nothing to Disclose

Ana P. Lourenco, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

Grayson L. Baird, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

Robert C. Ward, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

Arthur S. Maynard III, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

Martha B. Mainiero, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare interobserver variability in detecting architectural distortion (AD) on digital mammography (DM) and digital breast tomosynthesis (DBT).

METHOD AND MATERIALS

IRB-approved, HIPAA compliant retrospective search of radiology database at a tertiary breast center for "AD" or "possible AD" on screening from 3/5/12-11/27/13. Controls were matched for age, side of prior malignancy, side of new malignancy on presented mammogram, side of prior surgery, and date of mammogram when possible. Patient demographics, imaging findings, pathology findings, and follow-up imaging results were recorded. 2 breast radiologists and 2 breast imaging fellows blinded to outcomes independently reviewed images of 2 patient groups in 4 sessions: Group A DM only, Group B DBT only, then after a 1 month interval Group A DBT only, Group B DM only. For each breast, readers recorded presence or absence of AD and confidence in interpretation on a scale of 1-4. Agreement was examined using weighted Kappa. Differences in confidence between DBT vs DM and attendings vs fellows were examined using generalized mixed modeling with sandwich estimation. Agreement was examined for each breast, not each patient; outcomes are examined by breast but differences between breasts are not anticipated. Unilateral cases were removed (n=4).

RESULTS

59 patients with AD and 59 controls were identified. Mean age was 58.9 (range 42-86) and 57.5 (range 41-77), respectively. 79.7%(47/59) of patients with AD and 78.0%(46/59) of controls had heterogeneously or extremely dense breasts. 23.7%(14/59) of patients with AD and 25.4%(15/59) of controls had prior surgery. DM interobserver variability was 0.53 and 0.57 for right and left breasts, respectively. DBT interobserver variability was 0.72 and 0.69 for right and left breasts, respectively. Agreement was better for DBT than DM; confidence was higher with DBT, $p < .001$ (Table 1).

CONCLUSION

DBT decreases interobserver variability and increases reader confidence in the detection of AD.

CLINICAL RELEVANCE/APPLICATION

DBT decreases interobserver variability and increases reader confidence in the detection of AD. This may lead to improved detection of this subtle manifestation of breast cancer.

SSA01-05 **Concordance of Interpretations of Multi-modality Breast Cancer Screening in Women with Dense Breasts**

Sunday, Nov. 27 11:25AM - 11:35AM Room: Arie Crown Theater

Participants

Janie M. Lee, MD, Bellevue, WA (*Presenter*) Research Grant, General Electric Company
Savannah C. Partridge, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Christoph I. Lee, MD, Los Angeles, CA (*Abstract Co-Author*) Research Grant, General Electric Company
Habib Rahbar, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, General Electric Company
Constance D. Lehman, MD, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company
John R. Scheel, MD, PhD, Seattle, WA (*Abstract Co-Author*) Research support, General Electric Company

PURPOSE

To compare concordance of interpretations for digital mammography (2D) and digital breast tomosynthesis (3D), without and with automated whole breast ultrasound (ABUS) for screening women with dense breasts and at intermediate to high risk of developing breast cancer.

METHOD AND MATERIALS

This study was HIPAA compliant and IRB-approved. All women received multimodality screening with 2D, 3D, and ABUS. Routine 2D and 3D views were obtained. The 3D examination consisted of two-view tomosynthesis and synthetic 2D images of each breast. 2D and 3D examinations were interpreted by independent readers, with initial BI-RADS assessment (Categories 0, 1, or 2) recorded. Each reader then interpreted the ABUS examination, and provided combined 2D+ABUS or 3D+ABUS assessments. For examinations with positive results (BI-RADS 0), recalled lesions underwent further evaluation with diagnostic 2D views, hand-held breast ultrasound, or both. The final BI-RADS assessment was recorded. Lesion location, characteristics, and pathology results (for biopsied lesions) were recorded. Biopsy recommendation rates were compared using Fisher exact tests.

RESULTS

Of 121 women, mean age was 54 years (range 26-81 years). Forty-three women (36%) had a family history of breast cancer, 25 (21%) had a personal history of breast cancer, and 53 (44%) had both. For 2D and 3D alone, the recall rates were 5.0% (6/121) and 3.3% (4/121), respectively. Two women (25%) had lesions recalled by both readers while 6 women (75%) had lesions recalled by only one reader. For combined 2D+ABUS and 3D+ABUS interpretations, the recall rates were 13% (16/121) and 11% (13/121), respectively. Of women recalled, five (21%) had lesions recalled by both readers; the remaining 19 women (79%) had lesions recalled by only one reader. The biopsy recommendation rate tended to be higher for lesions recalled by both readers (3/5, 60%) than for lesions recalled by only one reader (3/19, 16%), $p=0.078$. Of 6 biopsies performed, 1 had malignant and 5 had benign pathology results.

CONCLUSION

For multimodality screening with two readers for each woman, the majority of recalls were seen only by one reader. There was a trend towards a higher biopsy recommendation rate for lesions recalled by both readers.

CLINICAL RELEVANCE/APPLICATION

When adopting a new screening modality, double reading may reduce false-positive recalls during the "learning curve" phase.

SSA01-06 **The Efficacy of 5-Year Consecutive Ultrasound (US) Surveillance for Detection of Axillary Lymph Node Recurrence in Breast Cancer Patients Treated with Sentinel Lymph Node Biopsy (SLNB)**

Sunday, Nov. 27 11:35AM - 11:45AM Room: Arie Crown Theater

Awards

Student Travel Stipend Award

Participants

Bo Ra Kwon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Ui Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Su Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Kyung Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Screening the axilla remains elective in ultrasound (US) screening for breast cancer and the efficacy of screening US for axillary recurrence in breast cancer patients treated with sentinel lymph node biopsy (SLNB) is unclear. The purpose of this study was to determine the efficacy of screening US in breast cancer patient treated with SLNB for evaluation of recurrences in breasts and axillae.

METHOD AND MATERIALS

A retrospective chart review was performed on 367 consecutive patients who were treated with mastectomy or breast conserving surgery and SLNB between January and June 2011. Among these, 303 patients who received annual follow-up screening during 5 years were included. Whole breast ultrasounds including both breasts, excision sites, and axillae were performed and interpreted by expert breast radiologists with mammographic information. The cancer detection rate, recall rate, and positive predictive value (PPV3) of biopsies in breasts and axillae were calculated separately on the basis of pathology or follow-up data.

RESULTS

A total 303 patients underwent 2045 screening US combined with MG during 5-year follow-up period, 12 had recurrences (5.87 per 1,000 cases) including one axillary recurrence (0.49 per 1,000 cases), and 8 occurred within the third year and 4 occurred in the fourth and fifth year. Among recurrent breast cancers, 8 breast lesions were detected by combined US and MG with 5-year accumulated cancer detection rate of 3.91 per 1,000 cases. Axillary recurrence was detected on chest CT scan by minimal size change, not by US. During the period, 244 cases were recalled for breast (11.9%), and 33 cases for axillary lesion (1.6%), and US-guided biopsy was performed in 38 breasts and 10 axillary findings, respectively. The PPV3 for breast was 26.3%, and 0% for axilla.

CONCLUSION

Screening US combined with MG detected 3.91 recurred cancers per 1,000 cases for 5-year follow-up period in breast cancer patients treated with SNLB. Axillary recurrence was very rare compared to in-breast recurrence and screening the axilla was not helpful for detecting axillary recurrence, although the recall rate is lower than that of breast lesions.

CLINICAL RELEVANCE/APPLICATION

Our study supports the benefit of screening axillae in patient treated with SNLB is minimal, even though the recall rate is not as high as screening breasts.

SSA01-07 Performance Metrics of Screening Tomosynthesis: Analysis by Patient Age and Baseline versus Incidence Exam

Sunday, Nov. 27 11:45AM - 11:55AM Room: Arie Crown Theater

Participants

Liane E. Philpotts, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Xiao Wu, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Madhavi Raghu, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Howard P. Forman, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Mammographic screening is criticized due to the imbalance of false positives with true positive cancer detection, particularly in younger women undergoing baseline exams when cancer incidence is lower. Digital breast tomosynthesis (DBT) has lower RR and higher cancer detection rates (CDR) than 2D mammography. The purpose of this study was to examine the performance metrics of screening DBT by patient age and baseline versus incidence screening.

METHOD AND MATERIALS

A IRB-approved audit of the breast imaging electronic database (PenRad) was performed to identify all DBT screening exams over 4-years at our main hospital and 2 satellite offices (total 46,140 exams). The data was sorted by patient age in 5-yr intervals: 40-44, 45-49, ..., 75-79, 80+. True positive, false positive, true negative, and false negative cases were identified and overall sensitivity, specificity and accuracy calculated. The data for baselines was analyzed separately from incidence exams. Statistical analyses performed included Chi square, student t and correlation tests.

RESULTS

The overall sensitivity, specificity, and accuracy of tomosynthesis screening in all age groups was very high. There was no significant correlation found between sensitivity and age. Sensitivity in 40-44 (86.4%) was higher than in the 45-49 group (82.8%). Specificity and overall accuracy increased with age, ranging from 88.7% in 40-44, to 96% in the oldest groups. When comparing baseline versus subsequent mammography, metrics were significantly worse ($p < 0.0001$). Subsequent mammography had higher accuracy than baseline in all age groups except 80+. Specifically, RR in baseline 40-44 (20%) was actually lower than other groups including 45-49 (23%) and 50-54 (27%) ($p = 0.02$). The overall accuracy for baseline exams decreased with age significantly with the best accuracy found in the 40-44 (80%) and the lowest in the 70-74 group (65%) ($p = 0.05$). Importantly, when only incidence exams were assessed, there were no significant differences in screening outcomes between the 40-44 and the 45-50 groups ($p = 0.225$).

CONCLUSION

Tomosynthesis screening yields excellent results in all age groups. Although accuracy is slightly lower in younger women, this effect is erased once non-baseline exams are compared.

CLINICAL RELEVANCE/APPLICATION

Screening with DBT performs at a high level and with similar accuracy between age groups such that younger women should not be deterred from undergoing screening.

SSA01-08 Predictors of Surveillance Mammography Outcomes in Women with a Personal History of Breast Cancer

Sunday, Nov. 27 11:55AM - 12:05PM Room: Arie Crown Theater

Participants

Kathryn Lowry, MD, Boston, MA (*Presenter*) Nothing to Disclose
Lior Braunstein, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Economopoulos, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Laura Salama, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Constance D. Lehman, MD, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Medical Advisory

Board, General Electric Company

Janie M. Lee, MD, Bellevue, WA (*Abstract Co-Author*) Research Grant, General Electric Company

G. Scott Gazelle, MD, PhD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, Marval Biosciences Inc

Elkan F. Halpern, PhD, Boston, MA (*Abstract Co-Author*) Research Consultant, Hologic, Inc; Research Consultant, Real Imaging Ltd; Research Consultant, Gamma Medica, Inc; Research Consultant, K2M Group Holdings, Inc

Jay R. Harris, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Alphonse G. Taghian, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Women with a personal history of breast cancer who survive their initial cancer face risk for second breast cancers, including subsequent ipsilateral breast tumor recurrence (IBTR) and contralateral breast cancers. The purpose of this study was to identify predictors of poor mammography surveillance outcomes based on clinicopathologic features.

METHOD AND MATERIALS

This study was HIPAA compliant and IRB approved. We performed a retrospective chart analysis on a cohort of women with American Joint Committee on Cancer (AJCC) Stage I or II invasive breast cancer and subsequent local recurrence or contralateral breast cancer diagnosed from 1997-2014. Information on ER, PR, HER2 status and histologic grade of primary breast cancer (PBC) was used to approximate biologic subtype (Luminal A, Luminal B, Luminal B-HER2, HER2, and Triple Negative subtypes). Poor surveillance outcome was defined as second breast cancers which were not detected by screening mammography, including interval cancers (diagnosed within 12 months of a negative screening mammogram) or clinically detected cancers diagnosed without a screening mammogram within the past year. Chi square statistics and logistic regression were performed to identify predictors of poor mammography surveillance outcome, including patient demographics, PBC characteristics, systemic treatment, breast density, and time to second cancer diagnosis.

RESULTS

The final cohort included 164 women with IBTR (n=65) or contralateral cancer (n=99). Of these, 124 second cancers were detected by surveillance mammography, and 40 were detected by breast symptoms. On univariate analysis, poor surveillance outcome was associated with age <50 years at primary breast cancer diagnosis ($p<0.0001$), PBC AJCC stage II ($p=0.007$), and heterogeneously or extremely dense breasts ($p=0.04$). On multivariate analysis, age <50 years at PBC diagnosis remained the only significant predictor of poor surveillance outcome ($p=0.001$).

CONCLUSION

Women diagnosed with PBC before the age of 50 are at risk of poor surveillance mammography outcomes, and may be appropriate candidates for more intensive clinical and imaging surveillance.

CLINICAL RELEVANCE/APPLICATION

Women with primary breast cancer diagnosed before age 50 are less likely to have second events detected by surveillance mammography and may be an important population for more intensive surveillance.

SSA01-09 Breast Imaging Keynote Speaker: Multimodality Screening Part 2

Sunday, Nov. 27 12:05PM - 12:15PM Room: Arie Crown Theater

Participants

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

SSA02

Breast Imaging (Ultrasound Diagnostics)

Sunday, Nov. 27 10:45AM - 12:15PM Room: N228



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

Discussions may include off-label uses.

Participants

Wendie A. Berg, MD, PhD, Pittsburgh, PA (*Moderator*) Nothing to Disclose
Catherine S. Giess, MD, Wellesley, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSA02-01 Comparison of Mammography, Digital Breast Tomosynthesis, Automated Breast Ultrasound, Magnetic Resonance Imaging in Evaluation of Residual Tumor after Neoadjuvant Chemotherapy

Sunday, Nov. 27 10:45AM - 10:55AM Room: N228

Participants

Jiyeon Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Eun Young Chae, 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
Woo Jung Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
young-wook Choi, Ansan-city, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hak Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the accuracy of mammography (MG), digital breast tomosynthesis (DBT), automated breast ultrasound (ABUS) and magnetic resonance imaging (MRI) for the assessment of residual tumor extent in breast cancer patients after neoadjuvant chemotherapy (NAC).

METHOD AND MATERIALS

Thirty-four women (age range, 40-68 years; mean age, 49 years) with 35 stage II-III invasive breast cancer undergoing NAC and mastectomy were enrolled from April 2015 to March 2016. Histopathological verification was available for all patients. The longest diameter of residual tumor measured with MG, DBT, ABUS and MRI has been compared with the residual invasive tumor size at pathologic evaluation. Mean differences (MD) in tumor size between measurement by radiologist and pathologic size were evaluated. Statistical analysis was performed using intraclass correlation coefficients (ICC) and marginal homogeneity test. Receiver operating characteristics (ROC) analysis was used to evaluate the diagnostic performance of MG, DBT, ABUS, and MRI for predicting pathologic complete response (CR) (pCR).

RESULTS

The ICC values between predicted tumor size and pathologic size were 0.69 for MG, 0.78 for DBT, 0.79 for ABUS and 0.85 for MRI. MD between MG, DBT, ABUS, MRI and pathology were 15.2mm, 10.8mm, 14.0mm and 10.1mm, respectively. A discrepancy limited in the interval from -5mm to +5 mm compared with the pathologic size was observed in 31.4%, 48.6%, 28.6% and 54.3% of the patients with MG, DBT, ABUS and MRI, respectively. The discrepancy between MRI and pathologic size was statistically different from that of MG and ABUS ($P=0.043$ and 0.0091 , respectively), but not different from that of DBT. Eight of 35 (22.9%) patients showed pCR and 27 (77.1%) showed nonpathologic CR (npCR). For predicting pCR, area under the ROC curve (AUC) for MG, DBT, ABUS and MRI was 0.90, 0.83, 0.77, and 0.92, respectively ($P=$ not significant).

CONCLUSION

Prediction of residual tumor size on MRI and DBT was better correlated with pathology than that on MG and ABUS. Thus, breast MRI and DBT allowed more accurate assessment of residual tumor extent in breast cancer after NAC.

CLINICAL RELEVANCE/APPLICATION

Breast MRI and DBT provide more accurate assessment of residual tumor extent in breast cancer after NAC. Thus, MRI and DBT can be a useful tool in planning an effective surgical treatment.

SSA02-02 Comparison of Automated Volume Breast Ultrasound to Hand Held Ultrasound for Diagnostic Breast Ultrasound Work-Up

Sunday, Nov. 27 10:55AM - 11:05AM Room: N228

Participants

Richard G. Barr, MD, PhD, Youngstown, OH (*Presenter*) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Toshiba Corporation; Research Grant, Esaote SpA; Research Grant, B and K Ultrasound; Research Grant, Hitachi Aloka Ultrasound
Robert DeVita, McDonald, OH (*Abstract Co-Author*) Nothing to Disclose
Stamatia V. Destounis, MD, Scottsville, NY (*Abstract Co-Author*) Nothing to Disclose
Federica Manzoni, PhD, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose
Annalisa DeSilvestri, PhD, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose
Carmine Tinelli, MD, MSC, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic accuracy and inter-observer variability of a hand held US (HH) and a single volume using AVBS centered over the clinical abnormality and to compare if there is a significant difference if the AVBS is performed by a sonographer (UT) or mammography technologist (MT).

METHOD AND MATERIALS

90 patients (age 53.1 years +/- 16.3) receiving a diagnostic US for a palpable mass (60), mammogram abnormality (25), follow-up study (1) or breast discharge (4) were enrolled in this HIPPA compliant, IRB approved study. Patients were randomized to have either a HH or AVBS first. HH was performed using a 14MHz transducer. The AVBS was performed using a L15-9 transducer. The technician performing the second study was blinded to results of the first exam. The AVBS was randomized between a UT and a MT. The studies were blinded, randomized and read by two radiologists each with greater than 10 years experience in breast ultrasound. The lesion with the highest BI-RADS score was used in the analysis. The HH studies were read 6 month before the AVBUS studies. Final diagnoses were made by core biopsy for follow-up for 2 years. Lesions included 9 malignant lesions and 81 benign lesions.

RESULTS

The K for benign/malignant was 0.831 (95% CI 0.744-0.925) while the global agreement using a 7-point BI-RADS score was 0.488 (95% CI 0.372-0.560). The K agreement between AVBS and HH in detecting breast pathology was 0.831 (95% CI 0.717-0.945). The first rater had a K of 0.910 (0.787-1.000) while the second 0.760 (0.578-0.943). The agreement between AVBS and HH was nearly the same when AVBS was performed by a MT (K=0.858 (0.723-0.963)) or UT (k=0.803(0.596-1.000)), p=0.47. The AUC for lesion characterization was AVBS reader 1 0.91 (0.84-0.96), AVBS reader 2 0.91 (0.83-0.96), HH reader 1 0.91 (0.84-0.96) and HH reader 2 0.83(0.74-0.90) with no statistical difference. The inter-observer agreement based on BIRADS was 0.568(0.468-0.647), with the HH k of 0.631(0.584-0.665) and for AVBS 0.492(0.457-0.564). The agreement based on pathology was K=0.831(0.718-0.944) with HH K=0.795 (0.623-0.967) and AVBS 0.869 (0.725-1.000).

CONCLUSION

Performing a one view diagnostic AVBS is equivalent to performing a HH (p=0.47) in diagnostic US work-up. There is no difference if the AVBS is performed by a trained UT or MT.

CLINICAL RELEVANCE/APPLICATION

For Diagnostic US workup HH and AVBS performed by a UT or MT are statistically equivalent.

SSA02-03 Utility of Ultrasound Evaluation of Symptomatic Patients with Fatty Replaced Breast Tissue with a Negative Mammogram

Sunday, Nov. 27 11:05AM - 11:15AM Room: N228

Participants

Jose M. Net, MD, Miami, FL (*Presenter*) Nothing to Disclose
James Henderson, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Jamie R. Spont, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Danea J. Campbell, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Cristina Hoyos, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Geetika A. Klevos, MD, Miami Beach, FL (*Abstract Co-Author*) Nothing to Disclose
Fernando Collado-Mesa, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Monica M. Yepes, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study was conducted to assess the utility of ultrasound evaluating breast pain or a palpable abnormality in patients with fatty replaced breast tissue in the setting of a negative

METHOD AND MATERIALS

We retrospectively reviewed 7180 patient charts of patients who underwent ultrasound evaluation between 1/01/2008 to 12/31/2010. Those who underwent both mammographic and concurrent sonographic evaluation for breast pain and/or palpable abnormality with fatty replaced breast tissue in the setting of a negative mammogram were included in the study. Medical records were reviewed to determine presence or absence of sonographic correlate of patient symptoms, need for biopsy, and final pathology. Those cases with reported positive ultrasound findings were reviewed by a fellowship trained board certified breast imager. Patients with a history of breast cancer or with axillary complaints were excluded from the study.

RESULTS

161 patients with fatty replaced breasts underwent mammographic and concurrent sonographic evaluation in the setting of a negative mammogram for the work-up of pain and/or palpable abnormality. No cancer was identified in any of the 161 patients. 78 ultrasounds were performed for pain and 83 for a palpable abnormality. There were 156 negative ultrasounds (96%) and 5 ultrasounds (4%) demonstrating 1 lipoma, 1 normal lymph node, 1 inclusion cyst, 1 heterogeneous area characterized as fat necrosis given history of trauma which resolved on follow up and 1 patient lost to follow-up. None of the patients with ultrasound correlates to symptomatic area of concern warranted biopsy.

CONCLUSION

In patients with fatty replaced breast tissue and a negative mammogram presenting with breast pain and/or a palpable abnormality, ultrasound did not yield any cancer detection.

CLINICAL RELEVANCE/APPLICATION

Ultrasound may not be required in patients with fatty replaced breasts who present with pain or a palpable abnormality within the breast in the setting of a negative mammogram.

SSA02-04 Participants

Superb Micro-Vascular Imaging (SMI) in Distinguishing Benign from and Malignant Solid Masses at Breast US: Comparison with Contrast-enhanced US

Sunday, Nov. 27 11:15AM - 11:25AM Room: N228

Ah Young Park, MD, Ansan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Bo Kyoung Seo, MD, PhD, Ansan, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Jaehyung Cha, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Suk Keu Yeom, MD, Ansan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively investigate the effect of Superb Micro-Vascular Imaging (SMI) in distinguishing benign from malignant solid breast masses by comparing with contrast-enhanced ultrasound (CEUS).

METHOD AND MATERIALS

Forty female patients who underwent US-guided core needle biopsy for 40 suspicious breast masses and gave written informed consent to this investigation were finally included. Before the biopsy, SMI and CEUS examinations were done in all patients using Aplio 500 US equipment (Toshiba Medical Systems Corporation, Japan) and SonoVue contrast agent (Bracco, Italy). Both quantitative and qualitative parameters were evaluated in SMI (vascular index-%area of vessel signal in the total lesion; qualitative parameters including morphology and distribution of vessels and presence of penetrating vessel) and CEUS (time intensity curve analysis-peak intensity[PI], time to peak[TTP], mean transit time, slope, area under the curve[AUC]; qualitative parameters including degree, margin, and order of enhancement and the presence of internal homogeneity, penetrating vessel, and perfusion defect). Each parameter was compared between benign and malignant masses using student's T-test and chi-square test. The diagnostic performance of SMI and CEUS was analyzed and compared using logistic regression and the receiver operating characteristic curve (ROC) analysis.

RESULTS

Twenty-four masses were benign and 16 were malignant. On SMI, malignant masses showed higher vascular index ($P<.001$), more frequently branching/shunting vessel ($P=.047$), central vascularity ($P=.027$), and penetrating vessels ($P=.002$). On CEUS, malignant masses demonstrated higher PI ($P=.073$) and AUC ($P=.057$), lower TTP ($P=.092$), more frequent hyperenhancement ($P=.061$), centripetal enhancement ($P=.022$), penetrating vessel ($P=.053$), and perfusion defect ($P=.018$). The area under the ROC curve of SMI and CEUS was 0.857 and 0.898, which was statistically equivalent ($P=.475$).

CONCLUSION

SMI is a valuable Doppler technique in distinguishing benign from malignant solid breast masses and its diagnostic performance was equivalent to CEUS.

CLINICAL RELEVANCE/APPLICATION

SMI is a very useful Doppler technique in distinguishing benign from malignant masses at breast US without the use of contrast agent in clinical setting.

SSA02-05 Improving Specificity of Whole Breast Ultrasound using Tomographic Techniques

Sunday, Nov. 27 11:25AM - 11:35AM Room: N228

Participants

Neb Duric, PhD, Detroit, MI (*Abstract Co-Author*) Officer, Delphinus Medical Technologies, Inc
Peter J. Littrup, MD, Providence, RI (*Presenter*) Founder, CryoMedix, LLC; Research Grant, Galil Medical Ltd; Research Grant, Endo International plc; Consultant, Delphinus Medical Technologies, Inc
Rachel F. Brem, MD, Washington, DC (*Abstract Co-Author*) 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
Mary W. Yamashita, MD, Los Angeles, CA (*Abstract Co-Author*) Research Grant, Delphinus Medical Technologies, Inc

PURPOSE

Ultrasound is a sensitive modality with a limited specificity for breast cancer. Ultrasound tomography (UST) is an emerging whole breast imaging modality that combines reflection, attenuation and speed of sound imaging, to support "triple acoustic detection" (TriAD). The purpose of this study is to determine UST's specificity utilizing the TriAD approach.

METHOD AND MATERIALS

This HIPAA compliant, IRB approved trial accrued 167 patients with breast masses identified by standard imaging. Sequential reflection images and quantitative sound speed ($SS=m/sec$) and attenuation ($AT=dB/cm/MHz$) images were generated from UST scans. Each mass was characterized using the TriAD approach: The masses were outlined by an experienced radiologist using an ROI ellipse (Figure 1A), for which 10 progressive peri-mass and 10 intra-mass ellipses were generated by an algorithm to create radial profiles (Figure 1B) which were used to estimate the relative SS and AT of each mass. A tumor margin assessment was made from visual inspection of the reflection images to yield values of REF = -1, 0 and 1 for sharp, indistinct and irregular margins respectively. The three parameters were then combined into two parameters via the formula: $DS = SS + REF/20$; $DA = AT + REF/20$ and the results plotted on a scatter plot. A cut line was chosen for which no cancers were missed and the resulting false positives evaluated (Figure 1C).

RESULTS

55 cancers, 71 fibroadenomas, and 41 cysts were found. Their resulting values of DS and DA are shown in the form of a scatter plot (Figure 1C) with DS plotted horizontally and DA vertically. The cutline shows threshold values running from $(DS,DA) = (-0.025, 0.25)$ to $(DS,DA) = (0.075, -0.2)$ and yielding 3 false positives in the form of cysts and 5 false positives in the form of fibroadenomas for a total of 8 false positives, compared to 55 true positives. This resulted in positive predictive values (PPV) for UST of 87%.

CONCLUSION

The addition of TriAD lesion characterization, using UST, demonstrates a PPV of 87%. This is higher than the reported 20-25% PPV for ultrasound guided breast biopsy and has the potential to decrease the number of false positive breast biopsies for breast masses.

CLINICAL RELEVANCE/APPLICATION

Whole breast UST demonstrates a significant difference in the quantitative evaluations of cancer and benign masses which may allow for fewer biopsies of benign masses.

SSA02-06 Identification and Biopsy of Sentinel Lymph Nodes using Intradermal Microbubbles and Contrast-enhanced Ultrasound (CEUS) in Pre-operative Breast Cancer Patients: The Experience of a National Collaborative Working Group

Sunday, Nov. 27 11:35AM - 11:45AM Room: N228

Participants

Karina Cox, MBBS, Maidstone, United Kingdom (*Presenter*) Nothing to Disclose
Nisha Sharma, MBChB, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alice A. Leaver, MBChB, FRCR, Gateshead, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Adrian K. Lim, MD, FRCR, London, United Kingdom (*Abstract Co-Author*) Luminary, Toshiba Corporation
Jennifer Weeks, Maidstone, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Philippa Mills, MD, Maidstone, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ali R. Sever, MD, Maidstone, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

At Maidstone Hospital Breast Clinic (MHBC), sentinel lymph nodes (SLN) are routinely biopsied in patients with newly diagnosed breast cancer and a normal grey-scale axillary ultrasound. The technique has been adopted by other Breast Units who now work collaboratively (UK Microbubble Working Group) and herein present their early experience.

METHOD AND MATERIALS

Data was collated from 4 Breast Units across the UK. Between 2010 and 2015; retrospective data was collected on 376 patients from Unit 1 and 122 patients from Unit 2, prospective data was collected on 64, mainly screen detected, breast cancer patients from Unit 3 and 48 patients from Unit 4. All patients were newly diagnosed with breast cancer, clinically lymph node (LN) negative and had SLN identified and core biopsied +/- fine needle aspiration (FNA) using intradermal microbubbles and CEUS.

RESULTS

Sentinel LN were identified and successfully biopsied (LN tissue retrieved) in 78% (Unit 1), 77% (Unit 2), 89% (Unit 3) and 79% (Unit 4) of patients with invasive breast cancer undergoing primary surgery. The sensitivities of the technique as a test to identify SLN metastases were; 53%, 46%, 62% and 45% respectively. The specificities were, 98%, 100%, 100% and 96% respectively. The negative predictive values were, 85%, 77%, 91% and 81% respectively. The prevalence of LN metastases in these populations were, 29%, 35%, 21% and 29% respectively. The post-test probabilities that given a benign biopsy the patient had SLN metastases were, 16%, 22%, 9% and 19% respectively.

CONCLUSION

The results represent 4 Breast Units around the UK serving different patient populations with heterogeneous data collection and some variation in the use of the technique. Nevertheless, the data show that CEUS guided SLN biopsy can be readily incorporated into a diagnostic pathway for breast cancer. The sensitivities of the test were all within the previously published confidence intervals for MHBC. Further work should be undertaken to consolidate a standardised approach for the use of CEUS guided SLN biopsy in the breast clinic to establish the foundations for a clinical trial. There may be patients, with a benign core/ FNA SLN biopsy, in whom it is appropriate to completely omit axillary surgery.

CLINICAL RELEVANCE/APPLICATION

This collaborative work establishes the foundation for a clinical trial as some patients may be able to avoid axillary surgery completely.

SSA02-07 Assessment of Shear Wave Elastography in the Ultrasonic Diagnosis of Breast Cancer in Chinese Patients: The BE3 Multicenter Study of 2262 Masses

Sunday, Nov. 27 11:45AM - 11:55AM Room: N228

Participants

Xi Lin, Guangzhou, China (*Presenter*) Nothing to Disclose
Ya-Ling Chen, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Anhua Li, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Cai Chang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To gather elastic information of breast masses based on Chinese population, and to determine the added value of SWE in the characterization of breast masses as compared to conventional US alone.

METHOD AND MATERIALS

From June 2014 to June 2015, 2262 patients consented to repeat standard breast US supplemented by quantitative SW elastographic examination in this prospective multicenter study. Features and assessments of B-mode BI-RADS and qualitative and quantitative SWE were recorded. The final diagnosis for each lesion in which biopsy was recommended was derived from histopathologic results. There were 2262 masses analyzable: 152 BI-RADS category 2 masses were assumed to be benign; reference standard was available for 2110 category 3 or higher lesions. Considering BI-RADS category 4a or higher as test positive for malignancy, effect of SW elastographic features on area under the receiver operating characteristic curve (AUC), sensitivity, and specificity after reclassifying category 3 and 4a masses was determined.

RESULTS

Of these 2262 patients, 1509 lesions were benign and 752 were malignant. If the BI-RADS test was considered to be Test >0 for BI-RADS 4 and 5 and Test <0 for BI-RADS 2 and 3, the accuracy, sensitivity, specificity were 69.0%, 97.5% and 54.8% respectively. Among qualitative SWE variables, SWE Homogeneity, SWE Shape and SWE Rim pattern and Emax, Emean, Eratio and ESD were significantly increasing the AUC (no overlap of 95%CI). And the best variable to add BI-RADS classification to improve the ACU for breast US diagnosis was Emax. By using a new reclassification rule, the malignancy rates were higher than 2% in BI-RADS 3 stiffer than 50 kPa, which could advocate for their upgrade to biopsy. Meanwhile, the malignancy rates were lower than 10% in BI-RADS 4a masse softer than or equal to 40 kPa, which could advocate for their downgrade to follow-up.

CONCLUSION

Qualitative and quantitative SWE features of Chinese population had been demonstrated well in this study. The importance of maximum stiffness on SWE was confirmed in the improvement of US performances in breast lesion characterization. By combining SWE to US, we could decrease the number of false positives of US in the sub-group of low-suspicion masses and avoid unnecessary biopsy.

CLINICAL RELEVANCE/APPLICATION

Combining SWE to US could decrease the number of false positives of US in the sub-group of low-suspicion masses and avoid unnecessary biopsy.

SSA02-08 The Comparison of Elastography and Apparent Diffusion Coefficient (ADC) Values of Solid Breast Lesions Benign Versus Malignant

Sunday, Nov. 27 11:55AM - 12:05PM Room: N228

Participants

Turkan Uz Ikizceli, Istanbul, Turkey (*Presenter*) Nothing to Disclose
Nurdan Gocgun, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Okkes I. Karahan, MD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Yildiray Savas, MD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Gokce Gulsen, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to compare elastography and the result of DWI-ADC values in terms of the discrimination of the solid breast lesions as benign versus malignant.

METHOD AND MATERIALS

This study was approved by Human Subjects Institutional Review Board. All patients gave informed consent. US and real-time Strain Ultrasound Elastography were performed in 71 women (mean age, 46.1±13.4 years; age range, 19-80 years), who had breast lesions greater than 1cm in diameter (29 benign, 42 malignant; confirmed by cytology/histology) evaluated prospectively. Elastography index (cutoff value is used 4.2) and scoring designed by Itoh et al. (Tsukuba elasticity score; 1-3 is considered to be benign, 4-5 is considered to be malignant) is obtained. All patients were assessed by DWI sequence and ADC value of each lesion was calculated from the ADC maps done using five b values 0, 125, 250, 375, and 500 s/mm². Results of the two techniques were compared the sensitivity and specificity according to the gold standard histopathology results.

RESULTS

As a result of histopathology; 42 of the 71 solid breast lesions were malignant and 29 were benign. Elastography scoring has one false negative and 3 false positives and sensitivity and specificity were 93.1% and 96.2%, respectively. Elastography index has 2 false negatives, 2 false positives; sensitivity and specificity were 95.4% and 95.2%, respectively. As a comparison of ADC values and gold standard histopathology, we find a strong correlation of 100 % between them. DWI-ADC values showed no false positive nor false negative results. The cutoff value of ADC is obtained with ROC curve as 0.71x10⁻³ mm²/s. The 29 benign lesions of histopathology are above the ADC cutoff and 42 of malign lesions of histopathology are below; and both the specificity and sensitivity of ADC were 100%.

CONCLUSION

When we compared the ADC results obtained by maximum b values of 500 s/mm²; the strong correlation is found (p < 0.0001). ADC has a prominent lesion characterization of solid breast lesions and superior to elastography in terms of benign and malignant discrimination. Also elastography provides specific benefits and plays an important role in the diagnosis of solid breast lesions.

CLINICAL RELEVANCE/APPLICATION

ADC has a prominent lesion characterization of solid breast lesions and superior to elastography in terms of benign and malignant discrimination.

SSA02-09 Prediction of Pathological Complete Response (pCR) to Neoadjuvant Chemotherapy (NACT) Comparing Greyscale Ultrasound (US), Shear Wave Elastography (SWE) and MRI

Sunday, Nov. 27 12:05PM - 12:15PM Room: N228

Participants

Andrew Evans, MRCP, FRCR, Dundee, United Kingdom (*Presenter*) Research Grant, SuperSonic Imagine; Speakers Bureau, SuperSonic imagine
Patsy Whelehan, MSc, Dundee, United Kingdom (*Abstract Co-Author*) Research Grant, Siemens AG
Alastair Thompson, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Colin Purdie, MBChB, PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Shelley Waugh, PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Lee Jordan, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Jane Macaskill, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sarah J. Vinnicombe, MRCP, FRCR, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pathological complete response (pCR) is increasingly common after neoadjuvant chemotherapy (NACT) for invasive breast cancer. Early prediction of pCR may influence planned surgical approaches in the breast and axilla. The aim of this project is to assess the value of interim SWE and US after 3 cycles in predicting pCR after 6 cycles of NACT and to compare performance of these parameters with MRI using RECIST criteria.

METHOD AND MATERIALS

51 patients with primary, operable breast cancer receiving NACT were recruited into a study which included baseline and interim US and SWE examinations. 4 shear wave images were performed in 2 orthogonal planes and quantitative data extracted prospectively. Maximum greyscale US diameter was measured. We compared three parameters with the binary outcome of presence or absence of pCR: 1. Mean elasticity at interim scan greater or less than 50 kPa (a threshold previously validated for benign-malignant differentiation); 2. Percentage stiffness reduction; 3. Percentage diameter reduction at interim US scan compared with pre-treatment. Interim MRI response using RECIST criteria was available for 42(82%) women. The Chi square test was used to ascertain the significance of differences.

RESULTS

Mean stiffness at baseline was 148 kPa. pCR occurred in 13 of 51 (25%) women. pCR was seen in 8 of 10(80%) women whose masses had an interim stiffness value of <50kPa, compared to 5 of 41(12%) of women whose masses had an interim stiffness value of \geq 50kPa, $p < 0.0001$. with a sensitivity (sens) 62%, specificity (spec) 95%, PPV 80% and NPV 88% respectively. Percentage reduction in stiffness was the next best performance parameter (sens 53% spec 94%, $p = 0.0002$) followed by % reduction in US diameter (sens 47%, spec 88%, $p = 0.007$). MRI performance using RECIST criteria was sens 55% and spec 74%, $p = 0.08$.

CONCLUSION

SWE stiffness less than 50 kPa after 3 cycles of NACT is strongly associated with pCR after 6 cycles of NACT and this parameter outperforms percentage reduction in stiffness, US diameter and MRI using RECIST criteria.

CLINICAL RELEVANCE/APPLICATION

SWE shows promise as a method of interim prediction of response in women with breast cancer treated with NACT and could be used to inform surgical decision making, allowing earlier discussion regarding breast conserving or oncoplastic options.

SSA03

Cardiac (Anatomy and Function)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S502AB



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

FDA Discussions may include off-label uses.

Participants

Gautham P. Reddy, MD, Seattle, WA (*Moderator*) Nothing to Disclose
Robert M. Steiner, MD, Philadelphia, PA (*Moderator*) Consultant, Educational Symposia; Consultant, Johnson & Johnson
Arthur E. Stillman, MD, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSA03-01 Imaging of Pericardiophrenic Bundles Using Multislice Spiral Computed Tomography for Phrenic Nerve Anatomy

Sunday, Nov. 27 10:45AM - 10:55AM Room: S502AB

Participants

Hong Zeng, MD, PhD, Changchun, China (*Presenter*) Nothing to Disclose
Yanjing Wang, ChangChun, China (*Abstract Co-Author*) Nothing to Disclose
Mengchao Zhang, Changchun, China (*Abstract Co-Author*) Nothing to Disclose
Lin Liu, Changchun, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Phrenic nerve injury and diaphragmatic stimulation are common complications following arrhythmia ablation and cardiac pacing therapies. This study aimed to investigate the feasibility of utilizing non-invasive multi-slice spiral CT imaging to assess the phrenic nerve anatomy pre-operatively to reduce the electrophysiological procedure related complications both intra-operatively and post-operatively.

METHOD AND MATERIALS

Coronary CT angiography data of 121 consecutive patients was collected. Imaging of left and right pericardiophrenic bundles was performed with volume rendering and multi-planar reformation techniques. The shortest spatial distances between phrenic nerves and key anatomical structures likely to be at risk during interventional electrophysiological procedures were determined. The frequency of the spatial shortest distances ≤ 5 mm, > 5 mm, and direct contact or intersection between phrenic nerves and adjacent structures were calculated.

RESULTS

Left and right phrenic nerves were identified in 86.8% and 51.2% of the enrolled patients, respectively ($P < 0.001$). The right phrenic nerve was < 5 mm from right superior pulmonary vein ostium and main branches, and right inferior pulmonary vein ostium and main branches in 12.9%, 92.0%, 0% and 3.2% of the patients, respectively. The percentage of right phrenic nerve, < 5 mm from right atrium, superior caval vein, and superior caval vein-right atrium junction was 87.1%, 100% and 62.9%, respectively. Left phrenic nerve was < 5 mm from left atrial appendage, great cardiac vein, anterior interventricular vein, middle cardiac vein, and left ventricular posterior vein in 81.9%, 1.0%, 39.1%, 28.6% and 91.4% of the patients, respectively. Merely 0.06% left phrenic nerves had a distance < 5 mm with left superior pulmonary vein main branches, and none left phrenic nerve (0%) showed a distance < 5 mm with left superior pulmonary vein ostium, or left inferior pulmonary vein ostium and main branches.

CONCLUSION

One-stop enhanced coronary CT angiography enabled detection of phrenic nerve courses and their anatomical relationship with adjacent structures, which might be a promising method to apply clinically before interventional procedures in cardiac electrophysiology.

CLINICAL RELEVANCE/APPLICATION

Preoperative comprehension of phrenic nerve anatomy via non-invasive CT imaging may help to minimize the complications of phrenic nerve injury and diaphragmatic stimulation in interventional electrophysiology.

SSA03-02 Multiparametric Structure-Function Cardiac MR in the Assessment of Cardiotoxicity in Breast Cancer Patients Receiving Chemotherapy

Sunday, Nov. 27 10:55AM - 11:05AM Room: S502AB

Participants

Amir Ali Rahsepar, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Ahmad Reza Ghasemi Esfe, MD, Tehran, Iran (*Abstract Co-Author*) Nothing to Disclose
Kai Lin, MD, MSc, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Julie A. Blaisdell, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Nausheen Akhter, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Bradley D. Allen, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Michael Markl, PhD, Chicago, IL (*Abstract Co-Author*) Institutional research support, Siemens AG; Consultant, Circle Cardiovascular Imaging Inc;
Jeremy D. Collins, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
James C. Carr, MD, Chicago, IL (*Abstract Co-Author*) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA

PURPOSE

Cardiotoxicity following chemotherapy affects 10-20% of patients receiving chemotherapy and may lead to acute or chronic heart failure. Newer tissue characterization/functional cardiac magnetic resonance (CMR) techniques may allow earlier detection of toxicity thereby facilitating earlier intervention. Here, we aimed to assess whether CMR techniques can detect early myocardial abnormalities in patients with suspected cardiotoxicity.

METHOD AND MATERIALS

18 healthy subjects (age: 51.66 ± 16.09 y) and 12 patients (age: 54.15 ± 11.18 y) with recent history of breast cancer and chemotherapy, who presented with more than 5% drop in LV ejection fraction (LVEF) by echocardiography were recruited. Tissue phase mapping (TPM) and T1 mapping pre and post contrast images were acquired in short axis and long axis orientations on a 1.5 T MRI scanner. T1 values were measured segmentally based on the AHA 16-segment model for all subjects and extracellular volume fraction (ECV) was calculated in patients. Radial and longitudinal systolic and diastolic velocities were measured segmentally from TPM images.

RESULTS

Native T1 values were significantly higher in patients compared with controls (1046±32 vs. 974±40 ms, $p<0.001$). TPM analyses showed that global systolic radial and long axis velocities were significantly lower in patients compared with controls [(2.3±0.5 vs. 2.9±0.5 cm/s, $p=0.004$), and (3.4±1.4 vs. 4.9±1.8 cm/s, $p=0.025$), respectively]. Diastolic velocities were also lower in patients than controls, but the difference was not statistically significant ($p>0.05$). There was a strong association between EF (i.e. lowest EF% recorded during course of treatment) and radial systolic and diastolic velocities [($r=0.66, p=0.017$) and ($r=-0.62, p=0.028$), respectively] and also calculated ECV ($r=-0.72, p=0.016$).

CONCLUSION

Preliminary CMR results show lower TPM-derived myocardial velocities in patients with suspected cardiotoxicity compared to controls. T1 and ECV values were higher in patients vs controls and global EF correlated with both regional myocardial velocities and ECV. Work is ongoing to assess the value of multiparametric structure-function CMR for early detection of myocardial abnormalities in patients receiving potentially cardiotoxic chemotherapy agents.

CLINICAL RELEVANCE/APPLICATION

Multiparametric structure-function CMR may act as a surrogate for early detection of myocardial abnormalities in patients receiving potentially cardiotoxic chemotherapy agents.

SSA03-03 Myocardial Strain Evaluation in Thalassemia Major: Use of Tagging Sequence

Sunday, Nov. 27 11:05AM - 11:15AM Room: S502AB

Awards

Student Travel Stipend Award

Participants

Chiara Tudisca, MD, Palermo, Italy (*Presenter*) Nothing to Disclose
Antonella Meloni, MS, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Fausto Pizzino, Messina, Italy (*Abstract Co-Author*) Nothing to Disclose
Calogera Gerardi, Sciacca- Agrigento, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessia Pepe, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimo Midiri, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic resonance (MR) tagging analyzed by dedicated tracking algorithms allows very precise measurements of myocardial motion and characterization of regional myocardial function. No extensive data are available in literature. Our aim was to quantitatively assess for the regional myocardial contractility in thalassemia major (TM) patients and to correlate it with heart iron overload and global biventricular function

METHOD AND MATERIALS

One-hundred and one TM patients (59 F; 33,34 ± 9,01 yrs) enrolled in the MIOT (Myocardial Iron Overload in Thalassemia) network underwent MR (1.5T). Three short-axis (basal, medial and apical) tagged MR images were analyzed offline using harmonic phase (HARP) methods (Diagnosoft software) and the circumferential shortening (Ecc) was evaluated for all the 16 myocardial segments. Four main circumferential regions (anterior, septal, inferior, and lateral) were defined. The same axes were acquired by a T2* GRE multiecho technique to assess myocardial iron overload (MIO). Biventricular function parameters were quantitatively evaluated by cine images

RESULTS

Segmental ECC values ranged from -9.51 ± 4.23 % (basal inferior segment) to 14.62 ± 8.24 % (medial anterior segment). No significant circumferential variability was detected. Compared with previously studied healthy subjects, TM patients showed strain values significantly lower in all the circumferential regions at each level (mean difference from 5 % to 13 %; $P<0.001$ for all the comparisons). Segmental Ecc values were not significantly correlated with the correspondent T2* values and no correlation was detected considering the global values, averaged over all segmental values. Three groups identified on the basis of cardiac iron distribution: no MIO, heterogeneous MIO and homogeneous MIO. The global ECC was comparable among the three groups (-12.03 ± 2.89 % vs -12.22 ± 1.88 % vs -11.32 ± 3.28 %; $P=0.416$). Circumferential shortening was not associated to left ventricular (LV) volumes and ejection fraction (with a $P>0.5$ in all the comparisons).

CONCLUSION

TM patients showed a significant lower cardiac contractility compared with healthy subjects, but this altered contractility was not related to cardiac iron, volumes and function.

CLINICAL RELEVANCE/APPLICATION

Tagging imaging with future post-processing implementation, could represent a valid alternative to detect alteration of cardiac function and contraction in thalassemia major patients.

SSA03-04 Local Myocardial Function Measured in Normal Human Hearts with CT SQUEEZ

Sunday, Nov. 27 11:15AM - 11:25AM Room: S502AB

Participants

Elliot McVeigh, PhD, San Diego, CA (*Presenter*) Stockholder, MRI Interventions Inc;
Amir Pourmorteza, PhD, Bethesda, MD (*Abstract Co-Author*) Researcher, Siemens AG
Michael A. Guttman, MS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Veit Sandfort, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Francisco Contijoch, PhD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Suhas Budhiraja, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Zhenhong Chen, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
David A. Bluemke, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Research support, Siemens AG
Marcus Y. Chen, MD, Bethesda, MD (*Abstract Co-Author*) Institutional research agreement, Toshiba Corporation

PURPOSE

To measure the range of endocardial fractional shortening obtained with CT SQUEEZ in the normal human left ventricle (LV).

METHOD AND MATERIALS

Regional myocardial function was measured at 20 time points over the entire LV endocardium in 13 humans with normal LV function (ejection fractions between 66% and 80%) using coronary CT imaging protocols from two vendors (Siemens and Toshiba). Regional endocardial contraction was quantified by average SQUEEZ values in 16 standard AHA segments of the LV. CT Fractional Shortening (FSct) was computed as $FSct=(1-SQUEEZ)$. Mean and standard deviation of Fractional Shortening values were computed in each segment to estimate the range of values expected in the normal LV as derived from SQUEEZ.

RESULTS

Calculating each SQUEEZ time frame over the entire left ventricle endocardium required ~30 seconds of compute time on a 2.8 GHz Intel Core i7 computer. The curves describing SQUEEZ vs. time were very consistent between hearts, and segments within each heart. There was a slight gradient of decreasing minimum SQUEEZ value (increased Fractional Shortening) from the base to the apex of the heart. The mean values, and standard deviations of FSct computed at end-systole over the segments were: Base = 33% + 1%, Mid = 34% + 1.5%, Apex = 37% + 1%. The standard deviation of the maximum systolic FSct in each segment over the 13 hearts was 5%. This suggests a very tight guideline for calling a segment normal.

CONCLUSION

CT SQUEEZ is a simple, robust, operator independent method for measuring regional wall function over the entire left ventricle. SQUEEZ can be rapidly obtained in humans from standard cardiac gated CT protocols independent of vendor. A normal range of values of Fractional Shortening derived from SQUEEZ can be used to characterize normal local LV function: we estimate that 95 percent of normal LV end-systolic FSct values will fall between 33% and 47%. Therefore, FSct values lower than 33% indicate hypokinetic segments in the human heart.

CLINICAL RELEVANCE/APPLICATION

CT SQUEEZ is a simple, robust, operator independent method to measure quantitative regional LV function in the human heart using currently available coronary CTA protocols in as few as one heartbeat.

SSA03-05 Ventricular Deformation Assessed on Cardiac MRI Cine Images Correlated with Haemodynamics with Patients with Connective Tissue Disease Associated Pulmonary Artery Hypertension

Sunday, Nov. 27 11:25AM - 11:35AM Room: S502AB

Participants

Xiao Li, MD, Beijing, China (*Presenter*) Nothing to Disclose
Yining Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Lu Lin, MD, Peking, China (*Abstract Co-Author*) Nothing to Disclose
Jian Cao, MD, Peking, China (*Abstract Co-Author*) Nothing to Disclose
Lingyan Kong, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zheng Yu Jin, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To identify the correlation of cardiac function and ventricular strain assessed on cardiac MRI cine images with hemodynamics of right heart catheterization in patients with connective tissue disease associated pulmonary artery hypertension.

METHOD AND MATERIALS

After informed consent, 25 patients (age, 35.1±11.0years; male/female=2/23) with right heart catheterization proved connective tissue disease associated pulmonary artery hypertension (SLE/pSS/SSc/overlap=12/2/1/10; mPAP, 45.0±16.1mmHg) were included. Cardiac MRI (3.0T, Magnetom Skyra Siemens, Germany) was performed before treatment was given. Cardiac function was measured on cine images using Argus software (Siemens, Germany). Ventricular deformation was measured as the average total peak systolic strain in longitudinal, radial and circumferential direction on cine images using cvi42 software (version 5.3, Circle Cardiovascular Imaging, Canada). Spearman correlation was used.

RESULTS

Longitudinal strain of the RV correlated with sPAP ($r=0.635$, $P=0.020$), dPAP ($r=0.718$, $P=0.006$), mPAP ($r=0.718$, $P=0.003$) and PVR ($r=0.693$, $P=0.001$). Radial strain of the RV correlated with sPAP ($r=-0.682$, $P=0.010$), dPAP ($r=-0.753$, $P=0.003$), mPAP ($r=-0.685$, $P=0.001$) and PVR ($r=-0.680$, $P=0.002$). Circumferential strain of the RV correlated with sPAP ($r=0.559$, $P=0.047$) and dPAP ($r=0.555$, $P=0.049$). There was no significant correlation between right heart catheterization results with strain of the left ventricle. There was no significant correlation between right heart catheterization results with EDV or EF of the LV or RV.

CONCLUSION

RV strain measured on cardiac MRI cine images correlates with right heart catheterization results in patients with connective tissue disease associated pulmonary artery hypertension, and is promising to reflect the degree of RV afterload and identify early cardiac dysfunction.

CLINICAL RELEVANCE/APPLICATION

RV strain measured on CMRI cine images correlates with right heart catheterization results in CTD associated PAH patients, and helps identify the degree of RV afterload and early cardiac dysfunction.

SSA03-06 Submillisievert Median Radiation Dose for 4D Functional Cine Cardiac CT with a Third-generation Dual-source CT Scanner

Sunday, Nov. 27 11:35AM - 11:45AM Room: S502AB

Participants

Naoki Nagasawa, RT, PhD, Tsu, Japan (*Presenter*) Nothing to Disclose
Kakuya Kitagawa, MD, PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Akio Yamazaki, RT, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (*Abstract Co-Author*) Departmental Research Grant, Siemens AG; Departmental Research Grant, Bayer AG; Departmental Research Grant, Guerbet SA; Departmental Research Grant, DAIICHI SANKYO Group; Departmental Research Grant, FUJIFILM Holdings Corporation; Departmental Research Grant, Nihon Medi-Physics Co, Ltd

PURPOSE

Continuous retrospectively ECG-gated multislice volume scanning allows 4D functional (cine) cardiac CT imaging with 3D reconstruction of the heart volume. However, its clinical use is limited due to high radiation ($\approx 20\text{mSv}$). In this study, we propose a new data acquisition/post-processing scheme for cine CT assessment of cardiac function with less than 1mSv . Its accuracy was evaluated by comparing with standard cine CT.

METHOD AND MATERIALS

This study was performed in ten consecutive patients (4 men, mean age: 82 years) who were referred for cine cardiac CT before transcatheter aortic valve implantation planning. Retrospective ECG-gating low tube voltage (70kV) scan was acquired 20 seconds after the end of acquisition of standard retrospective ECG-gating cine CT at 120kV using 3rd generation dual-source CT (SOMATOM Force; Siemens, Forchheim, Germany). Delay of 20 seconds was set so that the low-dose cine CT can capture the recirculation of contrast medium injected for standard cine CT scan. Twenty axial image series were reconstructed every 5% (0-95%) of the RR-interval. Then, low-dose images were post-processed with the non-rigid registration-based noise reduction algorithm (PhyZiodynamics; Ziosoft, Tokyo, Japan).

RESULTS

Mean DLP of low-dose CT was significantly lower compared to standard scan ($63.6\pm 26.3\text{mGy}\cdot\text{cm}$ vs $1472.2\pm 527.5\text{mGy}\cdot\text{cm}$, $p=0.005$). End-systolic volume, end-diastolic volume, ejection fraction and left ventricular (LV) mass by low-dose CT agreed well with standard scan (bias \pm SD, $-8.6\pm 7.7\text{mL}$, $r=0.98$; $-4.5\pm 3.9\text{mL}$, $r=0.99$; $0.7\pm 2.5\%$, $r=0.99$; $1.2\pm 12.5\text{g}$, $r=0.98$) in spite of lower contrast-to-noise ratio of LV cavity to myocardium (3.9 ± 1.4 vs 23.7 ± 9.3 , $p=0.005$). Contrast-to-noise ratio of right-ventricular cavity to myocardium was higher with low-dose scan (3.4 ± 1.4 vs 1.9 ± 1.6 , $p=0.007$).

CONCLUSION

Proposed low-dose cine cardiac CT scheme allows for accurate assessment of LV function with less than 1 mSv. By exploiting the recirculation of contrast medium used for coronary CT angiography, this method can be combined with any coronary CT acquisition protocol without additional contrast injection.

CLINICAL RELEVANCE/APPLICATION

Routine implementation of cine cardiac CT assessment of LV and RV function in coronary CT examinations may become feasible with the proposed ultralow-dose method.

SSA03-07 Cardiac Function and Ventricular Deformation Assessed on Cardiac MRI Cine Images are Impaired in Connective Tissue Disease Associated Pulmonary Artery Hypertension Patients Without Late Gadolinium Enhancement

Sunday, Nov. 27 11:45AM - 11:55AM Room: S502AB

Participants

Xiao Li, MD, Beijing, China (*Presenter*) Nothing to Disclose
Yining Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Lu Lin, MD, Peking, China (*Abstract Co-Author*) Nothing to Disclose
Jian Cao, MD, Peking, China (*Abstract Co-Author*) Nothing to Disclose
Lingyan Kong, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zheng Yu Jin, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the cardiac function and ventricular deformation on cardiac MRI cine images in patients with connective tissue disease associated pulmonary artery hypertension, and in subgroup patients without late gadolinium enhancement (LGE).

METHOD AND MATERIALS

After informed consent, 25 patients (age, 35.1 ± 11.0 years; male/female=2/23) with right heart catheterization proved connective tissue disease associated pulmonary artery hypertension (SLE/pSS/SSc/overlap=12/2/1/10; mPAP, $45.0\pm 16.1\text{mmHg}$) and 10 healthy control subjects (age, 27.3 ± 6.0 years; male/female=1/9) were included. Cardiac MRI (3.0T, Magnetom Skyra Siemens, Germany) was performed before treatment was given. Patients were further divided into two subgroups with LGE or without LGE. Cardiac function was measured on cine images using Argus software (Siemens, Germany). Ventricular deformation was measured as the average total peak systolic strain in longitudinal, radial and circumferential direction on cine images using cvi42 software (version 5.3, Circle Cardiovascular Imaging, Canada). Mann-Whitney U test was used.

RESULTS

There were significant differences of RVEF ($34.64\pm 12.74\%$ vs. $56.7\pm 4.93\%$, $p=0.002$) and RV radial strain ($25.50\pm 10.89\%$ vs. $45.04\pm 18.85\%$, $p=0.024$) between all patients and healthy subjects. There were 18 patients with LGE, which mainly located in the ventricular insertion point of the inter-ventricular septum, and 7 patients without LGE. There was significant difference of RVEF ($32.07\pm 6.26\%$ vs. $56.7\pm 4.93\%$, $p=0.003$) and RV radial strain ($20.54\pm 6.10\%$ vs. $45.04\pm 18.84\%$, $p=0.018$) between patients without LGE and healthy subjects. There was no significant difference of RV strain, RVEF or RVEDV between subgroups.

CONCLUSION

In connective tissue disease associated pulmonary artery hypertension patients, RVEF and radial strain assessed on cardiac MRI cine images are significantly impaired, and help identify the early cardiac dysfunction in patients without LGE.

CLINICAL RELEVANCE/APPLICATION

In CTD associated PAH patients, RVEF and radial strain assessed on cardiac MRI cine images are significantly impaired, and help identify the early cardiac dysfunction in patients without LGE.

SSA03-08 Visualization Method of Myofiber Structure of the Left Ventricle Apex from Micro CT Volumes

Sunday, Nov. 27 11:55AM - 12:05PM Room: S502AB

Participants

Hirohisa Oda, MENG, Nagoya, Japan (*Presenter*) Nothing to Disclose
Masahiro Oda, PhD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Takayuki Kitasaka, Toyota, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshiaki Akita, PhD,MD, Uchinada-machi, Japan (*Abstract Co-Author*) Nothing to Disclose
Kensaku Mori, PhD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Understanding the myofiber structure of the left ventricular apex is a challenging task due to high complexity of the underlying structures, as well as the restriction imposed because of the thickness of fiber bundles. In this study, we propose a visualization method for understanding each distinct layer.

METHOD AND MATERIALS

We create a specimen of the left ventricular apex from a dog's heart infiltrated with paraffin wax. We obtain a micro CT volume of the specimen by using a micro-focus X-ray CT scanner, inspeXio SMX-90CT, Shimadzu (Japan). The micro CT volume consists of $1024\times 1024\times 545$ voxels, and the size of each voxel is $51.6\times 51.6\times 51.6\mu\text{m}$. We set the initial points as grid pattern on a micro CT volume. For each initial point, fiber tracking is performed. The eigenvector corresponding to the smallest eigenvalue of Structure Tensor (ST) is then assumed to represent the myofiber direction. Short tracking trajectories are eliminated. We utilize a visualization tool, Paraview, for flexible viewing setting. It is possible to show only some part of the result, only one range of the direction, etc. We define the axis and utilize it to compute the myofiber direction. Color scheme is defined for representing the myofiber direction at each point: -60° with red, 0° with blue, and $+60^\circ$ with green.

RESULTS

Myofiber around the left ventricular apex was extracted. Considering only one axial part, three layers were clearly identified by colors: endocardium with red, myocardium with blue, and epicardium with green. However, there were several wrong trajectories at each layer, so we should improve tracking accuracy. For viewing each layer, we looked at myofiber in a limited range of directions: around -60° , 0° , and $+60^\circ$. Rough flow of each layer and location of singular point of each layer could be highlighted. Basically, due to the fact that there exists a high similarity

between the dog's cardiac anatomy and the human's, this approach could also be applicable to the human's heart.

CONCLUSION

We proposed a method for visualizing the myofiber structure of the separability of the left ventricular apex. Future work will involve improving both the accuracy of the fiber tracking approach and separability of each individual layer and addressing how to utilize micro CT volumes of the human heart for diagnostic purposes.

CLINICAL RELEVANCE/APPLICATION

This approach enables medical students to learn anatomical structure of the myofiber.

SSA03-09 Validation of CMR 4D Flow against Cardiac CT for Left Ventricular Function Quantification

Sunday, Nov. 27 12:05PM - 12:15PM Room: S502AB

Participants

Raluca G. Chelu, MD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

Adriaan Coenen, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Consultant, Bracco Group; Scientific Advisor, Zebra Medical Vision Ltd; Advisory Board, Quantib BV

Albert Hsiao, MD, PhD, San Diego, CA (*Abstract Co-Author*) Founder, Arterys, Inc Consultant, Arterys, Inc Research Grant, General Electric Company

Shreyas S. Vasanawala, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research collaboration, General Electric Company; Consultant, Arterys Inc; Research Grant, Bayer AG;

Koen Nieman, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

4D MR flow is a rapidly evolving technique, offering both anatomical and functional information in just a single acquisition. The purpose of this study was to use the anatomical information from the 4D flow sequence, assess the global left ventricular function and compare the results with the functional cardiac CT acquisitions.

METHOD AND MATERIALS

Between November 2015 and February 2016, we prospectively included 10 consecutive adult patients (4 females, mean age 35 yo) known with bicuspid aortic valve. The MR and CT scan were performed in the same day. The 4D flow raw data sets were uploaded to a dedicated web-based software application (Arterys Inc., San Francisco, CA, USA). Images were reconstructed in 20 cardiac temporal phases separately with a compressed sensing algorithm. The end-diastolic, end-systolic and stroke volumes and ejection fractions were measured by CMR 4D flow. Cardiac CT was also reconstruct in 20 cardiac phases and measurements were performed in a similar method as used for 4D flow. In both modalities papillary muscles were included in the left ventricle cavity.

RESULTS

The mean end-diastolic, end-systolic stroke volumes and ejection fraction were 164(\pm 34) ml, 69(\pm 18) ml, 94 (\pm 19) ml and 58 (\pm 4)% respectively for CMR 4D flow and 183 (\pm 43) ml, 67 (\pm 21) ml, 117 (\pm 25) ml, 64 (\pm 5)% respectively for cardiac CT. The Pearson's correlations between CMR 4D flow and CT were 0.91, 0.86, 0.94 and 0.83 for end-diastolic, end-systolic, stroke volumes and ejection fraction respectively.

CONCLUSION

In this study we showed that global left ventricular function can be quantified accurately using CMR 4D flow imaging analysed using a cloud based software

CLINICAL RELEVANCE/APPLICATION

CMR 4D flow may replace the standard CMR acquisition.

SSA04

Cardiac (Coronary Artery Disease I)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S504AB



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

FDA Discussions may include off-label uses.

Participants

U. Joseph Schoepf, MD, Charleston, SC (*Moderator*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; Consultant, Guerbet SA; ; ;
Jill E. Jacobs, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSA04-01 Relationship between Pregnancy Complications and Subsequent Coronary Atherosclerosis in African-American Women: A Coronary Computed Tomography Angiography Study

Sunday, Nov. 27 10:45AM - 10:55AM Room: S504AB

Awards

Student Travel Stipend Award

Participants

Julian L. Wichmann, MD, Charleston, SC (*Presenter*) Nothing to Disclose
Johanna H. Nunez, MEd, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Rozemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Katharina Otani, PhD, Tokyo, Japan (*Abstract Co-Author*) Employee, Siemens AG
Carlo N. De Cecco, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; Consultant, Guerbet SA; ; ;
Sheldon Litwin, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Richard Bayer, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Stefan Baumann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Matthias Renker, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Nanette K. Wenger, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The objectives of this study were to compare the prevalence and extent of coronary atherosclerosis as detected by coronary computed tomography angiography (CCTA) in African-American women with and without a history of prior pregnancy complications.

METHOD AND MATERIALS

We retrospectively evaluated patient characteristics and CCTA findings in groups of African-American women with a prior history of preterm delivery (n=154), preeclampsia (n=137), or gestational diabetes (n=148), and a matched control group of African-American women who gave birth without such complications (n=445). Univariate and multivariate analyses were performed to assess predictors of coronary atherosclerosis.

RESULTS

Average age at delivery and CCTA, number of pregnancies, body-mass-index, smoking history, and prevalence of hypertension or hyperlipidemia were similar between groups (all P>0.2). All groups with prior pregnancy complications showed higher rates of any ($\geq 20\%$ luminal narrowing) and obstructive ($\geq 50\%$ luminal narrowing) coronary atherosclerosis (preterm delivery: 29.2% and 9.1%; preeclampsia: 29.2% and 7.3%; gestational diabetes: 47.3% and 15.5%) compared to control women (23.8% and 5.4%). After accounting for confounding factors at multivariate analysis, gestational diabetes remained a strong predictor of any (OR 3.26; 95% confidence interval 2.03-5.22; P<0.001) and obstructive coronary atherosclerosis (OR 3.00; 95% confidence interval 1.55-5.80; P<0.001) on CCTA.

CONCLUSION

African-American women with a history of pregnancy complications have a higher prevalence of coronary atherosclerosis on CCTA while only a history of gestational diabetes was an independent predictor of any and obstructive coronary atherosclerosis on CCTA in our study.

CLINICAL RELEVANCE/APPLICATION

Healthcare providers should consider pregnancy complications a risk factor for future coronary atherosclerosis, especially in African-American women, and monitor affected women more aggressively for coronary risk factors for premature atherosclerosis.

SSA04-02 Can Epicardial Adipose Fat Tissue Area on Non-ECG Gated Low Dose Chest CT for Lung Cancer Screening Be Used to Predict the Coronary Atherosclerosis in Asymptomatic Population?

Sunday, Nov. 27 10:55AM - 11:05AM Room: S504AB

Participants

Kyu-chong Lee, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hwan Seok Yong, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun-Young Kang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to evaluate that the non-ECG gated low dose chest CT (LDCT) for lung cancer screening can be used to predict the coronary atherosclerosis in asymptomatic population by measuring epicardial adipose fat tissue (EAT) area.

METHOD AND MATERIALS

Among 2,036 self-referred subjects who underwent LDCT for lung cancer screening and simultaneously took the coronary CT angiography (CCTA) for detecting the coronary artery disease from January 2010 to December 2015, we included adults aged 55-80 with a history of smoking and then excluded those who had other cardiovascular risk factors. Total 169 subjects were enrolled and 102 of them had plaque on CCTA. We measured EAT area on both CCTA (CCTA_EAT) and LDCT (LDCT_EAT) at the ostium of left main coronary artery level. Student t-test was used to compare the CCTA_EAT, LDCT_EAT and other continuous variables between the subjects with and without coronary atherosclerosis. Multiple logistic regression analysis was used to determine the factors related to atherosclerosis. We analyzed correlation between CCTA_EAT and LDCT_EAT by Pearson's correlation test. Finally, ROC curve analysis was performed to determine the CCTA_EAT and LDCT_EAT cut-off to predict the atherosclerosis.

RESULTS

CCTA_EAT (13.88±6.00 vs 10.46±4.97, $p<0.001$), LDCT_EAT (15.245±5.90 vs 12.667±5.42, $p=0.005$), age (60.89±5.12 vs 58.93±4.3, $p=0.008$) and SBP (121.45±13.67 vs. 115.66±15.00, $p=0.01$) were significantly different between the subjects with and without coronary atherosclerosis. On multiple logistic regression, CCTA_EAT and LDCT_EAT were significant factors related to the atherosclerosis. LDCT_EAT was well correlated to CCTA_EAT ($r=0.942$, $p<0.001$). ROC curve showed that CCTA_EAT (AUC=0.675, $p<0.001$) and LDCT_EAT (AUC=0.630, $p=0.004$) can be used to predict atherosclerosis. CCTA_EAT $\geq 11.25\text{cm}^2$ (sensitivity=0.637, specificity=0.612) and LDCT_EAT $\geq 13.25\text{cm}^2$ (sensitivity=0.598, specificity=0.597) can be used as a threshold to predict atherosclerosis.

CONCLUSION

EAT area can be used to predict the coronary atherosclerosis in asymptomatic population aged 55-80 with history of smoking who are considered for lung cancer screening by LDCT. LDCT_EAT shows very strong correlation with CCTA_EAT and has independent statistical significance to predict atherosclerosis.

CLINICAL RELEVANCE/APPLICATION

Radiologists will be able to predict the coronary atherosclerosis by measuring EAT area in those who take LDCT for lung cancer screening.

SSA04-04 Potential Impact of Noninvasive FFRct to Guide Therapy in Chest Pain Patients with Intermediate (50-70%) CTA Stenosis: Can It Reduce Cost, Risk and Radiation Exposure?

Sunday, Nov. 27 11:15AM - 11:25AM Room: S504AB

Participants

Kristof De Smet, MD, MSc, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Jeroen Sonck, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Dries Belsack, MD, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Kaoru Tanaka, MD, PhD, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Nico Buls, DSc, PhD, Jette, Belgium (*Abstract Co-Author*) Nothing to Disclose
Johan De Mey, Jette, Belgium (*Presenter*) Nothing to Disclose

PURPOSE

Can utilization of FFRct reduce cost, risk and radiation exposure in symptomatic patients with 50-70% CTA stenosis by reducing the number of "unnecessary" ICA-FFR examinations ?

METHOD AND MATERIALS

Retrospective analysis of 48 patients with stable chest pain, positive exercise ECG and intermediate (50-70%) CTA stenosis who were referred for ICA and FFR examination. Blinded FFRct analysis. Determination of diagnostic accuracy of FFRct vs CTA using FFR as reference standard. Evaluation of potential impact of clinical adoption of FFRct to guide clinical decision making; "unnecessary" ICA-FFR examinations defined as FFR in all vessels >0.80 .

RESULTS

FFRct had higher diagnostic accuracy than CTA (83% vs 29%) with higher PPV (69% vs 29%) and a sixfold reduction in false positives. Using invasive FFR-guided therapy, 34/48 patients (71%) had nonobstructive CAD (FFR >0.80) and were treated medically; 14 (29%) had FFR ≤ 0.80 and were revascularized (8 PCI, 6 CABG). There were no major adverse cardiac events. Use of a FFRct-guided strategy would have reduced "unnecessary" ICA-FFR procedures by 85%, thereby reducing the inherent risk of an invasive procedure. Assuming a cost of 1000€ per FFRct analysis, an overall cost reduction of 30% would have been achieved. Furthermore, radiation dose exposure would have been reduced by 63%, assuming an average dose of 2.1 mSv for CTA and 4.8 mSv for ICA.

CONCLUSION

Utilization of FFRct analysis in the evaluation of symptomatic patients with intermediate CTA stenosis may result in fewer "unnecessary" invasive ICA-FFR examinations with reduced costs, risks and radiation dose exposure.

CLINICAL RELEVANCE/APPLICATION

Utilization of FFRct analysis in the evaluation of symptomatic patients with intermediate CTA stenosis may result in fewer "unnecessary" invasive ICA-FFR examinations with significantly reduced costs, risks and radiation dose exposure.

SSA04-06 Pattern of Coronary Calcifications as an Independent Predictor of Obstructive Coronary Stenosis in Patients with Suspected Coronary Heart Disease

Participants

Zhi-Gang Chu, Stanford, CA (*Presenter*) Nothing to Disclose
Michael A. Kadoch, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Dominik Fleischmann, MD, Palo Alto, CA (*Abstract Co-Author*) Research support, Siemens AG;
Frاندics P. Chan, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Calcium scores (CS), reflecting the total burden of coronary artery calcification (CAC), has been established as a predictor of coronary events. However, CS does not incorporate information about CAC distribution. We test the hypothesis that the pattern of CAC is an independent predictor of obstructive coronary stenosis (OCS) in patients with suspected coronary heart disease.

METHOD AND MATERIALS

With retrospective IRB approval, patients who underwent coronary calcium scan and coronary CTA between 2009 and 2015 and found to have CAC were identified. Patterns of CAC were classified into five types, from I to V, generally with increasing calcium burden. Type I is characterized by single calcification, type II by a few sparsely distributed calcifications, type III by focal cluster of calcification, type IV by diffusely distributed calcifications without clustering, and type V by heavy burden of diffuse calcifications with or without clustering. OCS is defined as one or more greater than 50% stenosis found anywhere in a coronary CTA. Incidence of OCS is correlated with CAC types and CS. Area under the ROC curve is calculated for CS as a predictor of OCS.

RESULTS

A total of 369 patients were evaluated. The distribution by CAC types were type I: 101 (27.4%), type II: 86 (23.3%), type III: 40 (10.8%), type IV: 57 (15.5%), and type V: 85 (23.0%). As expected, CS significantly increases from type I to V ($P < 0.001$). A greater proportion of OCS cases are found in type III (33, 85.0%) and type V (65, 76.5%) relative to other types ($P < 0.001$). In particular, a greater incidence of OCS is found in type III than predicted by CS. The diagnostic performance of CS for detecting OCS for all patients, expressed as the area under the ROC curve, was 0.86 (95% CI: 0.81, 0.90; $P < 0.001$). By removing patients with type III pattern, the area increases to 0.93 (95% CI: 0.89, 0.96; $P < 0.001$).

CONCLUSION

Clustered coronary calcium, represented by type III pattern, has higher than expected incidence of OCS. This pattern may be a predictor of OCS independent of CS.

CLINICAL RELEVANCE/APPLICATION

Incorporation of CAC pattern information to CS may enhance prediction of clinically significant OCS.

SSA04-07 Coronary Artery Calcium Score in Symptomatic South Asian Patients - Poor Correlation with Coronary Artery Disease Severity

Sunday, Nov. 27 11:45AM - 11:55AM Room: S504AB

Participants

Anitha Kini, DMRD, Bangalore, India (*Presenter*) Nothing to Disclose
Sanjaya Viswamitra, MD, Bengaluru, India (*Abstract Co-Author*) Nothing to Disclose
Sunitha P Kumaran, MBBS, MD, Bengaluru, India (*Abstract Co-Author*) Nothing to Disclose
Pushpa Bhari Thippeswamy, MD, MBBS, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Vinay Hegde, MBBS, MD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
srikanth sola, MD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In symptomatic patients with chest pain undergoing coronary CT angiography (CCTA), a coronary artery calcium score (CCS) of zero is associated with a high negative predictive value (93-98%) for significant coronary artery disease (CAD). Patients of South Asian origin, however, have a much higher burden of CAD than western populations, and we hypothesized that a CCS=0 in this ethnic population would have poor correlation with absence of CAD. The objective of this study was to understand the relationship between CCS, the Framingham Risk Score (FRS), and CAD severity in a population of South Asian subjects with cardiac chest pain.

METHOD AND MATERIALS

We performed a prospective study at two centers involving subjects without known CAD referred for CCTA due to cardiac chest pain. Patients were excluded if they had a high pre-test likelihood of CAD (as determined by guideline based risk calculators) or if ejection fraction was $< 50\%$. Scans were performed on a 128-slice MDCT according to contemporary protocols. CCS and CAD severity were classified as per current guidelines. FRS was calculated to predict long term risk of CAD.

RESULTS

We enrolled a total of 100 subjects (52±9 years; 71% males). The mean CCS was 94±166 AU, and 83% had a low risk FRS. 72% of the study population had ≥ 1 vessel with $\geq 70\%$ stenosis. In subjects with a low CCS (< 100 AU), there was a weak correlation with CCS and the absence of CAD ($r=0.23$, $p=0.74$). CAD was present on CCTA in 53% of subjects with CCS=0 AU ($n=20$), 82% of subjects with CCS 1-100 AU ($n=27$), and 86% of subjects with CCS >100 AU ($n=25$). There was no correlation between FRS and presence of CAD ($r=-0.1$, $p=0.6$).

CONCLUSION

A coronary calcium score =0, thought to represent a low burden of CAD, has limited utility in low to intermediate risk South Asian subjects, where 53% of those with CCS=0 AU and 82% of those with CCS 1-100 AU already have $\geq 70\%$ stenosis, respectively. There is no relation between FRS and presence of CAD.

CLINICAL RELEVANCE/APPLICATION

The prevalence of CAD in South Asian subjects with cardiac chest pain is high, as defined by CCTA. Unlike Western countries, low coronary calcium scores have poor correlation with absence of CAD in this population.

SSA04-08 Prognostic Value of Coronary Atherosclerosis Progression Evaluated by Coronary CT Angiography in Patients with Suspected Coronary Atherosclerosis Disease

Sunday, Nov. 27 11:55AM - 12:05PM Room: S504AB

Participants

Yang Gao, Beijing, China (*Presenter*) Nothing to Disclose
Hui Gu, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Bin Lu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the progression of coronary atherosclerosis burden by coronary CT angiography (CCTA) and demonstrate the incidence of major adverse cardiac events (MACE) in patients with and without plaque burden progression.

METHOD AND MATERIALS

The retrospective study was approved by the institutional review board, and the requirement to obtain informed consent was waived. Two hundred ninety four patients with suspected coronary artery disease (CAD) underwent repeat CCTA examinations due to new/worsening symptoms were enrolled. Quantitative plaque burden categorized as lipid, fibrous, calcified and total plaque burden were analyzed using a semi-automated image workstation. Patients were follow-up for the incidence of MACE was defined as cardiac death, coronary revascularization (PCI and CABG) and occurrence of cardiac death and hospitalization due to unstable angina. Cumulative event rates of MACE were estimated by using the Kaplan-Meier method and log-rank test. The association between all the clinical characteristics and MACE were estimated by using Cox proportional hazard model. Logistic regression was used to analyze the associated factors with plaque progression.

RESULTS

Among 294 patients, 268 patients (mean age 52.9 years \pm 9.8, male 71.0%) were follow-up with the mean period of 4.6 years \pm 0.9. 26 patients were lost. Compared with patients with plaque regression, those with lipid, calcified and total plaque progression have a significantly higher incidence of MACE (all $p < 0.05$). The progression of lipid plaque burden (hazard ratio = 3.226, $p = 0.048$), calcified plaque burden (hazard ratio = 5.062, $p = 0.007$) and total plaque (hazard ratio = 8.022, $p = 0.031$) were considered as independent predictors of MACE. Baseline dyslipidemia, statin therapy and low-density lipoprotein cholesterol (LDL-C) were associated with progression of lipid plaque burden ($p < 0.05$ for all).

CONCLUSION

In patients with new/ worsening symptoms after a prior CCTA, lipid, calcified and total plaque burden were progressed in patients who underwent MACE.

CLINICAL RELEVANCE/APPLICATION

Assessment of coronary atherosclerosis burden progression by repeat CCTA could predict MACE and provide risk stratification of patients with suspected CAD.

SSA04-09 Coronary CT Angiography-Derived Quantitative Markers for Predicting In-Stent Restenosis

Sunday, Nov. 27 12:05PM - 12:15PM Room: S504AB

Participants

Christian Tesche, MD, Charleston, SC (*Presenter*) Nothing to Disclose
Carlo N. De Cecco, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Moritz H. Albrecht, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Rozemarijn Vliegthart, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Akos Varga-Szemes, MD, PhD, Charleston, SC (*Abstract Co-Author*) Consultant, Guerbet SA
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; Consultant, Guerbet SA; ;
Daniel H. Steinberg, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Salvatore Chiaramida, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Richard Bayer, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Russel Rosenberg, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Ullrich Ebersberger, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate lesion-related quantitative markers derived from coronary CT angiography (CCTA) performed prior to percutaneous coronary intervention (PCI) with stent placement for predicting in-stent restenosis (ISR) as defined by quantitative coronary angiography (QCA).

METHOD AND MATERIALS

We retrospectively analyzed data of 74 patients (60 \pm 12 years, 72% male) who had undergone dual-source CCTA within 3 months prior to PCI with stent placement. Several quantitative markers of the target atheromatous plaque were derived from CCTA: total plaque volume (TPV), calcified and non-calcified plaque volumes (CPV and NCPV), plaque burden (PB in %), remodeling index (RI), and lesion length (LL). The performance of these markers for the prediction of ISR, as defined by clinically indicated QCA on follow-up, were assessed.

RESULTS

Among 74 lesions with stent placement, 21 showed ISR on angiographic follow-up (mean 616.9 \pm 447.4 days). There was a trend towards insufficient coverage of the target lesion by the stent, when comparing stent length and LL in ISR versus non-ISR patients (17 vs 4, $p=0.068$). Odds ratios (ORs) in multivariate analysis were as follows: TPV (OR 1.02 per mm³, $p=0.065$), CPV (OR 0.66 per mm³, $p=0.002$), NCPV (OR 1.85 per mm³, $p=0.037$), LL (OR 1.23 per mm, $p=0.002$), and RI (OR 1.06 per mm², $p=0.007$). Sensitivity and specificity for detecting ISR were as follows: CPV 39% and 93%, NCPV 65% and 80%, LL 74% and 74%, and RI 71% and 78%, respectively. At receiver operating characteristics analysis these markers showed discriminatory power for predicting ISR: CPV (AUC 0.67, $p=0.012$), NCPV (0.72, $p=0.001$), LL (0.77, $p<0.0001$), and RI (0.79, $p<0.0001$).

CONCLUSION

CPV, NCPV, LL, and RI derived from CCTA as quantitative markers of target plaque lesion anatomy and disease activity portend predictive value for ISR. Obtaining these markers prior to PCI may guide selection of an appropriate revascularization and follow-up strategy.

CLINICAL RELEVANCE/APPLICATION

Coronary CT angiography-derived quantitative markers may be used to identify patients at increased risk for in-stent restenosis. Evaluation of these markers for informing percutaneous coronary intervention may improve procedural outcomes and enhance long-term stent patency.

SSA05

Chest (Dual Energy/Radiomics)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S404CD



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

Participants

Mannudeep K. Kalra, MD, Boston, MA (*Moderator*) Technical support, Siemens AG; Technical support, Medical Vision
Satinder P. Singh, MD, Birmingham, AL (*Moderator*) Nothing to Disclose

Sub-Events

SSA05-01 Dual Energy CT Pulmonary Angiography (CTPA) in 1120 Patients with Suspected Pulmonary Embolism: Why Things Go Wrong?

Sunday, Nov. 27 10:45AM - 10:55AM Room: S404CD

Participants

Alexi Otrakji, MD, Boston, MA (*Presenter*) Nothing to Disclose
Mannudeep K. Kalra, MD, Boston, MA (*Abstract Co-Author*) Technical support, Siemens AG; Technical support, Medical Vision
Efren J. Flores, MD, 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
Subba R. Digumarthy, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Canellas, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine reasons for suboptimal CTPE examinations performed on dual energy scanners (DE-CTPA) in suspected pulmonary embolism.

METHOD AND MATERIALS

Our IRB approved HIPAA compliant study included 1251 consecutive DE-CTPA exams performed in 1120 patients (M: F 502:618, mean age 60±17 years, 81±35kg) scanned on dual source MDCT (Somatom Definition Flash, Siemens) or single source 64-row MDCT (GE 750HD Discovery, GE). All exams were performed with identical contrast volume, concentration and rate of injection using bolus tracking technique at a threshold of 100 HU in the right ventricle. Structured radiology report template was used for determination of suboptimal and optimal examination for evaluation of pulmonary embolism. Information regarding artifacts (motion, metal, beam hardening), patient weight, location of region of interest (ROI) for bolus tracking, and pulmonary arterial enhancement were assessed for all suboptimal studies. The presence of pulmonary embolism (PE) was recorded in all cases. Statistical analysis was performed with Fisher's exact test.

RESULTS

Suboptimal studies were reported in 80/1251 (6%) studies. Of these, 14/80 (17%) were suboptimal at all levels of pulmonary arteries, and 66/80 (83%) were suboptimal at main (8%), lobar (18%) and segmental (78%) levels. A combination of two or more causes was recorded in 37% of all non-diagnostic CTPA. Most common causes of non-diagnostic DE-CTPA at all levels of pulmonary arteries were bolus timing (57%), large body habitus (43%) (mean weight 144±44 kg), incorrect scanning technique (35%) and severe motion artifacts (21%). Most common causes of partial non-diagnostic DE-CTPA were mild to moderate respiratory motion artifacts (55%), large body habitus (39%) (mean weight 138±40 kg), incorrect scanning techniques (26%), beam hardening and metal artifacts (14%), and bolus timing (8%). PE was diagnosed in 6 partial non-diagnostic exams. Respiratory motion artifacts were significantly more common in single source than dual source dual energy CT ($p=0.0001$).

CONCLUSION

Respiratory motion artifacts, incorrect scan techniques, and large body habitus are the main causes of suboptimal DE-CTPA examinations.

CLINICAL RELEVANCE/APPLICATION

Suboptimal DE-CTPA can occur if attention is not given to scan techniques and breath-hold. Patients with large body habitus should be scanned with substantial protocol modifications for DE-CTPA or with single energy CTPA protocols.

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

SSA05-02 Prediction of Incomplete Resolution of Acute Pulmonary Embolism (PE) by Dual Energy Computed Tomography (DECT) Pulmonary Blood Volume (PBV) Measurements

Sunday, Nov. 27 10:55AM - 11:05AM Room: S404CD

Participants

Joanna Moser, MBChB, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sarah L. Sheard, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Charlie Sayer, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Stefanidis, MD, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sam Dumonteil, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (*Presenter*) Research Consultant, Siemens AG; Research Consultant, General Electric Company;
Brendan P. Madden, MBBCh, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether DECT PBV defect patterns can predict incomplete PE resolution or residual PBV defects at follow up DECT.

METHOD AND MATERIALS

56 patients with an initial acute PE were identified from a 4yr retrospective review of patients with initial and follow up DECT imaging (100/Sn140kVp,refmAs 150/128,100 mls,5ml/s iohexol 300mgI/ml, Definition FLASH, Siemens). 9 patients (technical failures, apparent initial chronic thromboembolic disease) were excluded. On the initial 47 patient studies (23 male) the Qanadli score (QS), presence of main pulmonary artery (PA) PE or right cardiac strain signs were recorded. In each lobe the largest vessel division with occlusive or non-occlusive PE was recorded. PBV defects were categorised by 2 reader consensus in each lobe as triangular, non-triangular, or mixed in shape and homogeneous or heterogenous in density. The presence and extent of residual PE (rPE) and residual PBV defects (rPBV) were recorded on the follow up study and parameters predictive of rPE or rPBV were analysed (MWU test, Chi-Square).

RESULTS

rPE was present in 34% of follow-up studies and was not significantly related to days to follow up (mean 219 in rPE v 181 no rPE), age (53 v 54yrs) or initial QS (18 v 13). Initial main PA PE (44 v 23%) and right cardiac strain (50 v 26%) were non-significantly higher in rPE patients ($p>0.05$). At least one PBV defect pattern was present in 89% of initial studies. Well defined triangular homogeneous defects were present in 16/47 (34%) of initial cases, with rPE occurring in 75% vs 13% of cases without this pattern ($p<0.001$, Sens 75%, Spec 87%). Other PBV defect patterns did not predict rPE. Initial occlusive PE (81%) was the only other parameter that less strongly predicted rPE (42% v 0%, $p=0.02$, Sens 100%, Spec 29%). rPBV were present in 40% of cases with initial defects. rPBV were only associated with initial triangular homogeneous PBV defects (87.5% v 16% without, $p<0.001$). Initial occlusive PE demonstrated a trend towards rPBV association (47% v 11%, $p=0.06$).

CONCLUSION

Triangular homogenous PBV defects on initial CT appear the most accurate predictor of residual PE and PBV defects at follow-up CT.

CLINICAL RELEVANCE/APPLICATION

A DECT PBV defect pattern may identify which acute PE patients are at risk of residual PE (and hence potential chronic thromboembolic pulmonary hypertension) which current CT criteria do not provide.

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/>

Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator

SSA05-03 Dual Energy Spectral CT for Assessing Degrees of Malignancy between Pure and Partially Invasive Lung Adenocarcinoma Based on IASLC/ATS/ERS Classification

Sunday, Nov. 27 11:05AM - 11:15AM Room: S404CD

Participants

Chenglong Ren, Shanxi, China (*Presenter*) Nothing to Disclose
Dong Han, MA, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Chuangbo Yang, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Fabao Gao, MD, PhD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the value of dual energy spectral CT in assessing the degrees of malignancy of invasive lung adenocarcinoma.

METHOD AND MATERIALS

We retrospectively analyzed the dual-phase contrast enhanced spectral CT images of 65 cases of pathologically confirmed lung invasive adenocarcinoma (IA) diagnosed from 2013 to 2015. The IAs were reclassified as pure invasive (group A, n=27) and partially invasive (group B, n=38) based on IASLC/ATS/ERS classification and malignant behavior by the Department of Pathology. IAs with a predominant invasive component less than half of the lepidic growth were classified as pure invasive lesions, and the ones with lepidic growth were considered as partially invasive ones. Iodine concentration (IC) for tumors was measured in pulmonary phase (PP) and arterial phase (AP) on the iodine-based material decomposition images and normalized to that of aorta to obtain normalized IC (NIC). The index of normalized iodine concentration was calculated using the formula: $iNIC = NIC_{ap} / (NIC_{ap} + NIC_{pp})$. Independent t-test was used to analyze the statistical difference. Values of the 2 groups were compared and ROC study was performed to assess the differential diagnosis performance.

RESULTS

The NIC and iNIC values in AP for group A were significantly higher than those for group B (0.21 ± 0.06 vs. 0.15 ± 0.03 for NIC; 0.14 ± 0.04 vs. 0.09 ± 0.05 for iNIC; both $p<0.05$), while the NIC value in PP for group A (1.30 ± 0.15) was significantly lower than for group B (1.58 ± 0.29). Using the index of normalized IC (iNIC) of 0.13 in AP as a threshold, one could obtain an area-under-curve of 0.92 for ROC study with sensitivity of 91.7% and specificity of 86.1% for differentiating pure invasive from partially invasive lung adenocarcinoma.

CONCLUSION

Quantitative parameters obtained in spectral CT in the arterial phase provide high sensitivity and specificity for differentiating pure invasive lung adenocarcinomas from partially invasive one.

CLINICAL RELEVANCE/APPLICATION

Quantitative iodine concentration measurement in spectral CT may be used to improve accuracy for assessing the degrees of malignancy for invasive lung adenocarcinoma.

SSA05-04 Dual Energy Computed Tomography for Treatment Monitoring of Patients with Chronic Thromboembolic Pulmonary: Histogram Analysis of Lung Perfused Blood Volume Images

Sunday, Nov. 27 11:15AM - 11:25AM Room: S404CD

Participants

Hideki Ota, MD, PhD, Sendai, Japan (*Presenter*) Nothing to Disclose
Koichiro Sugimura, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Junya Tominaga, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Hidenobu Takagi, MD, PhD, Morioka, Japan (*Abstract Co-Author*) Nothing to Disclose
Katharina Otani, PhD, Tokyo, Japan (*Abstract Co-Author*) Employee, Siemens AG
Kei Takase, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate correlation between voxel-based histogram analysis of lung perfused blood volume (LPBV) data acquired by dual-energy computed tomography (CT) and right heart catheter (RHC) findings before and after balloon pulmonary angioplasty (BPA) for chronic thromboembolic pulmonary hypertension (CTEPH).

METHOD AND MATERIALS

This institutional review board-approved prospective study included twelve consecutive patients (men, 2, women, 10) with CTEPH who underwent BPA procedures. Informed consent was obtained from all patients. Serial CT examinations before and after BPA were acquired. Contrast-enhanced LPBV images were acquired in pulmonary arterial phase using a second-generation dual-source CT scanner. Whole volume data of LPBV for the bilateral lung parenchyma were extracted and frequency distribution of voxel values were generated. Pulmonary vascular resistance (PVR) and mean pulmonary artery pressure (mPAP) were measured before and after BPA. Histogram analysis parameters were correlated with RHC findings using Pearson's correlation coefficients. $P < 0.05$ indicated statistical significance.

RESULTS

BPA significantly improved PVR (mean, 532.8 dyn·s/cm⁵ vs. 339.0 dyn·s/cm⁵, $p < 0.01$) and mPAP (mean, 35.0 mmHg vs. 24.5 mmHg, $p = 0.01$). Frequency distributions of LPBV values appeared non-normal. At baseline, the mode and the 75th, 90th and 95th percentile of the histograms showed negative correlations with mPAP ($r = -0.62$ and $p = 0.03$, $r = -0.59$ and $p = 0.04$, $r = -0.64$ and $p = 0.02$, $r = -0.66$ and $p = 0.02$, respectively); the mode and the 90th and 95th percentile of the histograms showed marginal correlation with PVR ($r = -0.53$ and $p = 0.08$, $r = -0.51$ and $p = 0.08$, $r = -0.56$ and $p = 0.06$, respectively). However, changes of the parameters after BPA were marginally correlated only in the following: changes of the 90th and 95% percentiles of the histograms and changes of PVR ($r = -0.53$ and $p = 0.08$, $r = 0.55$ and $p = 0.06$, respectively). The mean or standard deviations of the CT values in LPBV were not correlated with RHC findings.

CONCLUSION

Based on non-normal distribution of LPBV values, histogram parameters indicate the severity of CTEH as determined by RHC at the baseline. However, its use for monitoring treatment effect of angioplasty procedure is limited.

CLINICAL RELEVANCE/APPLICATION

Histogram analysis of lung perfused blood volume imaging obtained by dual-energy CT allows for estimation of clinical severity in chronic thromboembolic pulmonary hypertension before angioplasty.

SSA05-05 Radiomic Biomarkers for Predicting Progressive-free Survival of Patients with Rheumatoid Arthritis-Associated Interstitial Lung Disease

Sunday, Nov. 27 11:25AM - 11:35AM Room: S404CD

Participants

Chinatsu Watari, MD, Boston, MA (*Presenter*) Nothing to Disclose
Radin A. Nasirudin, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Toru Hironaka, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Janne J. Nappi, PhD, Boston, MA (*Abstract Co-Author*) Royalties, Hologic, Inc.; Royalties, MEDIAN Technologies;
Shoji Kido, MD, PhD, Ube, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Yoshida, PhD, Boston, MA (*Abstract Co-Author*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

PURPOSE

To identify radiomic features of thin-section lung CT images which predict progression-free survival (PFS) of patients with rheumatoid arthritis-associated interstitial lung disease (RA-ILD).

METHOD AND MATERIALS

Twenty patients with RA-ILD who underwent thin-section lung CT and serial pulmonary function tests were retrieved retrospectively. For each patient, ILD was considered as progressed if the forced vital capacity declined more than 10%. The PFS of the patient was determined as the time from the CT scan until either progression or death occurred. We dichotomized the censored survival data using a cutoff time of 3 years, which is considered as a relevant PFS time for RA-ILD patients. A single observer extracted 951 regions of interests (ROIs) that delineated the diseased lung areas on the CT images, and the following radiomic features were computed: homogeneity, dissimilarity, contrast, entropy, energy, sum variance, difference variance, mean,

second moments, autocorrelation, correlation, cluster shape, and cluster prominence. ROC analysis was employed to determine an optimal cut-off value that divides the patients into surviving and non-surviving groups for each radiomic feature, and its value in predicting 3-year survival was assessed by Kaplan-Meier survival analysis with log-rank test. Also, a random forest classifier was trained using leave-one-patient-out method to combine all the radiomic features into a single index, and its predictive value was evaluated using accuracy and area under the ROC curve (AUC).

RESULTS

Mean duration of follow up was 1012 days. Ten subjects showed disease progression or died. Optimal cut-off values (p-value) for the 4 representative radiomic features were: contrast: 102.15 (p=0.42), dissimilarity: 7.98 (p=0.045), homogeneity: 0.25 (p=0.44), and entropy: 6.11 (p=0.88). A combined radiomic feature by random forest yielded an accuracy of 0.70 [95% CI: (0.46, 0.88)] and ACU of 0.64 [0.40, 0.89] in predicting 3-year PFS.

CONCLUSION

Radiomic features, in particular, the dissimilarity feature that showed statistical significance, are a potentially effective biomarker for predicting of the 3-year PFS of patients with RA-ILD.

CLINICAL RELEVANCE/APPLICATION

Radiomic features can provide an effective prognostic imaging biomarker of patients with RA-ILD, which benefits precise management of the disease.

SSA05-06 A Combination of Shape and Texture Features Enables Discrimination of Benign Fungal Infection from Non-small Cell Lung Adenocarcinoma on Chest CT

Sunday, Nov. 27 11:35AM - 11:45AM Room: S404CD

Participants

Mahdi Orooji, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

Mehdi Alilou, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

Niha G. Beig, MS, BEng, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

Sagar Rakshit, MBBS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Abstract Co-Author*) Institutional Research Grant, Koninklijke Philips NV; Speaker, Koninklijke Philips NV

Michael Yang, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

Frank Jacono, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

Robert C. Gilkeson, MD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC; Research support, Koninklijke Philips NV; Research support, Siemens AG; Research support, General Electric Company

Philip A. Linden, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

Vamsidhar Velcheti, MD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Anant Madabhushi, PhD, Piscataway, NJ (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Histoplasmosis is the most common endemic fungal infection in the US. Granulomas secondary to histoplasmosis infection can radiographically appear identical to malignant lung nodules. In a CT screening study of the 51% of baseline screening CT scans found to be positive for lung nodules, only 1-2% were malignant, the remainder felt to be granulomas due to a prior histoplasmosis infection. The goal of this work is to show that a combination of computer extracted image texture and shape features of a nodule on a lung CT exam can enable accurate discrimination of fungal infection versus carcinomas on routine chest CTs. This work could pave the way for substantially reducing unnecessary surgical interventions that result in a diagnosis of histoplasmosis.

METHOD AND MATERIALS

From in vivo lung CTs of the patients who had surgical resection, we used two retrospective cohorts from two sites. Site 1 involved N=123 solitary nodules (66 carcinomas, 57 granulomas) employed for training the classifier and Site 2 involved N=56 independent testing nodules (34 carcinomas, 22 granulomas). Note that patients with multiple solitary nodules were excluded to allow accurate annotation. A total of 669 computer extracted texture and shape features were obtained from the manually delineated nodules from CT scans. Following feature extraction, the most discriminative features within the training cohort were determined via 3-fold cross validation and one-shot testing was performed on the independent testing cohort

RESULTS

The most discriminative features were sum of variance and skewness of Law features with area under the receiver operating characteristic curve (AUC) of 88% and 84%, respectively. Employing the trained diagnosis model on the independent cohort showed AUC as high as 71%.

CONCLUSION

The combination of computer extracted texture and shape features of nodules on a CT scan appear to distinguish granulomas from adenocarcinomas. By identifying the appropriate threshold at which the false omission rate was 0%, a positive predictive value of 62% was achieved on the validation set.

CLINICAL RELEVANCE/APPLICATION

A combination of shape and texture features of nodules on in vivo lung CT scans may allow for discrimination between benign infection and malignant lung nodules. This may potentially impact morbidity and healthcare cost of diagnosing lung cancer by reducing unnecessary bronchoscopy, biopsy, and surgery for benign fungal infections.

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/>

SSA05-07 CT Texture Analysis of Pulmonary Nodules in a Coffee-Break

Sunday, Nov. 27 11:45AM - 11:55AM Room: S404CD

Participants

Aambika Talwar, MA, MBBS, Oxford, United Kingdom (*Abstract Co-Author*) Research funded, Mirada Medical Ltd
Julien M. Willaime, PhD, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Mirada Medical Ltd
Lyndsey C. Pickup, MEng, DPhil, Oxford, United Kingdom (*Abstract Co-Author*) Former Employee, Mirada Medical Ltd; Employee, Optellum Ltd
Monica Enescu, DPhil, MSc, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Mirada Medical Ltd
Djamal Boukerroui, PhD, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Mirada Medical Ltd.
William Hickey, MSc, Oxford, United Kingdom (*Abstract Co-Author*) Research Grant, Mirada Medical Ltd
Mark J. Gooding, MEng, DPhil, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Mirada Medical Ltd
Timor Kadir, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Mirada Medical Ltd.
Fergus V. Gleeson, MBBS, Oxford, United Kingdom (*Presenter*) Consultant, Alliance Medical Limited Consultant, Blue Earth Diagnostics Limited Consultant, Polarean, Inc

PURPOSE

CT Texture analysis (CTTA) has been shown to be a potential imaging biomarker of malignancy. The aims of this study were to assess the reproducibility of texture features extracted from pulmonary nodules (PNs) and compare this to the inter-scan variability of volume measurements, which can vary by up to 25% (Gietema et al 2007).

METHOD AND MATERIALS

19 patients, (11 with indeterminate PN(s) and 8 with pulmonary metastases) underwent two Low Dose Volumetric 'Coffee-break' CT scans within a 60 minute period. CTTA and nodule volume, computed on a contour generated using a semi-automatic Otsu thresholding method, were measured for one solid PN per patient, including nodules abutting vessels or pleura. 20 texture features including Haralick, LoG and Gabor features, basic statistics and fractal dimensions previously used to predict a nodule probability of malignancy were extracted from each contoured region. The variability of textural measurements within individual nodules was assessed by computing the relative differences between baseline and validation scans. Mean and standard deviation (std) were estimated from the relative differences. Lower and upper limits of repeatability (LLR & ULR) were calculated as $\text{mean} \pm 1.96 \times \text{std}$. In addition, the intra-class correlation coefficient (ICC) was also used to assess the repeatability of the image features for the group of patients included in this study. Full Research Ethics Approval was obtained to undertake this study.

RESULTS

Nodule volumes ranged from 76 to 1389 mm³, (mean 2D diameter 8.1mm; std 2.3). Mean difference in volume between the two scans was 18.40mm³ (4.64%, std 22.7), but this was not statistically different (p-value = 0.75 Wilcoxon rank sum test). 95% of textural features displayed ULR & LLR below $\pm 29\%$ (std $\leq 14\%$). These measurements were less variable than nodule volume (mean = 4.0%; std = 16.3%; LLR = -27.9%; ULR = 35.8%). All features had high repeatability ($0.82 \leq \text{ICC} \leq 0.98$).

CONCLUSION

Textural features were found to be more stable than the automatic volumetric measurements. However, editing the volumes might produce better consistency.

CLINICAL RELEVANCE/APPLICATION

CTTA has previously been proposed to predict nodule malignancy on Chest CT. Repeatability of these measurements is an essential step in ensuring CAD systems provide reliable results.

SSA05-08 CT Based Radiomics Approach for Differentiation of Metastatic from Non-metastatic Lymph Node in Patients with Primary Lung Adenocarcinoma

Sunday, Nov. 27 11:55AM - 12:05PM Room: S404CD

Participants

Ying Liu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Olya Stringfield, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Jongphil Kim, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Shichang Liu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Fangyuan Qu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Qian Li, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Yoganand Balagurunathan, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
John J. Heine, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Steven A. Eschrich, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Zhao Xiang Ye, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Robert J. Gillies, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
John A. Arrington, MD, Tampa, FL (*Presenter*) Nothing to Disclose

PURPOSE

To determine the diagnostic performance of computed-tomography (CT) based radiomics approach for differentiation between metastatic and non-metastatic lymph nodes in patients with lung adenocarcinomas.

METHOD AND MATERIALS

Institutional review board approval was obtained for this retrospective study, and the requirement for patients' informed consent was waived. A total of 108 patients with lung adenocarcinoma who underwent preoperative CT scans (both pre- and post-contrast enhanced), and then received surgical resection with systematic lymph node dissection were enrolled in this study. 295 lymph nodes with short-axis diameter of 5 mm or larger on axial CT images were analyzed. Each lymph node was manually segmented and 43 quantitative computerized features were quantitatively extracted by using custom metrics implemented in MATLAB; meanwhile,

10 conventional CT features (semantic features) were evaluated by radiologists. These findings were correlated to the gold standard of pathology. Statistical evaluation was performed on a per-nodal basis. Multiple logistic regression analyses were performed to identify independent factors of indicating nodal malignancy.

RESULTS

Eight semantic features and twenty-four computerized features were significantly associated with nodal malignancy. On multivariate analysis, the model with combined semantic features and computerized features showed excellent performance in differentiation between metastatic and non-metastatic lymph nodes, and the AUC (0.942) was significantly higher compared to the model with just semantic features (adjusted $P=0.022$) or the model with computerized features alone (adjusted $P<0.00001$). Using the optimal cutoff value for this best model, 111 of 134 metastatic lymph nodes and 148 of 161 non-metastatic lymph nodes were correctly diagnosed, and the sensitivity, specificity, accuracy, PPV and NPV were 82.8%, 91.9%, 87.8%, 89.5%, and 86.5%, respectively.

CONCLUSION

CT based radiomics approach has the potential ability to improve differentiation between metastatic and non-metastatic lymph nodes in lung adenocarcinoma.

CLINICAL RELEVANCE/APPLICATION

CT based radiomics approach which combined semantic features and computerized features could serve as a non-invasive image biomarker for nodal malignancy in patients with lung adenocarcinoma, and this modality can easily be added to clinical use without additional cost.

SSA05-09 Visual Assessment of Regional Xenon Ventilation, Perfusion, and Ventilation-Perfusion Mismatch using Dual-Energy Computed Tomography in COPD Patients: Follow-up Study after Pharmacological Treatment

Sunday, Nov. 27 12:05PM - 12:15PM Room: S404CD

Participants

Hye Jeon Hwang, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Young Oh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Taekjin Jang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Seung Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sei Won Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yeon-Mok Oh, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the interval change of regional ventilation (V) and perfusion (Q) status in COPD patients after pharmacological treatment using combined xenon-enhanced V and iodine-enhanced Q dual-energy CT (DECT).

METHOD AND MATERIALS

Twenty-three COPD patients were prospectively enrolled. Baseline combined V and Q DECT was performed after discontinuation of the medication. After a 3-month pharmacological treatment, follow-up combined V and Q DECT was performed. Virtual noncontrast (VNC) images, V maps, and Q maps were anatomically co-registered with in-house software. VNC, V maps and Q maps of follow-up images were registered to the baseline VNC images. For visual analysis, the regional disease patterns—emphysema, bronchial wall thickening, or normal looking parenchyma—in each segment was determined on VNC image of baseline image. And regional V/Qratio pattern of each segment was determined to be matched (-11), or reversed mismatched ($V/Qratio<1$) in both baseline and follow-up study.

RESULTS

Most of segments with normal parenchyma or emphysema showed the matched V/Qratio pattern (90.1% and 71.2%), whereas the segments with bronchial wall thickening commonly showed reversed mismatched pattern (66.7%) on baseline images. On follow-up, the regional V/Qratio pattern did not change in most of segments with matched V/Qratio (91.7%). In more than half of the segments with reversed mismatched V/Qratio (60.6%), V/Qratio pattern changed into the matched V/Qratio on follow-up. Pattern change from the reversed mismatched V/Qratio to the matched V/Qratio was more frequently seen in the normal looking parenchyma than in the diseased lung parenchyma ($p < 0.05$). In most of the area with mismatched V/Qratio, V/Qratio pattern did not changed (66.7%).

CONCLUSION

The recovery of V/Q abnormality after pharmacological treatment can be visualized with combined V and Q DECT imaging in COPD patients. The correction of V/Q abnormality in non-emphysematous areas may be associated with the response to pharmacological treatment in COPD patients.

CLINICAL RELEVANCE/APPLICATION

Visual assessment of the interval change of the regional V and Q status after pharmacological treatment with combined V and Q DECT imaging is feasible in COPD patients.

SSA06

Emergency Radiology (Utilization and Practice Management)

Sunday, Nov. 27 10:45AM - 12:15PM Room: N226



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

Participants

Karen S. Lee, MD, Boston, MA (*Moderator*) Nothing to Disclose
Michael N. Patlas, MD, FRCPC, Hamilton, ON (*Moderator*) Nothing to Disclose

Sub-Events

SSA06-01 Accuracy of Outside Radiologists' Reports of Computed Tomography Exams of Emergently Transferred Patients

Sunday, Nov. 27 10:45AM - 10:55AM Room: N226

Participants

Jeffrey D. Robinson, MD, MBA, Seattle, WA (*Presenter*) Consultant, HealthHelp, LLC; President, Cleareview, Inc;
Ken F. Linnau, MD, MS, Seattle, WA (*Abstract Co-Author*) Royalties, Cambridge University Press; Speaker, Siemens AG
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Kellie L. Sheehan, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Joel A. Gross, MD, MS, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Determine the concordance rate of CT interpretations of emergently transferred patients to a Level 1 trauma center.

METHOD AND MATERIALS

The IRB determined this retrospective study to be exempt after reviewing the study protocol. Outside CT scans of all adult patients transferred to the Emergency Department of a Level 1 trauma center from May 9, 2015 to June 9, 2015 were retrospectively reviewed. Patients were categorized as trauma or non-trauma transfers. The original imaging report was compared to the reviewer's findings, and categorized as concordant or discordant. Discordant findings were rated as minor, moderate or major. Major discordances were defined as having the potential to impact clinical management. Rates of each type of discordance and 95% confidence intervals (CIs) were calculated per transfer and per exam.

RESULTS

628 CT scans from 327 transfers were reviewed. There were 213 (65%) trauma transfers and 114 (35%) non-trauma transfers, corresponding to 490 trauma-related exams and 138 non-trauma exams. Of the 327 total transfers, there were 119 (36%, 95% CI: 31-42%) with any discordance and 56 (17%, 95% CI: 13-22%) with at least one major discordance. These major discordances were identified in 49 (23%, 95% CI: 18-29%) of the 213 trauma transfers and 7 (6.1%, 95% CI: 2.7-13%) of the non-trauma transfers ($p < 0.001$ for the difference). On a per exam basis, 59 of 628 (9.4%) total exams had a major discordance. Among the trauma-related exams and non-trauma exams there were 51 (10%) and 8 (5.8%) major discordances, respectively. The rates of major, moderate and minor discordances are further summarized in the Figure.

CONCLUSION

We identified major interpretive discrepancies in the CT scans of 17% of patients emergently transferred to a Level 1 trauma center. Trauma transfer patients were significantly more likely to have a major discordance than non-trauma transfer patients.

CLINICAL RELEVANCE/APPLICATION

Routine over-reading of pre-transfer CT scans may be justified due to the substantial likelihood of a major discordance in interpretation that may impact the clinical management of patients.

SSA06-02 Repeated CT Scans in Trauma Transfers: An Analysis of Indications, Radiation Dose Exposure, and Costs

Sunday, Nov. 27 10:55AM - 11:05AM Room: N226

Participants

Ricarda M. Hinzpeter, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Kai Sprengel, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Hatem Alkadhi, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To identify the number of CT scans repeated in acute trauma patients receiving imaging before being referred to a trauma center, to define indications, and to assess radiation doses and costs of repeated CT.

METHOD AND MATERIALS

This retrospective study included all adult trauma patients transferred from other hospitals to a Level-I trauma center during 2014. Indications for repeated CT scans were categorized into: inadequate CT image data transfer, poor image quality, repetition of head CT after head injury together with completion to whole-body CT (WBCT), and follow-up of injury known from previous CT. Radiation doses from repeated CT were determined; costs were calculated using.

RESULTS

Within one year, 85/298 (28.5%) trauma patients were transferred from another hospital because of severe head injury (n=45, 52.9%) and major body trauma (n=23; 27.1%) not manageable in the referring hospital, repatriation from a foreign country (n=14; 16.5%), and no ICU-capacity (n=3; 3.5%). Of these 85 patients, 74 (87.1%) had repeated CT in our center because of inadequate CT data transfer (n=29; 39.2%), repetition of head CT with completion to WBCT (n=24; 32.4%), and follow-up of known injury (n=21; 28.4%). None occurred because of poor image quality. Cumulative DLP and annual costs of potential preventable, repeated CT (inadequate data transfer) was 631mSv (81'304mGy*cm) and 40'192\$, respectively. The mean time from trauma to admission to our center was significantly shorter in patients without repeated CT (median 1.5 ± 3 hours) as compared to those with repeated CT (median 3.0 ± 19 hours, p<0.001).

CONCLUSION

A considerable number of transferred trauma patients undergo potentially preventable, repeated CT, adding radiation dose to patients and costs to the health care system.

CLINICAL RELEVANCE/APPLICATION

Repetition of CT in trauma patients occurs relatively often and mainly is caused by inadequate image data transfer.

SSA06-03 Prospective Implementation of a Triage System to Prioritize Review and Finalization of Preliminary Reports with Emergent Findings

Sunday, Nov. 27 11:05AM - 11:15AM Room: N226

Awards

Student Travel Stipend Award

Participants

Hriday Shah, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Stanley Lee, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Joseph Mesterhazy, BS, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Eric C. Ehman, MD, Pacifica, CA (*Abstract Co-Author*) Nothing to Disclose
Javier Villanueva-Meyer, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Soonmee Cha, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Jason F. Talbott, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Data Safety Monitoring Board, StemCells, Inc

PURPOSE

In an academic center, expedient finalization of radiology reports with emergent findings is challenging but clinically critical. We prospectively investigated the efficacy of a PACS-based system that allows trainees taking independent call to rapidly prioritize attending review and finalization of preliminary reports with critical findings.

METHOD AND MATERIALS

On-call trainees triaged studies using a PACS-based system based on their impression of study acuity. "Prelim 1" was defined as studies with emergent radiologic findings, "Prelim 2" as studies with subacute or no concerning findings, and "Prelim 3" as outpatient studies with non-urgent findings. Triage status and final dictation times were queried for consecutive CT preliminary reports from weeknights between July 1, 2015 and March 23, 2016. Discrepancies between preliminary and final reports were scored as major or minor by a board-certified radiologist. Dictation times between triage statuses were compared using ANOVA testing. The proportion of reports finalized before 12pm and discrepancy rates were compared by triage status using Fisher's exact test.

RESULTS

A total of 6597 studies were initially interpreted by trainees on call over 9 months. Of these, 2671 (40.4%) were triaged as Prelim 1, 3427 (51.9%) as Prelim 2, 199 (3.0%) as Prelim 3, and 300 (4.5%) were not triaged. Prelim 1 studies were finalized earlier than the remainder of the studies (p<0.01). The average final dictation time was 9:50am for Prelim 1 studies, 10:23am for Prelim 2 studies, and 10:38am for Prelim 3 studies. The percentage of studies dictated before 12 pm was also significantly different by triage status: 93% for Prelim 1, 87% for Prelim 2 and 83% for Prelim 3 (p<0.01). Major discrepancies occurred in 1% of Prelim 1 studies compared to 0.5% of Prelim 2 studies (p=0.24).

CONCLUSION

We successfully implemented a triage system at a large academic center to expedite attending review and finalization of preliminary reports ruling acute findings. Our data shows that this triage system is effective in prioritizing finalization of high-priority studies with acute clinical implications.

CLINICAL RELEVANCE/APPLICATION

At teaching institutions, finalization of preliminary reports can be triaged based on acuity of findings to improve patient care. Our triage method is easy to implement and generalizable to other academic institutions.

SSA06-04 Impact of Insurance Status on Obtaining Recommended Imaging Follow-Up of Incidental Pulmonary Nodules Identified in the Emergency Department

Sunday, Nov. 27 11:15AM - 11:25AM Room: N226

Participants

Michael S. Kelleher Jr, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Lauren Sapienza, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Howard P. Forman, MD, New Haven, CT (*Presenter*) Nothing to Disclose

PURPOSE

Communication of imaging follow-up recommendations is essential for optimal patient care. Despite effective communication, many patients do not receive recommended follow-up. We sought to determine if patient insurance status impacts the percentage of

patients who successfully complete recommended imaging follow-up in the emergency department setting

METHOD AND MATERIALS

Our institution's IRB deemed this study a QI project. During the month of February 2016, a retrospective chart review identified patients who presented to our ED during the year 2014 who were found to have 4-8mm incidental pulmonary nodules. Patients with a history of pulmonary nodules or malignancy were excluded, as were those who died during the recommended follow-up period. We then determined if follow-up imaging was performed. Patient demographics, including insurance status were recorded. We then contacted the primary care providers for patients who did not undergo imaging follow-up in our healthcare system to determine if the provider was aware of follow-up and if it had been performed at an outside facility. Descriptive statistics were then calculated and p values were determined using a Fisher's exact test.

RESULTS

87 patients met study criteria. 27 patients were excluded with the most common reason being death during the follow-up period (11/27). Average patient age was 62.6 years (range 36-91 years). 21% (21/87) of patients received follow-up imaging. A significantly higher percentage of patients with private insurance received follow-up compared to those on Medicare ($p=0.02$) as well as compared to those on Medicaid or uninsured ($p=0.02$). Of patients who did not receive imaging follow-up within our health care system, 11% had imaging follow-up performed at an outside facility, 11% did not show up for follow-up imaging, and in 78% of patients the primary care provider was not aware of the need for follow-up.

CONCLUSION

A minority of our emergency department patients obtain recommended lung nodule follow-up. Of those who do, the majority have private insurance. These findings suggest that reporting and communicating is not enough and that additional strategies must be implemented in order to "close the loop."

CLINICAL RELEVANCE/APPLICATION

We have found that despite appropriately communicating critical results, the "loop" is infrequently closed for emergency department patients found to have incidental pulmonary nodules.

SSA06-05 Assessing the Gap in First or Senior Female Authorship in the Journal Emergency Radiology: Trends Over a 20-year Period

Sunday, Nov. 27 11:25AM - 11:35AM Room: N226

Awards

Student Travel Stipend Award

Participants

Kristopher McKenzie, MD, Pontiac, MI (*Presenter*) Nothing to Disclose

Milita Ramonas, MD, Hamilton, ON (*Abstract Co-Author*) Nothing to Disclose

Michael N. Patlas, MD, FRCPC, Hamilton, ON (*Abstract Co-Author*) Nothing to Disclose

Douglas S. Katz, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To examine trends in female first and senior (listed last) authors in the journal Emergency Radiology, from January 1994 to December 2014.

METHOD AND MATERIALS

Two researchers retrospectively reviewed a total of 1617 articles in the journal Emergency Radiology. Original articles, case reports, review articles, and pictorial essays were included. However, articles including letters, acknowledgements, communications, commentaries, editorials, status reports, book reviews, technical notes, annual meeting reports, proceedings, point counterpoints, clinical quizzes, challenge cases, and abstract reviews were all excluded. Special editions or supplementary issues were also excluded from analysis. Author's gender was categorized as male or female using the knowledge of basic names that are commonly associated with gender (such as Anna for female and John for male). For less common names, a Google search was performed with the author's names. The first 30 search listings were examined to determine the gender of the author. If the gender was still uncertain, the author was excluded. Comparative statistical tests were performed using a commercially available statistical package (SPSS).

RESULTS

Out of a total of 1617 articles reviewed, there were 1420 articles fulfilling the inclusion criteria. There were a total of 1420 first authors and 1295 senior authors. 125 were solo authors. We were able to confidently determine the gender of 96% of first authors (1368 of 1420), and 96% of last authors (1246 of 1295). Overall, female authors constituted 20% of first authors (290 of 1420), and 14% of last authors (180 of 1295). The increase in female first authors throughout the last 20 years was non-significant, from 17.5% in 1994 to 20.9% in 2014 ($P = 0.514$). However, there was significant increase in female last authors, from 12.9% in 1994, to 21.3% in 2014 ($P = 0.026$).

CONCLUSION

Over last 20 years, there has been statistically significant upward linear trend of female senior authorship in the journal Emergency Radiology, and a non-statistically significant increase in female first authorship.

CLINICAL RELEVANCE/APPLICATION

Despite an increase in female authors in the Emergency Radiology journal over last two decades, the authorship remains low and female participation should be encouraged.

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

SSA06-06 Inadequate Clinical Information in Emergency Radiology Consultations-Does it Really Affect the Error Rate or is it Merely a Bugbear?

Sunday, Nov. 27 11:35AM - 11:45AM Room: N226

Participants

Anjali Agrawal, MD, Delhi, India (*Presenter*) Nothing to Disclose
Arjun Kalyanpur, MD, Bangalore, India (*Abstract Co-Author*) CEO, Teleradiology Solutions Pvt Ltd

PURPOSE

The frustration of receiving inadequate clinical information during a referral is well known to any practicing radiologist. We sought to determine if there was any correlation between the quality of clinical information and the types of errors in our emergency teleradiology practice.

METHOD AND MATERIALS

We maintain a record of cases sent for quality assurance (QA) review by our client radiology practices. These comprise less than 1% of all cases and are scored as per ACR RADPEER guidelines, ranging from 1 (no error) to 4 (obvious miss), further denoted as "a" (clinically insignificant) or "b" (clinically significant). In 831 cases flagged for QA review, we additionally scored the quality of clinical information – category 1 (inadequate), 2 (adequate), 3 (detailed), for the study type ordered, and without knowledge of the missed findings or the QA grade. Similarly, we also scored 304 cases where no QA was flagged. Chi-square tests and regression models were used to determine the associations between quality of clinical information and radiologic error.

RESULTS

Surprisingly, detailed histories (Category 3) were less frequent in the cases without QA than those with QA or error ($p < 0.01$). There was no significant influence of clinical information score upon QA category. More history did not reduce the rates of obvious errors or any errors. Stronger effects were seen for the type of study, with MR studies being significantly associated with increased rates of clinically significant (ACR "b") errors ($p=0.008$). The level of clinical information was not associated with any reduction in the proportion of significant error (ACR2b, 3b, 4b), when compared to no error.

CONCLUSION

It is likely that experienced radiologists do not require much clinical information to reach an accurate radiological diagnosis in the emergent setting with a relatively well defined mix of cases. Whether this is also true for radiologists-in-training or those in the early years of practice needs to be tested.

CLINICAL RELEVANCE/APPLICATION

Perceived inadequate clinical information by radiologists does not translate to increased rates of radiologic error, at least in an emergency radiology setting with experienced radiologists.

SSA06-07 Emergency Radiology Resident Interpretation in an Era of 24-7 Radiology Attending Coverage and Supervision

Sunday, Nov. 27 11:45AM - 11:55AM Room: N226

Awards

Student Travel Stipend Award

Participants

Siavash Behbahani, MD, Mineola, NY (*Presenter*) Nothing to Disclose
A. Orlando Ortiz, MD, MBA, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the impact of 24-7 in-house radiology attending coverage on radiology resident performance

METHOD AND MATERIALS

We retrospectively reviewed radiology resident reports on emergent diagnostic radiology procedures over an 11 month period. The emergent studies included plain radiographs and cross sectional examinations (US, CT and MRI). All reports were assessed for accuracy in terms of missed findings as compared to the final attending reading. Missed findings were identified using emergency room call back forms. The missed findings were categorized as minor or major depending on whether or not the finding impacted on subsequent patient management. A radiology attending and resident reviewed each missed finding in order to determine, by consensus, the significance of the missed finding. Resident performance was also stratified by year of training. These data were compared to a metaanalysis of historical resident performance as gleaned from the radiology literature.

RESULTS

During 11 months, a total number of 29,636 studies were preliminarily interpreted by 17 radiology residents on call under 24/7 supervision of an in-house radiology attending. The resident-faculty discrepancy rate for radiographs is 0.8% vs. 1.4% (based on literature). For cross-sectional studies the rates were: CT 0.5% vs. 2.4%, US 0.1% vs. 0.6%, MR 1.1% vs. 3.7%, based on literature, respectively. With respect to plain radiographs the most common area for discrepant findings was chest radiography. The rate of minor and major discrepancy substantially decreased by increasing resident year of training

CONCLUSION

Radiology resident on-call performance, with respect to diagnostic radiology interpretations, improves with the presence of 24-7 in-house radiology attending coverage. In-house radiology attending coverage and supervision ultimately improves patient care, emergency room management/discharge time, and appropriateness of management.

CLINICAL RELEVANCE/APPLICATION

In a new era of the provision of real-time radiology services, a concern has arisen regarding the educational experience and performance of radiology residents who take call in programs where an in-house radiology attending is available. Our results show a favorable impact on resident performance based on a reduction of missed findings.

SSA06-08 Criteria-based Direct Access to Polytrauma Whole-body CT in the Emergency Department Leads to a Dramatic Fall in Use of Plain Radiographs Prior to Whole-body CT at a Major Trauma Centre

Sunday, Nov. 27 11:55AM - 12:05PM Room: N226

Awards

Student Travel Stipend Award

Participants

Nikola Tomanovic, MBBS, Brighton, United Kingdom (*Presenter*) Nothing to Disclose

Ahmed Dagher, MRCP, FRCR, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A set of criteria for direct Emergency Department access to polytrauma whole-body CT were introduced in 2013 to help guide clinical decision making and speed up patient imaging in the Emergency Department. This study aims to determine whether the use of criteria based patient selection protocols affects the numbers of plain radiographs performed prior to CT acquisition.

METHOD AND MATERIALS

A retrospective sample of 60 polytrauma whole-body CT scans, performed over a two month period, at a major trauma centre was analysed in 2012, 2014 and 2015. Criteria-based direct Emergency Department access to polytrauma whole-body CT scans was introduced over 2013 at our hospital, with criteria modified from the patient inclusion criteria for the REACT-2 trial. When the criteria are met the patient proceeds directly to CT without prior discussion with a radiologist. The proportion of patients undergoing a plain radiograph examination of the chest or pelvis prior to CT was compared before (2012) and after (2014 and 2015) introduction of these criteria.

RESULTS

In 2012, prior to the implementation of the direct ED access to CT protocol, 73% of polytrauma patients (44/60) had a plain chest radiograph and 60% (36/60) had a plain pelvic radiograph prior to CT. Following protocol implementation, however, these numbers reduced drastically. In 2014, 37% of polytrauma patients (22/60) had a plain chest radiograph and 25% (15/60) had a plain pelvic radiograph prior to CT. In 2015, no patients (0/60) had a plain chest radiograph and only 2% (1/60) had a plain pelvic radiograph prior to CT. None of the plain pelvic and chest radiographs in this study yielded any results that were not also noted on the subsequent CT.

CONCLUSION

Our results show that a criteria-based direct access to CT protocol in the Emergency Department is associated with a dramatic decrease in the use of plain chest and pelvic radiographs prior to whole-body CT. As expected our data also confirm that there were no additional findings shown on plain film over CT.

CLINICAL RELEVANCE/APPLICATION

The introduction of a "direct access to CT" protocol is associated with a dramatic reduction in the use of plain radiographs before CT. This implies that faster access to CT removes the need for plain radiographs to direct urgent intervention for life-threatening injuries.

SSA06-09 National Trends in Imaging Suspected Appendicitis: Current Status

Sunday, Nov. 27 12:05PM - 12:15PM Room: N226

Awards

Student Travel Stipend Award

Participants

Victoria F. Tan, MD, Hamilton, ON (*Presenter*) Nothing to Disclose

Michael N. Patlas, MD, FRCPC, Hamilton, ON (*Abstract Co-Author*) Nothing to Disclose

Douglas S. Katz, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the current trends in the imaging of suspected appendicitis in adult patients presenting to emergency departments of academic medical centers across our country.

METHOD AND MATERIALS

A questionnaire was sent electronically to all 17 academic centers in our country to be completed by Emergency Radiology Section Chiefs. The questionnaires were sent over a period of 3 months starting on October 1, 2015. The survey and analysis of the resulting data was approved by the IRB at our institution.

RESULTS

Fifteen centers (88%) responded to the questionnaire. Eleven respondents (73%) used IV contrast - enhanced CT as the imaging modality of choice in imaging of all patients with suspected appendicitis. Twelve respondents (80%) use ultrasound as the initial modality of choice in imaging pregnant patients with suspected appendicitis. Ten respondents (67%) use ultrasound as the modality of choice in patients younger than 40 years of age. When CT is used, 80% use non-focused CT of the abdomen and pelvis, and 47% of centers routinely use oral contrast. Twelve centers (80%) have ultrasound available 24 hours/7 days a week. At twelve centers (80%), the ultrasound examinations are performed by trained ultrasound technologists. Ten centers (67%) have MRI available 24/7. All fifteen centers (100%) use non-enhanced MRI. However, MRI is used as first modality for the imaging of pregnant patients in only three centers (20%) and as first modality for the imaging of patient younger than 40 years in only one center (7%).

CONCLUSION

There is heterogeneity in the imaging practice and protocols for patients with suspected appendicitis at our country, which varies depending on patient demographics, resource availability and institutional protocols.

CLINICAL RELEVANCE/APPLICATION

Imaging trends should be considered to develop a national imaging algorithm to permit standardization across our country.

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

SSA07

Science Session with Keynote: Gastrointestinal (Rectal Cancer)

Sunday, Nov. 27 10:45AM - 12:15PM Room: E353A



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

Participants

Kedar Jambhekar, MD, Little Rock, AR (*Moderator*) Nothing to Disclose
Mukesh G. Harisinghani, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSA07-01 Gastrointestinal Keynote Speaker: Evolving Expectations from Imaging in the Management of Rectal Cancer

Sunday, Nov. 27 10:45AM - 10:55AM Room: E353A

Participants

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

SSA07-02 Clinical Impact of Preoperative Gadoteric Acid-enhanced Liver MRI in the Evaluation of Synchronous Liver Metastasis of Colon Cancer

Sunday, Nov. 27 10:55AM - 11:05AM Room: E353A

Awards

Student Travel Stipend Award

Participants

Cherry Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
So Yeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min-Ju Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Soo Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, DONGKOOK Pharmaceutical Co, Ltd
Kyu-Pyo Kim, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Yong Sik Yoon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chan Wook Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Hoon Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Moon-Gyu Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether additional MRI with gadoteric acid increases the survival rate of patients with synchronous liver metastasis of colon cancer (sCLM) planning to undergo curative-intended treatment, compared with patients assessed only with CT.

METHOD AND MATERIALS

We retrospectively identified 117 patients with sCLM who underwent curative-intended treatment for colon cancer with resectable sCLM from 2006 to 2010 and who were initially evaluated using CT. Among these patients, 65 underwent additional gadoteric acid-enhanced MRI (CT+MRI group) before surgery. The remaining 52 patients who were assessed using only CT constituted the CT group. We compared the baseline characteristics, including pathologic staging and the surgical margin status in the two groups. In the CT+MRI group, we analyzed patients with discrepancy between CT and MRI. We correlated the detected sCLM with the pathologic findings. The 5-year survival rate was compared between the two groups, and multivariable analyses were performed using a Cox proportional hazard model. The inverse probability treatment weighting analysis (IPTW) adjusted by propensity scores was done to reduce the effect of selection bias.

RESULTS

The CT and CT+MRI groups were comparable regarding the baseline characteristics. In the CT+MRI group, 43 patients (66.2%, 43/65) showed a discrepancy in the numbers of sCLM between CT and MRI and MRI detected 25 additional sCLM (38.5%, 25/65) which were initially missed on CT. The numbers of detected sCLM were correlated with the pathologic findings better in the CT+MRI group (86.2%) than in the CT group (65.4%) ($P=0.014$). The 5-year survival rate was significantly higher in the CT+MRI group than in the CT group (70.8% vs. 48.1%, $P=0.003$). On multivariate analyses, the CT+MRI group showed a lower mortality rate (HR, 0.413; 95% CI, 0.256 - 0.830) than the CT group. After the IPTW, the CT+MRI group was associated with a significantly lower risk of overall mortality (HR, 0.434; 95% CI, 0.226 - 0.831) than the CT group.

CONCLUSION

In patients with colon cancer and sCLM who underwent CT, additional preoperative evaluation by gadoteric acid-enhanced MRI allowed us to detect sCLM more precisely and consequently increased the overall survival.

CLINICAL RELEVANCE/APPLICATION

Optimal preoperative staging using gadoteric acid-enhanced liver MRI for synchronous liver metastasis in patients with colon cancer can improve the overall survival.

SSA07-03 Tumor Enhancement on Gadoteric Acid-enhanced MRI is Associated with Long-term Survival in Patients with Colorectal Liver Metastases

Sunday, Nov. 27 11:05AM - 11:15AM Room: E353A

Awards

Student Travel Stipend Award

Participants

Helen Cheung, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Paul Karanicolas, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Natalie Coburn, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Calvin Law, MD, FRCPC, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Laurent Milot, MD, MSc, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Surgical resection is the standard of care for treatment of colorectal liver metastases (CRLM) and gadoxetate-enhanced MRI is routinely used for preoperative diagnosis and staging. Tumor fibrosis on post-hepatectomy specimens is associated with long-term survival and delayed enhancement on gadolinium-enhanced MRI is associated with fibrosis in other disease processes. Therefore, the goal of this study is to determine whether tumor enhancement on preoperative delayed-phase gadoxetate-enhanced MRI can predict disease-specific survival in patients with CRLM post-hepatectomy.

METHOD AND MATERIALS

Patients who received a preoperative gadoxetate-enhanced MRI prior to liver resection for CRLM from January 1, 2010 to December 31, 2012 were included in this retrospective study. The signal-to-noise ratio (SNR) was measured on the noncontrast and 10-minute delayed phases. Tumor enhancement was calculated as the percentage increase in SNR from noncontrast to 10-minute delayed phase. If there were multiple lesions, we calculated the mean tumor enhancement, weighted by size of tumor (largest axial diameter). Per patient tumor enhancement was stratified into weak and strong enhancement based on the a cutoff determined by the Youden J statistic for 3-year survival. Kaplan-Meier and Cox-Regression analyses were used to determine whether tumor enhancement could predict disease-specific survival, independent of potential confounders.

RESULTS

Eighty-four patients met inclusion/exclusion criteria. Based on the Youden Index, the threshold for weak and strong tumor enhancement was a 12% increase in SNR between noncontrast and delayed phase. Tumor enhancement predicted disease-specific death with 61.1% surviving at 3 years in those with weak enhancement vs. 85.5% surviving in those with strong enhancement ($p=0.01$). The adjusted hazard ratio of death in patients who had weak tumor enhancement after adjusting for potential confounders was 3.48 ($p=0.009$).

CONCLUSION

Tumor enhancement seen on gadoxetate-enhanced MRI is associated with survival in patients with CRLM post-hepatectomy.

CLINICAL RELEVANCE/APPLICATION

Tumor enhancement of colorectal liver metastases on preoperative delayed-phase gadoxetate-enhanced MRI is a biomarker of long-term survival and may be helpful in preoperative patient risk-stratification.

SSA07-04 Discriminating Stages of Rectal Cancer by Texture Analysis on Apparent Diffusion Coefficient Maps

Sunday, Nov. 27 11:15AM - 11:25AM Room: E353A

Participants

Liheng Liu, MD, Jinan, China (*Presenter*) Nothing to Disclose
Wenwu Li, MD, Shandong, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the potential of texture analysis based on apparent diffusion coefficient (ADC) maps, as a predictor of local invasion depth (stage T1-2 vs. T3-4) and nodal status (N0 vs. N1-2) of rectal cancer.

METHOD AND MATERIALS

In this retrospective study, 68 patients with rectal cancer who underwent preoperative MRI with diffusion-weighted sequence prior to the surgery were enrolled. Texture features of ADC maps of the mass lesions (skewness, kurtosis, entropy, contrast, correlation) and routine ADC variables (ADCmean, ADCmin, ADCmax) were compared between T1-2 and T3-4 stages, between N0 and N1-2 stages, as well as between overall stages.

RESULTS

Significant inter-group differences were observed with respect to skewness ($P=0.015$), entropy ($P=0.004$) and contrast ($P=0.017$) between T1-2 and T3-4 tumors. The three parameters were significantly lower in patients with T1-2 as compared to those with T3-4 tumors (skewness, 0.166 vs. 0.476; entropy, 3.212 vs. 3.441; contrast, 10.773 vs. 13.596). Further, skewness and entropy were identified as independent predictors for extramural invasion of tumors (stage T3-4). Using a logistic regression model that factored skewness and entropy to differentiate T3-4 from T1-2 tumors, we achieved an area under the receiver-operating characteristic curve (AUC) of 0.743. Significant differences were observed between N0 and N1-2 tumors with respect to ADCmean ($P=0.023$), ADCmax ($P=0.005$) and entropy ($P=0.015$). ADCmax and entropy were independent predictors of positive nodal status. An AUC of 0.750 was achieved by using this logistic model. In addition, ADCmean, skewness, entropy and contrast were significantly different among the overall stages (stage I, II, III and IV).

CONCLUSION

Texture analysis on ADC maps could provide valuable information in indentifying locally advanced rectal cancer.

CLINICAL RELEVANCE/APPLICATION

The findings might be help for the preoperative evaluation of rectal cancer.

SSA07-05 Survival Prediction in Patients Treated by Folfiri and Bevacizumab using Contrast-enhanced CT

Texture Analysis: Ancillary Study of a Multicenter Prospective Study (PRODIGE 9)

Sunday, Nov. 27 11:25AM - 11:35AM Room: E353A

Participants

Anthony Dohan, MD, Montreal, QC (*Presenter*) Nothing to Disclose
Benoit P. Gallix, MD, PhD, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose
Caroline Reinhold, MD, MSc, Montreal, QC (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc
Philippe A. Soyer, MD, PhD, Paris, France (*Abstract Co-Author*) Consultant, Guerbet SA;
Boris Guiu, MD, Dijon, France (*Abstract Co-Author*) Nothing to Disclose
Karine Le Malicot, Dijon, France (*Abstract Co-Author*) Nothing to Disclose
Jaafar Bennouna, MD, Saint-Herblain, France (*Abstract Co-Author*) Nothing to Disclose
Francois Ghiringhelli, Dijon, France (*Abstract Co-Author*) Nothing to Disclose
Valerie Boige, MD, PhD, Villejuif, France (*Abstract Co-Author*) Research Grant, Merck KGaA; Research Consultant, Bayer AG;
Research Consultant, Merck KGaA
Julien Taieb, MD, PhD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Olivier Bouche, Reims, France (*Abstract Co-Author*) Nothing to Disclose
Eric Francois, MD, Nice, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Marc Phelip, MD, Saint-Priest-En-Jarez, France (*Abstract Co-Author*) Nothing to Disclose
Christian Borel, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Roger Faroux, MD, La Roche Sur Yon, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Francois Seitz, MD, Marseille, France (*Abstract Co-Author*) Nothing to Disclose
Stephane Jacquot, MD, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose
Dominique Genet, MD, Limoges, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Louis Jouve, MD, Dijon, France (*Abstract Co-Author*) Nothing to Disclose
Francoise Desseigne, MD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Come Lepage I, MD, PhD, Dijon, France (*Abstract Co-Author*) Nothing to Disclose
Thomas Aparicio, MD, PhD, Bobigny, France (*Abstract Co-Author*) Nothing to Disclose
Christine C. Hoefel, MD, Reims, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether surface area (SA) measurement and texture analysis (TA) on pre-treatment and two months post-chemotherapy computed tomography (CT) images can predict 2-year survival in patients with liver metastases from colo-rectal cancer (CRC) treated by Folfiri and bevacizumab.

METHOD AND MATERIALS

This is an ancillary study from PRODIGE-9 multicenter prospective study for which 494 patients with CRC metastatic to the liver and treated by Folfiri and bevacizumab had been enrolled. In 223 patients, TA was performed by two radiologists in consensus using TexRAD® software on the dominant liver lesion during the venous phase of a contrast-enhanced CT examination, at baseline and two months post-chemotherapy. Metastasis SA, TA parameters and their changes were correlated with the 2-year survival status. Receiver operating characteristic (ROC) curves were performed and the 4 strongest parameters were incorporated into a multivariate logistic regression model to identify predictive factors for 2-year survival and their odd-ratios(OR). A score combining these 4 factors was built and optimal cutoff values for predicting 2-year survival status was determined with ROC curve analysis. Survival was estimated with the Kaplan-Meier method and compared between groups with the log-rank test.

RESULTS

The strongest independent predictive factors for 2-year survival status were decrease in SA(AUC=.67;(.59-.74)), decrease in kurtosis value (ssf=0)(AUC=.54;(.56-.62)), the baseline mean value (ssf=0)(AUC=.64;(.56-.72)) and the baseline Mean Positive Pixels (MPP) value (ssf=0)(AUC=.63;(.56-.71)). Using multivariate analysis, predictive factors of 2-year survival status were the decrease in SA>44%(OR=2.6,P=.002), the decrease in kurtosis value (ssf=0)(OR=2.49,P=.030), baseline mean value (ssf=0)>62.27UH (OR=2.15,P=.39) and baseline MPP value (ssf=0)>67.05 UH,(OR=2.15,P=.11). A score ranging from 0 to 16 was built. AUC of the score for predicting 2-year survival was .72(.66-.79) with a sensitivity of 67% and specificity of 61% for a cutoff value of 7. Patients with a score>7 had a higher survival rate (P<.001).

CONCLUSION

SA and TA parameters on baseline and first evaluation CT may be able to predict which patient will have an increased survival in CRC with liver metastases treated by Folfiri and bevacizumab.

CLINICAL RELEVANCE/APPLICATION

TA performed on liver metastases from CRC treated by Folfiri and bevacizumab allows prediction of patients 2-year survival.

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

SSA07-06 Using Quantitative Imaging Features of Colorectal Liver Metastases on Pre-Treatment CT to Predict Volumetric Response to Chemotherapy

Sunday, Nov. 27 11:35AM - 11:45AM Room: E353A

Participants

Hairong Chen, New York, NY (*Abstract Co-Author*) Nothing to Disclose
John M. Creasy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Richard Kinh Gian Do, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

Lauryn B. Adams, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Camilla Gomes, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mithat Gonen, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Patrick Seastedt, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Michael D'Angelica, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Amber Simpson, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether quantitative imaging features that measure tumor heterogeneity can be used to predict volumetric response in patients with colorectal liver metastases (CRLM).

METHOD AND MATERIALS

An IRB approved retrospective study included 103 patients from two prospective clinical trials on hepatic arterial infusion chemotherapy. Index tumors were extracted from contrast enhanced CT using Scout Liver (Pathfinder Technologies Inc., TN) at baseline and at 8 weeks follow-up. Volumetric response (as a percentage change) was assessed as a continuous variable. Imaging features (summary statistics including Hounsfield Unit -HU, texture, and shape properties) were extracted from index tumor volumes in the baseline CT scan using Matlab (Natick, MA). Imaging features statistically significant for volumetric response on univariate analysis were included in the regression model. The data were randomly split into training (n=93) and test sets (n=10). Random forest regression models were employed with cross validation on the training set. Test data were input into the trained regression models. Predicted accuracy of volumetric response was averaged over the models. Imaging features of CRLM in patients with partial response (PR) and stable disease (SD) defined by RECIST were also compared.

RESULTS

Predicted accuracy of volumetric response for CRLM after chemotherapy was 86.68% (CI: 85.35% - 88%). HU and the short run emphasis (SRE: a feature measuring consecutive pixels with the same intensity values) were the top two predictors of volumetric response. Mean HU values in PR were 91.2 (n=56) and 82.2 for SD (n=47), while SRE for PR was lower than the SD group (0.0864 vs. 0.098), suggesting that higher density and coarser grained image texture (more heterogeneity) may be related to better response. Increased heterogeneity reflects greater intravenous contrast uptake, which may translate to greater intake of chemotherapy within CRLM and subsequent volumetric response.

CONCLUSION

Quantitative imaging features extracted from pre-treatment CT are promising predictors of volumetric response to chemotherapy in patients with CRLM. External validation is required prior to using these novel imaging marker in a clinical setting.

CLINICAL RELEVANCE/APPLICATION

Pre-treatment prediction of response to chemotherapy using quantitative data from CT imaging has the potential to better select patients for chemotherapy.

SSA07-07 Correlation between Intravoxel Incoherent Motion (IVIM) and Dynamic Contrast-enhanced Magnetic Resonance Imaging (DCE-MRI) Parameters in Rectal Cancer

Sunday, Nov. 27 11:45AM - 11:55AM Room: E353A

Participants

Yanyan Xu, Beijing, China (*Presenter*) Nothing to Disclose
Hongliang Sun, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wu Wang, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Kaining Shi, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the correlation between intravoxel incoherent motion (IVIM) and multiphase dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) quantitative parameters in rectal cancer.

METHOD AND MATERIALS

Ninety-seven patients with histological diagnosis of rectal cancer were included in this study. All pelvis magnetic resonance imaging were performed in a 3.0T MR unit including diffusion-weighted imaging with 16 b-values (0, 10, 20, 30, 40, 60, 80, 100, 150, 200, 400, 800, 1000, 1200, 1500 and 2000s/mm²) and DCE-MRI(40 dynamic phases) as reference. IVIM perfusion-related parameters (f, perfusion fraction; D*, pseudo-diffusion coefficient; f·D*, the multiplication of the two parameters) were calculated by bi-exponential analysis. Quantitative parameters included K_{trans} [transfer constant between blood plasma and extravascular extracellular space (EES)], K_{ep} (rate between EES and blood plasma), V_e (extravascular Volume fraction), V_p (plasma volume fraction). DCE-MRI parameters were automatically calculated after region of interest (ROI) being selected along the outline of tumor maximal dimension (axial view), meanwhile relevant signal intensity (SI) time curves were obtained. Correlations between f and quantitative DCE-MRI parameters were respectively analyzed using Pearson's or Spearman's correlation coefficients, D* and f·D* were also similarly analyzed. Interobserver agreements were evaluated using the intraclass correlation coefficient (ICC) and Bland-Altman analysis.

RESULTS

There were 75 males and 22 females with a median age of 58.8 years (range, 26-85 years). Interobserver reproducibility for IVIM parameters, DCE-MRI semi-quantitative and quantitative parameters were good to excellent (ICC=0.9417-0.9618, ICC=0.7695-0.9905, ICC=0.7826-0.9488, respectively; narrow width of 95% limits of agreement). D* demonstrated significant correlations with V_p (r= -0.370; p<0.001), meanwhile, f·D* demonstrated significant correlations with TTP(r= -0.387; p=0.001). However, no correlation was observed between f and DCE-MRI quantitative parameters.

CONCLUSION

IVIM perfusion-related parameters, especially f·D*, demonstrated moderate correlations with DCE-MRI quantitative parameters in rectal cancer.

CLINICAL RELEVANCE/APPLICATION

IVIM imaging parameters can be used as alternatives to DCE-MRI in reflecting the changes of rectal cancer perfusion in longitudinal monitoring treatment response.

SSA07-08 The Development and Validation of a CT-based Radiomics Signature for the Preoperative Discrimination of Stage I-II and State III-IV Colorectal Cancer

Sunday, Nov. 27 11:55AM - 12:05PM Room: E353A

Participants

Yanqi Huang, Guangzhou, China (*Presenter*) Nothing to Disclose
Zaiyi Liu, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the predictive ability of radiomics signature based on CT image for the preoperative staging (I-II vs. III-IV) of primary colorectal cancer (CRC).

METHOD AND MATERIALS

The ethical-approved retrospective study consisted of 494 consecutive patients (training dataset: n=286; and validation cohort, n=208) with stage I-IV CRC. A radiomics signature was constructed based on the radiomics features extracted from CT images using LASSO logistic regression model. The potential association between the radiomics signature and CRC staging was explored. The classification performance of the radiomics signature was explored with respect to the receiver operating characteristics (ROC) curve, with accuracy, sensitivity and specificity obtained.

RESULTS

The developed 16-feature based radiomics signature was an independent predictor for the staging of CRC patients, which successfully discriminate stage I-II and stage III-IV CRC patients ($p < 0.0001$) in both the training and validation dataset. The median value of the radiomics signature of stage III-IV patients was significantly higher than that of the stage I-II patients. As for the classification performance of the radiomics signature in CRC staging, the yielded AUC was 0.792 (95%CI: 0.741-0.853), with a sensitivity of 0.667 and a specificity of 0.874. The validity of the signature in the validation dataset obtained an AUC of 0.708 (95%CI: 0.639-0.778), a sensitivity of 0.685, and a specificity of 0.690.

CONCLUSION

A radiomics signature was developed and validated to be a significant predictor for the discrimination of stage I-II from stage III-IV CRC, which may serve as a complementary tool for the preoperative tumor staging in CRC patients.

CLINICAL RELEVANCE/APPLICATION

The developed and validated radiomics signature could be used to discriminate stage I-II from stage III-IV CRC patients, which may serve as a noninvasive tool for the preoperative tumor staging in CRC patients.

SSA07-09 Can MRI Predict Recurrence in Patients with Locally Advanced Rectal Cancer?

Sunday, Nov. 27 12:05PM - 12:15PM Room: E353A

Awards

Student Travel Stipend Award

Participants

Cynthia Cruz, MD, Boston, MA (*Presenter*) Nothing to Disclose
Betsa Parsai Salehi, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
James H. Thrall, MD, Boston, MA (*Abstract Co-Author*) Stockholder, Peregrine Pharmaceuticals, Inc; Stockholder, iBio, Inc; Stockholder, Antares Pharma, Inc; Speaker, Bracco Group; ;
Mukesh G. Harisinghani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Determine MRI findings in locally advanced rectal cancer that can be used as predictors of disease recurrence.

METHOD AND MATERIALS

Single center retrospective study. 152 potential consecutive subjects. Inclusion criteria: diagnosis of locally advanced rectal cancer(T3) between 2010-2015, neo-adjuvant therapy, radical surgery and availability of a baseline MR imaging scan and 1 year follow up pelvic MRI within our PACS (Picture Archiving and Communications System). Recurrence: abnormal follow-up MRI in the evaluated period. Scans were performed in a 1.5T(GE™) or 3T(Siemens™) clinical scanners, using the standard departmental rectal protocol. Scans were read by two radiologists blinded to outcomes. Recorded data: location (upper, mid or lower rectum or combination); transverse diameter of the tumor, length, shortest distance from the tumor to the mesorectal fascia (DMRF), lymphnode involvement (≥ 5) (LI), sphincter and extramural vessel involvement (EMV). Interobserver variability was evaluated. Fisher's exact and Z tests were applied.

RESULTS

Sixty-nine patients, 22 women, 47 men. Mean age 57.8 years(y). No gender difference in recurrence incidence. Recurrent(19/69 28%) versus non-recurrent(50/69 72%) tumors showed no significant differences in length, diameter, LI or EMV. Length 48.8:51.5mm ($p>0.05$), diameter 19.1:17.7mm($p>0.05$), MRF 3.1:5.1mm ($p=0.03$), LI 9/19(47%):30/50(60%)($p=0.3$), mid-lower rectum 14/19(74%): 21/50(42%) ($p=0.01$), sphincter involvement 9/19(47%):10/50(20%) ($p=0.02$) and EMV 2/19(10%):2/50(4%) ($p>0.05$). Tumors with DMRF <3.9 mm(14/19, 74%) as well as those located in the mid-lower rectum(14/19, 74%), were highly associated with recurrence ($p=0.01$ and $p=0.03$, respectively). Mid-lower rectum involvement, MRF <4 mm and sphincter involvement in combination (9/19(47%) vs 0/50(0) $p=0.03$), were highly associated with recurrence (OR=91, 95% CI:5 to 1695, $p=0.002$) demonstrating a sensitivity and specificity of 100% and 83%, respectively. Acceptable variation among readers ranged from 1.2-5.5%.

CONCLUSION

Mid-lower rectum involvement and MRF<4mm are highly associated with rectal cancer recurrence when found on 1 year follow-up MRI. In combination with sphincter involvement, such tumors demonstrated a 91-fold greater chance of recurring.

CLINICAL RELEVANCE/APPLICATION

MRI features and tumor location may be used to predict recurrence and markers of worst prognosis in locally advanced rectal cancer at 1-year-follow up scans.

Science Session with Keynote: Gastrointestinal (CT Dose)

Sunday, Nov. 27 10:45AM - 12:15PM Room: E450A



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

Participants

William P. Shuman, MD, Seattle, WA (*Moderator*) Research Grant, General Electric Company
 Andrea Laghi, MD, Rome, Italy (*Moderator*) Speaker, Bracco Group Speaker, Bayer AG Speaker, General Electric Company Speaker, Koninklijke Philips NV
 Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Moderator*) Grant, Guerbet SA; Support, Siemens AG; Grant, Bayer AG; Grant, General Electric Company; Grant, STARmed Co, Ltd; Grant, RF Medical Co, Ltd; Grant, Toshiba Corporation; Grant, Samsung Medical Healthcare

Sub-Events**SSA08-01 Gastrointestinal Keynote Speaker: Novel CT Image Reconstruction Techniques**

Sunday, Nov. 27 10:45AM - 10:55AM Room: E450A

Participants

William P. Shuman, MD, Seattle, WA (*Presenter*) Research Grant, General Electric Company

SSA08-02 Image Noise and CNR: Are These Meaningful Parameters to Assess the Potential for Dose Reduction for Abdominal CT at Different Tube Voltages in the Era of Advanced Modeled Iterative Reconstruction? A 12-reader Phantom Study

Sunday, Nov. 27 10:55AM - 11:05AM Room: E450A

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

Andre Euler, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose
 Zsolt Szucs-Farkas, MD, PhD, Berne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
 Bram Stieltjes, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
 Reto M. Eichenberger, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
 Clemens Reisinger, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
 Anna Hirschmann, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
 Caroline Zahringer, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
 Achim Kircher, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
 Sebastian Kopp, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
 Sebastian T. Schindera, MD, Basel, Switzerland (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Ulrich GmbH & Co KG; Research Grant, Bayer AG; Speakers Bureau, Bayer AG

PURPOSE

To assess the impact of changes in image noise (IN) and contrast-to-noise-ratio (CNR) on low-contrast-detectability by applying advanced modeled iterative reconstruction algorithm and low-kVp abdominal CT in phantoms of different phantom sizes with simulated liver lesions.

METHOD AND MATERIALS

A multi-energy liver phantom with 45 hypoattenuating, iodine-containing lesions (diameters of 5, 10, 15 mm; lesion-to-liver contrast of 10, 25, 50 HU) was placed in water containers mimicking a medium and large patient (diameters: 30 and 40 cm). The phantom was scanned at 70, 80, 100 and 120 kVp (SOMATOM Force, Siemens). The 120 kVp-protocol served as the reference protocol and the mAs settings of the other protocols were adjusted to keep the CTDI_{vol} constant. The datasets were reconstructed with advanced modeled iterative reconstruction (ADMIRE, strength 3) and filtered back projection (FBP). IN was measured and CNR was calculated. Low-contrast lesion detection was independently assessed by twelve radiologists. Descriptive statistics and Fisher exact test were applied.

RESULTS

Applying iterative reconstruction, the IN decreased on average by 24% and by 27% and the CNR increased on average by 28% and by 34% for the medium and the large phantom, respectively. Lowering the tube voltage, the CNR increased on average by 72%, 59%, 35% at 70, 80, 100 kVp, respectively compared with 120 kVp in the medium phantom and by 4%, 16%, 7% in the large phantom. Despite the improvement of quantitative image quality by applying iterative reconstruction or low-kVp-imaging, there was no significant difference in overall detection rate within each phantom size (medium: 79% to 82%; large: 57% to 65%; P-value range: 0.37 to 1). Interobserver agreement was very good for both groups (κ -range of 0.8 to 0.9).

CONCLUSION

Improvement of quantitative image quality by advanced modeled iterative reconstruction or low-kVp-imaging did not impact low-contrast lesion detection in phantoms simulating medium and large patients.

CLINICAL RELEVANCE/APPLICATION

IN and CNR are well accepted parameters to grade quantitative image quality. However, they do not encompass the effects of dose optimization. More sophisticated image quality parameters are needed.

SSA08-03 Comparison of Measured and Estimated Organ Doses from Two Radiation Dose Tracking Software at Different kV

Sunday, Nov. 27 11:05AM - 11:15AM Room: E450A

Participants

Atul Padole, MD, Boston, MA (*Presenter*) Nothing to Disclose
Yiming Gao, Troy, NY (*Abstract Co-Author*) Employee, Virtual Phantoms, Inc
Alexi Otrakji, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Bob Liu, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
George Xu, PhD, Troy, NY (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD, Boston, MA (*Abstract Co-Author*) Technical support, Siemens AG; Technical support, Medical Vision

PURPOSE

To compare the measured and estimated CT organ doses from two radiation dose tracking (RDT) software at different tube voltage (kV) using fixed tube current (mAs) and automatic exposure control (AEC) techniques in a human cadaver.

METHOD AND MATERIALS

In an IRB approved study, ionization chambers (Radcal) were surgically implanted in an adult male human cadaver (88 yrs, male, 68 kg) in six locations including the liver, stomach, small intestine, left kidney, colon, and urinary bladder. The cadaver was scanned with routine abdomen/pelvis CT protocol on a 128-slice dual-source MDCT scanner (Siemens Definition FLASH) at 8 different settings – 4 with AEC (at constant CTDIvol 2.5mGy) & 4 with fixed mAs (at constant CTDIvol 4mGy). Scans were performed at 80, 100, 120 and 140 kV with mA values changed to achieve the abovementioned CTDIvol for each kV. All other scanning parameter were held constant including pitch of 0.9:1, rotation time of 0.5 second, and detector configuration of 128*0.6 mm. Scanning was repeated three times for each setting and organ doses were recorded for each acquisition (total series = 4*3*2=24). All CT image series were exported to the web-based RDT software: eXposure (Bayer, Germany) and VirtualDose (Albany, NY) to obtain estimated organ doses.

RESULTS

At constant CTDIvol, there was a variation (not statistically significant) in measured organ doses at different kV (both fixed mAs and AEC); lower kV was associated with lower organ doses ($p=0.7$). However, there were significant variation in estimated organ doses from both RDT software at different kV ($p<0.02$). The estimated organ doses from both RDT software were lowest at 80 kV compared to 140 kV ($p<0.02$). The estimated organ doses from VirtualDose were significantly lower than measured (except for 80 kV) and estimated organ doses from eXposure for both fixed mAs and AEC ($p<0.02$). The estimated organ doses from eXposure were slightly higher than most measured organ doses, however this difference was not statistically significant ($p=0.9$).

CONCLUSION

At constant CTDIvol, both measured and estimated organ doses fluctuate with different kV; lower kV settings are associated with lower dose for both fixed mAs and AEC. The estimated organ doses from VirtualDose were substantially lower than measured and estimated organ doses from eXposure.

CLINICAL RELEVANCE/APPLICATION

CT at lower kV settings is associated with lower organ doses even at constant CTDIvol.

SSA08-04 Comparison of Abdomen CT Radiation Doses (CTDIvol, DLP, & SSDE) from ACR Dose Index Registry based on Age and Type of Medical Facility in Different Geographical Regions of US

Sunday, Nov. 27 11:15AM - 11:25AM Room: E450A

Participants

Amirhossein Mozafarykhamseh, MD, Boston, MA (*Presenter*) Nothing to Disclose
Atul Padole, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Debapriya Sengupta, MBBS, MPH, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Judy Burleson, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD, Boston, MA (*Abstract Co-Author*) Technical support, Siemens AG; Technical support, Medical Vision
Mythreyi Bhargavan-Chatfield, PhD, Reston, VA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare abdomen CT radiation dose (CTDIvol, DLP & SSDE) from the ACR Dose Index Registry (DIR) across different types of facilities and geographical regions in US

METHOD AND MATERIALS

Using Radiology Playbook identification (RPID) numbers, we assessed CT dose metrics CTDIvol, DLP and size-specific dose estimates SSDE in 271287 abdomen CT exams (mean age 54.7±18.8 yrs) in the ACR DIR from 2011-2015 (10% sample). Data were stratified according to the geographic census in to New England (NE), Middle Atlantic (MA), South Atlantic (SA), East North Central(ENC), East South Central (ESC), West South Central (WSC), Mountain (MO) and Pacific(PA)) regions and then sub-stratified by year of CT (2011-15), patient age (≤ 40 years; 41-64 years; ≥ 65 years) and type of facility where CT was done (academic, community, multispecialty, freestanding). Mean and standard deviations for maximum CTDIvol (mGy), DLP (mGy.cm) and SSDE were calculated. ANOVA tests were used for analysis

RESULTS

The national mean CTDIvol, SSDE and DLP for abdomen CT were 15±8, 17±8 and 736±426 . There were significant variations for CTDIvol, DLP and SSDE values between census divisions. The highest CTDIvol and DLP was seen for WSC (15±11, 721±471 n=8916) and the lowest CTDIvol and DLP was for PA (11±6, 496±302, n=27095) ($p<0.0001$). For SSDE values, NE had the highest (25±8, n=17011), while, PA had the lowest (8±7, n=13758). The mean SSDE values of academic, community, multispecialty and freestanding facilities were 16±7, 17±9, 19±8, and 15±6 ($p<0.0001$), respectively. Among all 8 census divisions, no significant difference in dose based on age was noted. The mean±SD CTDIvol, DLP and SSDE for <40 years age group were 14±8, 737±441,

16±9; while, 16±9, 771±441 and 17±8 for 41-64 years and 15±8, 633±388 and 17±8 for >64 years (p value > 0.1). Since the inception of the ACR DIR in 2011, abdomen SSDE has decreased by average 12.2% in different census divisions. The biggest decrease (25.6%) was in ENC; while there was only 1.2% decrease in PA region

CONCLUSION

There were significant variations in the values of CTDIvol, DLP, and SSDE for abdomen CT among different US census regions. There was no significant difference in dose metrics based on age, among all 8 census divisions

CLINICAL RELEVANCE/APPLICATION

The ACR DIR reveals that there is decrease in radiation dose for abdomen CT in the last 5 years. Improved effort is needed to achieve similar dose levels in all regions of US

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

SSA08-05 Comparison of Low kVp and Automatic Spectral Imaging Mode Selection Protocols in Abdominal CT with Statistical Iterative Reconstruction and Low Contrast Agent Dose: A Prospective Matched Cohort Study

Sunday, Nov. 27 11:25AM - 11:35AM Room: E450A

Participants

Peijie Lv, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Liyang Zhang, Zhengzhou, China (*Presenter*) Nothing to Disclose
Jianbo Gao, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A prospective matched cohort study was performed to compare the image quality and radiation dose obtained with automatic spectral imaging mode selection (ASIS) and adaptive statistical iterative reconstruction (ASIR) with that obtained with low kVp with ASIR in abdominal multiphase computed tomography (CT) with low contrast agent dose.

METHOD AND MATERIALS

This prospective study was institutional review board approved and written informed consents from all patients were obtained. Four groups of 60 patients each underwent the arterial-phase (AP) and portal venous phase (PVP) contrast-enhanced abdominal CT scan with low kVp (80 kVp or 100 kVp) or spectral CT imaging with ASIS modes, matched by age, gender, body mass index (BMI), cross sectional area of the abdomen and contrast agent dose. One hundred and twenty patients (group A, 80 kVp and group B, spectral CT imaging) accepted contrast agent dose of 300mgI/kg with BMI < or = 23.9 kg/m² while 120 patients (group C, 100 kVp and group D, spectral CT imaging) accepted 450mgI/kg contrast agent dose with BMI from 24 to 28.9 kg/m². ASIR 50% was used to reconstruct the low-kVp images and monochromatic images (40-60keV) from spectral CT imaging. Quantitative parameters (CT attenuation and contrast-to-noise ratio of the liver, pancreas, aorta and portal vein, image noise in HU) and qualitative visual parameters (overall image quality as graded on a 5-point scale) were compared by using two sample t tests or Mann-Whitney U test.

RESULTS

Compared to 80-kVp and 100-kVp images, 40-keV images showed similar contrast and overall image quality despite the higher image noise, 50-keV images provided higher image noise but similar or higher contrast and overall image quality, 60-keV images provided similar image noise and contrast but similar or higher overall image quality. The CTDIvol and DLP in group A were lower than group B (P = 0.001 and 0.042 respectively), but were similar between group C and group D.

CONCLUSION

In abdominal CT with low contrast agent dose, application of ASIR and ASIS to monochromatic imaging from 40 to 60keV maintained good image quality with higher radiation dose than 80 kVp and without increasing radiation dose than 100 kVp.

CLINICAL RELEVANCE/APPLICATION

Combined use of automatic spectral imaging protocol selection and iterative reconstruction can maintain good image quality with low contrast agent dose and have the potential to reduce radiation dose.

SSA08-07 Dose-Equivalent Triple Arterial Phase CT Imaging of the Liver: Initial Experience in Comparison to Single Arterial Phase at 80kV

Sunday, Nov. 27 11:45AM - 11:55AM Room: E450A

Participants

Katharina Brehmer, MD, Stockholm, Sweden (*Presenter*) Nothing to Disclose
Torkel B. Brismar, MD, PhD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Anders P. Svensson, PhD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Antonios Tzortzakakis, Gothenburg, Sweden (*Abstract Co-Author*) Nothing to Disclose
Nikolaos Voulgarakis, MD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Michael A. Fischer, MD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop an optimized triple arterial phase CT (triple arterial CT) liver protocol from previously acquired perfusion CT data and to

prospectively evaluate the image quality (IQ) and diagnostic accuracy in comparison to standard single arterial phase CT (standard-CT) in patients with suspicion of hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

A total of 42 patients prospectively underwent clinically indicated standard multiphasic liver CT and perfusion-CT at the same day using a dual-source 128-slice CT-scanner. A so called time maximum intensity projection (time-MIP) was reconstructed by fusion of three dedicated arterial time points of the perfusion split-series. Arterial time points were depicted prospectively based on arterial peak enhancement times (TTP) of 27 HCC lesions derived retrospectively from a previously acquired perfusion CT series of 15 patients. Single arterial phase of the standard liver CT and arterial time-MIP were compared by two readers (R1; R2) who assessed image quality and detection-rate of HCC. A third reader assessed image-noise, lesion-to-liver-contrast-ratio (LLR) and contrast-to-noise-ratio(CNR).

RESULTS

The triple arterial CT consisted of three low-dose scans (80 kV; 160 mAs) at 8.1/13.4/23.7 sec (min/mean/max values of TTP in 27 HCC) after a contrast enhancement of 160 HU was reached in the abdominal aorta. Mean CTDIvol (CT Dose Index) of triple arterial CT and standard-CT was 11.5 mGy and 12.2 mGy respectively. Time-MIP showed significantly lower noise and better CNR as compared to standard-CT ($P < 0.001$; both). There was no significant difference in LLR between time-MIP and standard-CT ($P = 0.26$). Inter-reader agreement and subjective IQ was good for both protocols. In total there were 73 HCC. Detection rate was 89/88 % (R1/R2) at time-MIP and 86/82% (R1/R2) at standard-CT. Time-MIP detected additional 7 (R1) respectively 9 (R2) HCC, which were missed on standard-CT.

CONCLUSION

Time-MIP derived from dose-equivalent triple arterial phase CT has the potential to improve both image quality and detection rate of HCC in comparison to standard single arterial phase CT.

CLINICAL RELEVANCE/APPLICATION

Dose-equivalent triple arterial phase CT scanning of the liver has the potential to improve diagnostic accuracy for HCC and thus improve oncologic patient care.

SSA08-08 Observer Performance at Varying Dose Levels and Reconstruction Methods for Detection of Hepatic Metastases

Sunday, Nov. 27 11:55AM - 12:05PM Room: E450A

Participants

Joel G. Fletcher, MD, Rochester, MN (*Presenter*) Grant, Siemens AG; ;
Jeff L. Fidler, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
David M. Hough, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Naoki Takahashi, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Maria Shiung, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Adam Bartley, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
David R. Holmes Iii, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Alicia Toledano, DSc, Kensington, MD (*Abstract Co-Author*) Consultant, iCAD, Inc
Rickey Carter, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

To estimate the ability of abdominal radiologists to detect hepatic metastases (HM) at varying dose levels with or without iterative reconstruction (sinogram-affirmed iterative reconstruction; IR).

METHOD AND MATERIALS

Projection data from 83 CT contrast-enhanced exams were collected (42 with HM). HM was defined by histopathology or progression/regression on CT/MR. Using a validated noise insertion technique, each exam was reconstructed with filtered back projection (FBP) or IR at 5 dose levels (automatic exposure control settings of 80, 100, 120, 160 and 200 quality reference mAs [QRM]) to generate 8 dose-reconstruction configurations (664 cases). Three abdominal radiologists used a dedicated workstation to circle suspected HM, indicate a confidence score (0 – 100), and grade image quality, evaluating each patient once/session. Automated matching of reference and reader HMs was performed. Non-inferiority was assessed using JAFROC analysis and reader agreement rules. JAFROC analysis was performed on a per-lesion basis for HM using a narrow non-inferiority limit of -0.05. For reader agreement, a successful reading for lower dose configurations was defined as ≥ 2 readers circling all HM identified by ≥ 2 readers at routine dose (or no non-lesion localizations in negative cases), with a priori rules requiring ≥ 71 successful readings for each configuration.

RESULTS

There were 123 HM with a median size of 1.4 ± 1.0 cm with median CTDIvol = 11 mGy (mean CTDIvol of 12.4 ± 6.0 mGy; mean SSDE of 14.6 ± 4.7 mGy). Using JAFROC FOM, configurations using 80 and 100 QRM and either FBP or IR failed to meet non-inferiority criteria, with estimated differences from routine dose being - 0.04 (95% CI: -0.06 to -0.01). 5 of the 8 configurations had successful interpretations in 71 – 77 of 83 patients, corresponding to dose levels of ≥ 120 QRM (i.e., ≥ 8.8 mGy SSDE). Intraclass correlation coefficient for reader FOM was 0.44. At each dose level, IR improved image quality ($p < 0.05$) but not performance.

CONCLUSION

Lower dose CT images reconstructed at dose levels corresponding to 120 QRM (SSDE 8.8 mGy) and higher performed similar to 200 QRM FBP in this large pilot study for detection of hepatic metastases.

CLINICAL RELEVANCE/APPLICATION

Pilot data obtained over a range of doses suggests that substantial dose reduction is possible without compromising observer

Pilot data obtained over a range of doses suggests that substantial dose reduction is possible without compromising observer performance. IR did not appear to improve performance.

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/>

Naoki Takahashi, MD - 2012 Honored Educator

SSA08-09 Personalized Liver CT Examination Protocol Based on BMI: Combination of Optimized kVp and Iodine Injection Protocol

Sunday, Nov. 27 12:05PM - 12:15PM Room: E450A

Participants

Jian Jiang, MD, Beijing, China (*Presenter*) Research Grant, General Electric Company

Xiaoying Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Ke Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether the personalized liver CT examination protocol based on body mass index (BMI) could obtain the diagnostic image quality.

METHOD AND MATERIALS

This prospective study was approved by institutional review board. From 2014 May to 2016 March, patients with known or suspected hepatocellular carcinoma were recruited consecutively, who underwent MDCT examination (Siemens, Somatom Definition Flash). Patients were scanned with different tube voltage (70-120 kVp) in combination with different amount of iodine contrast medium (352 mgI/kg to 550 mgI/kg) based on their body mass index (BMI): BMI \leq 18.0, 70-kVp, 352mgI/kg; BMI 18.1-24.0, 80-kVp, 352mgI/kg; BMI 24.1-28.0, 100-kVp, 440 mgI/kg; BMI \geq 28.1, 120-kVp, 550 mgI/kg. Images in all phases for 70-kVp and 80-kVp protocol were reconstructed with strength SAFIRE 3 and those for 100-kVp and 120-kVp protocol were reconstructed by using strength SAFIRE 2. The image noise, attenuation, contrast-to-noise ratio (CNR), and figure of merit (FOM) were measured and calculated. The estimated effective dose (ED) and Size-specific dose estimate (SSDE) of the 4 protocols were also calculated and compared. Radiologists independently graded images quality, as well as the timing of late arterial phase.

RESULTS

Totally 165 patients were recruited. Dynamic CT demonstrated that a reduction from 120-kVp protocol to 80- and 70-kVp protocols led to a reduction in the SSDE of 36% and 56%. 92% of the arterial phase with the 4 protocols was classified as the accurate late arterial phase. There was no significant difference in the mean image noise, CNRs and FOMs of the portal vein and liver between the 100- and 120-kVp protocols. Mean image noise and FOMs was significantly higher with the 70-kVp protocol than with the others. For the liver, significantly lower CNRs were found with the 80-kVp protocol than with the others. Moreover, in the comparison of the 80-, 100- and 120-kVp protocols, they had no statistically significant difference, for image quality score ($P > 0.05$).

CONCLUSION

High quality liver CT images could be obtained by using personalized liver CT protocol based on BMI, with combination of optimized kVp and iodine injection method.

CLINICAL RELEVANCE/APPLICATION

This method will be of benefit to the patients with lower BMI, who will receive lower contrast dosage, significantly less radiation dose compared with the conventional uniform method.

SSA09

Science Session with Keynote: Gastrointestinal (Liver Fibrosis)

Sunday, Nov. 27 10:45AM - 12:15PM Room: E450B



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

FDA Discussions may include off-label uses.

Participants

Claude B. Sirlin, MD, San Diego, CA (*Moderator*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Guerbet SA; ;
Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Moderator*) Nothing to Disclose
Anthony E. Samir, MD, Boston, MA (*Moderator*) 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

Sub-Events

SSA09-01 2D Ultrasound Shearwave for Staging Liver Fibrosis: Preliminary Results of a Prospective Multicentre European Study

Sunday, Nov. 27 10:45AM - 10:55AM Room: E450B

Participants

Adrian K. Lim, MD, FRCR, London, United Kingdom (*Presenter*) Luminary, Toshiba Corporation
Maxime Ronot, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Giovanna Ferraioli, MD, Pavia, Italy (*Abstract Co-Author*) Speaker, Koninklijke Philips NV; Speaker, Hitachi Ltd; Speaker, Toshiba Corporation
Hans Peter Mueller, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Mireen Friedrich-Rust, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
David O. Cosgrove, MBBCh, FRCR, London, United Kingdom (*Abstract Co-Author*) Research Consultant, SuperSonic Imagine Research Consultant, Bracco Group Speakers Bureau, Toshiba Corporation
Carlo Filice, MD, Pavia, Italy (*Abstract Co-Author*) Speaker, Koninklijke Philips NV; Speaker, Hitachi, Ltd ; Research Grant, Bracco Group; Research Grant, Hitachi, Ltd; Research Grant, Toshiba Corporation; Research Grant, Esaote SpA
Valerie Vilgrain, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ultrasound Shearwave (SW) speed measurements using Transient Elastography (TE) is an accepted non-invasive test of liver stiffness and indirectly the presence of significant liver fibrosis. Newer SW technologies have since been developed but have yet to be validated against this standard of care test. To assess the reliability and accuracy of 2D Ultrasound SW technology at grading the severity of Liver Fibrosis using TE as the gold standard.

METHOD AND MATERIALS

Centers from France, Germany, Italy and United Kingdom were involved. Patients were recruited prospectively with a variety of chronic liver diseases to have 2D Ultrasound Shearwave (ToSWE) (Toshiba Medical Systems) and TE (Echosens) performed on the same day. 10 valid measurements were obtained from fasted patients (>8 hours) using both techniques and the median result in kPa was used for analysis. Based on a previous meta-analysis (Tsochatzis, et al. J Hepatol 2011) for staging liver fibrosis (F), TE cut-offs of 7.0, 9.5 and 12.0 kPa, were used to denote liver fibrosis stages of significant fibrosis (F \geq 2), advanced fibrosis (F \geq 3), and cirrhosis (F = 4) respectively. A TE value of < 7.0 kPa was used to denote no significant fibrosis (F0/F1). The measurements obtained from ToSWE were correlated with the TE-derived stages of fibrosis.

RESULTS

367 patients have been recruited to date, (215 M:152 F) with a mean age of 53 years (range: 21-88 years). The main etiologies of liver disease were HCV-related (64%) and HBV-related (23%). The rest comprised a mixture of ALD, AIH and NAFLD. 350 datasets were complete showing excellent correlation of liver stiffness values between the ToSWE and TE techniques at all centres (R2 correlation range: 0.78-0.92). The mean elasticity values using ToSWE for each liver fibrosis stage as described above was: F0/F1 (n = 179: 6.0 \pm 1.4 kPa), F2 (n = 54: 7.0 \pm 3.0 kPa), F3 (n = 42: 9.2 \pm 2.2 kPa) and F4 (n = 75: 16.7 \pm 11.8 kPa). This was highly statistically significant between all groups (Mann Whitney U test: p<0.001 for all pairs).

CONCLUSION

The liver stiffness measurements using ToSWE correlates well with TE and can be used to distinguish patients with significant liver fibrosis non-invasively in the appropriate clinical setting.

CLINICAL RELEVANCE/APPLICATION

2D Shearwave elastography is a useful non-invasive tool for grading the severity of chronic liver disease and can be linked with current established treatment algorithms for TE.

SSA09-02 Comparison of Elastography Point Quantification with Transient Elastography in Patients with Chronic Viral Hepatitis and Nonalcoholic Fatty Liver Disease: A Prospective Study

Sunday, Nov. 27 10:55AM - 11:05AM Room: E450B

Awards

Student Travel Stipend Award

Participants

Savinay Kapur, MBBS, MD, Chandigarh, India (*Presenter*) Nothing to Disclose
Naveen Kalra, MBBS, MD, Chandigarh, India (*Abstract Co-Author*) Nothing to Disclose
Ajay Duseja, Chandigarh, India (*Abstract Co-Author*) Nothing to Disclose
Ashim Das, MD, Chandigarh, India (*Abstract Co-Author*) Nothing to Disclose
Yogesh Chawla, Chandigarh, India (*Abstract Co-Author*) Nothing to Disclose
Niranjan Khandelwal, MD, Chandigarh, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To measure liver stiffness using a novel ultrasound-based point shear-wave elastography technique – Elastography Point Quantification (ElastPQ) and to compare its diagnostic accuracy with transient elastography (TE) and liver histology in patients with chronic viral hepatitis (CVH) and nonalcoholic fatty liver disease (NAFLD).

METHOD AND MATERIALS

32 patients of chronic liver disease (CVH=15; NAFLD=17) were evaluated by ElastPQ (iU22 xMATRIX System, Philips) and TE (FibroScan®, Echosens) within 7 days of liver biopsy by two independent observers who were blinded to each other's observations and to the results of the biopsy. Within the CVH group (n=15), subgroup analysis was done in patients with end stage renal disease (ESRD) (n=8) and in patients without ESRD (n=7). Within the NAFLD group, subgroup analysis was done in patients with HBsAg carrier state (n=6) and without HBsAg carrier state (n=11). AUROC curves were calculated for ElastPQ and TE. The optimal cut-off values were determined using Youden's index. DeLong test was used to compare AUROC curves.

RESULTS

Liver stiffness measurement by ElastPQ correlated significantly with the stage of fibrosis ($p=0.826$; $p<0.0001$). In the combined analysis of all patients, AUROCs of ElastPQ and TE for diagnosing any fibrosis ($F\geq 1$), significant fibrosis ($F\geq 2$) and severe fibrosis ($F\geq 3$) were 0.907, 0.959, 0.926 and 0.870, 0.770, 0.881, respectively, at optimal cut-off values of 5.37, 5.96, 8.42 kPa and 6.0, 8.8, 11.2 kPa, respectively. ElastPQ was superior to TE in diagnosing significant fibrosis in the combined analysis ($p=0.0149$) and in the CVH group ($p=0.0391$). The diagnostic accuracy of both ElastPQ and TE was excellent in NAFLD patients irrespective of their HBsAg carrier state. However the accuracy of both these techniques was poor in the CVH with ESRD subgroup. There was significant positive correlation between the two techniques ($p=0.704$; $p<0.0001$) with excellent intra-observer reproducibility of liver stiffness measurement by ElastPQ (Intraclass correlation coefficient=0.95).

CONCLUSION

ElastPQ is a good non-invasive diagnostic tool for evaluating liver fibrosis in patients of CVH and NAFLD comparing well with TE and liver biopsy. Its role in patients of CVH with ESRD needs further evaluation.

CLINICAL RELEVANCE/APPLICATION

ElastPQ can be effectively used for non-invasive assessment of liver fibrosis during routine sonographic evaluation of liver without the need of any additional equipment.

SSA09-03 Accuracy of Liver Surface Nodularity Quantification at MDCT as a Noninvasive Biomarker for Staging Liver Fibrosis

Sunday, Nov. 27 11:05AM - 11:15AM Room: E450B

Awards

Student Travel Stipend Award

Participants

Kyle Malecki, Ma, WI (*Presenter*) Nothing to Disclose
Meghan G. Lubner, MD, Madison, WI (*Abstract Co-Author*) Grant, Koninklijke Philips NV; Grant, Johnson & Johnson;
Perry J. Pickhardt, MD, Madison, WI (*Abstract Co-Author*) Co-founder, VirtuoCTC, LLC; Stockholder, Collectar Biosciences, Inc;
Stockholder, SHINE Medical Technologies, Inc; Research Grant, Koninklijke Philips NV

PURPOSE

To investigate objective semi-automated measurement of liver surface nodularity (LSN) at MDCT for prediction of underlying liver fibrosis (stages F0-F4).

METHOD AND MATERIALS

We evaluated 367 total patients (mean age, 51.1 years; 191M/176F), including a healthy (F0) control group (n=119) and fibrosis stages F1 (n=47), F2 (n=38), F3 (n=67), and F4/cirrhosis (n=97). Contrast-enhanced abdominal MDCT scans (120 kVp, variable mA, PV phase) were assessed utilizing an independently validated semi-automated surface nodularity tool. A series of ≥ 10 consecutive ROI measurements along the anterior liver, totaling ≥ 80 cm in length, were made using the left lateral segment as default. All intermediate stages of fibrosis (F1-F3) were based on liver biopsy within one year of MDCT.

RESULTS

MDCT-based liver surface nodularity scores increased with stage of fibrosis: 2.01 ± 0.28 for F0, 2.34 ± 0.39 for F1, 2.37 ± 0.39 for F2, 2.88 ± 0.68 for F3, and 4.11 ± 0.95 for F4. For discriminating significant fibrosis ($\geq F2$), advanced fibrosis ($\geq F3$), and cirrhosis ($\geq F4$), ROC AUC were 0.902, 0.932, and 0.959, respectively. Sensitivity and specificity for significant fibrosis ($\geq F2$; LSN threshold=2.38) was 80.2% and 80.2%; for advanced fibrosis ($\geq F3$; LSN threshold=2.53) was 89.0% and 84.2%; and cirrhosis ($\geq F4$; LSN threshold=2.81) was 97.9% and 84.8%.

CONCLUSION

Objective quantification of liver surface nodularity at MDCT allows for accurate discrimination between stages of hepatic fibrosis, especially at more advanced levels. Although the results are comparable to elastography, this simple semi-automated biomarker can be obtained retrospectively without additional equipment or patient time.

CLINICAL RELEVANCE/APPLICATION

Quantification of liver surface nodularity at MDCT can serve as a useful noninvasive biomarker for staging liver fibrosis and, unlike elastography or biopsy, can be obtained retrospectively.

Honored Educators

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

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

SSA09-04 Staging Liver Fibrosis Induced by HBV Infection using Contrast-Enhanced Dual-Energy CT

Sunday, Nov. 27 11:15AM - 11:25AM Room: E450B

Awards

Student Travel Stipend Award

Participants

Ke Wang, MD, Beijing, China (*Presenter*) Nothing to Disclose
Hong Zhao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Peter Lamb, Niskayuna, NY (*Abstract Co-Author*) Employee, General Electric Company
Ze Peng, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xuedong Yang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaojie Lin, Shanghai, China (*Abstract Co-Author*) Employee, General Electric Company
Guiqiang Wang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoying Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the utility of the contrast-enhanced Dual Energy Computed Tomography (DECT) for staging liver fibrosis induced by HBV infection.

METHOD AND MATERIALS

A total of 57 patients (45m/12f; mean age, 42; age range, 19–63) diagnosed as chronic hepatitis B and had undergone both liver biopsy (fibrosis stage S1-S4) and contrast-enhanced DECT were enrolled. The interval between biopsy and CT was one week to two months. The DECT consisted of a non-enhanced scan followed by arterial, portal venous and delayed phase scans at 25, 65 and 180 seconds after administration of contrast media (1.5 ml/kg, 320 mg/ml, 3.5 ml/s). The iodine concentration of aorta (aaorta) and liver parenchyma (aliver) was measured and the normalized iodine concentration (NIC, aliver/aaorta) was used to measure the severity of liver fibrosis. Two different methods were used to draw ROI in the liver parenchyma (①putting one single ROI under the 8th intercostal space- the place of liver biopsy; ②putting 4 ROIs in different segments of liver). Three different techniques were used to calculate the NIC on 4 different phases: Hounsfield Unit (HU), Iodine Material Density (MD) Map, and Iodine Multi-Material Decomposition (MMD) Map. NIC correlation with the fibrosis stage was determined via ANOVA and Spearman's rank correlation. Significance between fibrosis subgroups was determined via Tukey test. Bland-Altman analysis was used to determine the agreement between the two ROI methods.

RESULTS

Using method 1, only the NIC on delayed by using iodine MD and MMD map showed statistical significance between different liver fibrosis stages ($p < 0.05$). The NIC measured on delayed phase by using iodine MD and MMD map showed reasonable correlation with fibrosis stage (Spearman r value was 0.6126 for MD and 0.7197 for MMD) (Figure 1, 2). The results of Tukey's test showed that the NIC values calculated from both the MD and MMD map can differentiate mild from severe fibrosis groups (Table 1). Method 2 showed similar result. There was good agreement between the two methods of ROI placement (Figure 3).

CONCLUSION

DECT provides a quantitative method to stage liver fibrosis, and can serve to supplement and augment the clinical management of patients with chronic HBV.

CLINICAL RELEVANCE/APPLICATION

DECT provides a noninvasive quantitative method to stage liver fibrosis, and can serve to supplement and augment the clinical management of patients with chronic HBV.

SSA09-05 Efficacy of T1 Mapping on Gd-EOB-DTPA-Enhanced MRI for Staging Liver Fibrosis in Chronic Hepatitis B Patients with Normal Alanine Transaminase ≤ 40 IU/L

Sunday, Nov. 27 11:25AM - 11:35AM Room: E450B

Participants

Li Yang I, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Mengsu Zeng, MD, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Ying Ding, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Shengxiang Rao, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Ruofan Sheng, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to retrospectively assess the diagnostic efficacy of T1 mapping on Gd-EOB-DTPA-enhanced MRI for liver fibrosis staging in chronic hepatitis B (CHB) patients with normal ALT level.

METHOD AND MATERIALS

This retrospective study included 100 CHB patients (mean age: 54.8 years; 82 men and 18 women) who underwent Gd-EOB-DTPA-enhanced MRI including T1 mapping. Liver function tests were performed and alanine transaminase (ALT) levels were ≤ 40 IU/L. T1 mapping was performed before and 20-min hepatobiliary phase (HBP) after injection of Gd-EOB-DTPA (Primovist, Bayer-Schering). Liver fibrosis stages were histologically determined according to Scheuer scoring system: S0 (n=18), S1 (n=13), S2 (n=15), S3 (n=12) and S4 (n=42). Pre-contrast and HBP T1 relaxation times were measured and the reduction rate ($\Delta\%$) of the T1 relaxation times was calculated. Spearman's rank correlation coefficients between T1 relaxation times and histological hepatic fibrosis stages were calculated and receivers operating characteristic (ROC) curves were built to assess the diagnostic performance of T1 mapping in staging liver fibrosis.

RESULTS

The HBP, $\Delta\%$ of T1 relaxation times showed significant correlations with liver fibrosis stage (ρ : 0.70, -0.61, respectively, both $P < 0.05$). The area under ROC curves (AUROC) of pre-contrast, HBP, $\Delta\%$ T1 relaxation time for the diagnosis of no ($S=0$), mild ($S \leq 1$), significant ($S \geq 2$), advanced fibrosis ($S \geq 3$) and cirrhosis ($S=4$) are shown in the Figs 1. The AUROCs of HBP and $\Delta\%$ T1 relaxation time for identification of various degree of fibrosis were significantly greater than pre-contrast T1 relaxation times ($P < 0.05$). The sensitivities, specificities of HBP T1 relaxation times for identification of significant fibrosis were 81.48% and 84.78% at the cutoff of 212.4, and the sensitivities, specificities of $\Delta\%$ of T1 relaxation times for prediction of significant fibrosis were 79.63% and 69.57% at the cutoff of 69.06%.

CONCLUSION

The Gd-EOB-DTPA-enhanced T1 mapping is accurate for staging liver fibrosis in CHB patients with normal ALT level.

CLINICAL RELEVANCE/APPLICATION

About one fifth of CHB patients with normal ALT concentrations had stages 2-4 fibrosis, which may lead to low positive predictive value of commonly used serum fibrosis markers, such as FIB-4 index and APRI.

SSA09-06 Failure of Liver MR Elastography: What Are the Predictive Factors?

Sunday, Nov. 27 11:35AM - 11:45AM Room: E450B

Participants

Mathilde Wagner, MD, PhD, Paris, France (*Presenter*) Consultant Olea Medical
Idoia Corcuera-Solano, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Grace C. Lo, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Steven J. Essess, MD, New York City, NY (*Abstract Co-Author*) Nothing to Disclose
Joseph H. Liao, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Cecilia Besa, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maggie M. Fung, MEng, Bethesda, MD (*Abstract Co-Author*) Employee, General Electric Company
James S. Babb, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Richard L. Ehman, MD, Rochester, MN (*Abstract Co-Author*) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc;
Bachir Taouli, MD, New York, NY (*Abstract Co-Author*) Consultant, MEDIAN Technologies; Grant, Guerbet SA

PURPOSE

To determine technical failure rate of liver magnetic resonance elastography (MRE) and to assess the determinants of technical failure of liver MRE in a large series of patients.

METHOD AND MATERIALS

Seven hundred and eighty-one MRE examinations in 691 consecutive patients (mean age 58 y, 63% male) performed in a single center between 6/2013 and 8/2014 were retrospectively evaluated. MRE was acquired either on a 3.0T (n=443) or 1.5T system (n=338), using a Gradient-Recalled-Echo (GRE) MRE sequence (4 axial slices). Image analysis was performed by two observers. Technical failure was defined as no pixel with confidence index higher than 95% and/or no apparent shear waves imaged. The following parameters were noted: presence of cirrhosis, degree of ascites, steatosis, iron deposition and subcutaneous fat thickness. Logistic regression analysis was performed to assess the link between MRE technical failure and potential predictive factors of failure.

RESULTS

Failure occurred in 80 cases (10%). The technical failure rate for MRE exams at 1.5T was 4% (12/338), while it was higher, 15% (63/443), at 3.0T ($P < 0.0001$). On univariate analysis, BMI, liver iron deposition, massive ascites, use of 3.0T, presence of cirrhosis, alcoholic liver disease were all significantly associated with MRE failure ($P < 0.004$); while on multivariable analysis, only BMI, liver iron deposition, massive ascites and use of 3.0T were significantly associated with MRE failure ($P < 0.004$). Presence of steatosis and subcutaneous fat had no significant impact on failure rate ($P > 0.05$).

CONCLUSION

MR elastography with a GRE-based sequence at 1.5T had a low technical failure rate. Use of a GRE-based MRE sequence at 3.0T resulted in a substantially higher technical failure rate. Massive ascites and iron deposition are also independent factors associated with liver MRE failure.

CLINICAL RELEVANCE/APPLICATION

Technical failure rate of MR elastography with a GRE-based sequence is higher at 3.0T than at 1.5T; which provides motivation for the use of alternative sequences at 3.0T.

Honored Educators

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

Richard L. Ehman, MD - 2016 Honored Educator

SSA09-07 Reliability of ARFI Shear Velocity Cut-Off for Diagnosis of Cirrhosis in Chronic Hepatitis C: A 'Real World' Two Centre Simultaneous Biopsy-Controlled Study

Sunday, Nov. 27 11:45AM - 11:55AM Room: E450B

Participants

Nemi Gandy, MBBCh, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Phillip Lung, Middlesex, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ounali Jaffer, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Paul Tadrous, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Michael Heneghan, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Philip J. Shorvon, FRCR, FRCPC, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Paul S. Sidhu, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Speaker, Koninklijke Philips NV; Speaker, Bracco Group; Speaker, Hitachi, Ltd; Speaker, Siemens AG
David I. Sherman, London, United Kingdom (*Presenter*) Nothing to Disclose

PURPOSE

Non-invasive liver fibrosis assessment with elastography recently received FDA clearance and is increasingly used as the sole diagnostic method to assess suitability for new anti-viral therapies in patients with HCV infection. As shear velocity (SV) cut-offs for Metavir F4 fibrosis with ARFI technique (virtual touch quantification™) are based upon historical studies, there is a need for disease specific, population adjusted data. We report results from a biopsy controlled study from two centres, designed to investigate optimal ARFI cut-offs for determining cirrhosis in our population.

METHOD AND MATERIALS

Our database of 96 patients with HCV infection obtained from two centres was interrogated. ARFI SV estimation was performed with 10 right lobe measurements. Fibrosis stage was confirmed in 84 by right lobe liver biopsy within 2 hours of ARFI, and cirrhosis was confirmed by B-mode US imaging criteria in the remaining 12. B-mode and histopathological data was collated retrospectively. Diagnostic performance of ARFI was determined by ROC analysis, using: a) reference SV cut-off values for Metavir stage, and b) optimal SV thresholds for cirrhosis derived from our local data, including subgroup analysis.

RESULTS

Three subgroups were analysed: 1) all 96 cases, including 20 patients with co-pathology (HBV, NAFLD, or ALD); 2) 76 cases with HCV only; 3) 84 cases who had simultaneous biopsy. Cirrhosis was present in 26, 20 and 14, respectively. Predictive accuracy for Metavir F4 using the reference threshold of 1.75 m/sec was 90%, 92% and 88% in groups 1, 2 and 3, respectively. Using new thresholds and ARFI mean SVs required a higher cutoff of 1.99 in group 1 compared with 1.64 in groups 2 and 3 to achieve accuracies of 87% – 93%, whereas more consistent performance across all groups was achieved with median SVs at a cutoff of 1.89, achieving accuracies of 93%, 96% and 92%, respectively.

CONCLUSION

These "real world" data confirm high predictive accuracy of ARFI for Metavir F4 cirrhosis in our local HCV cohort. Optimal performance was seen for median SV cutoff of 1.89 m/sec. However, adjustment of diagnostic thresholds may be necessary when making treatment decisions for less selected populations and in patients with co-existent pathology.

CLINICAL RELEVANCE/APPLICATION

ARFI has high predictive accuracy for Metavir F4 cirrhosis in real world HCV patients. However, population specific diagnostic thresholds are recommended to optimise accuracy.

SSA09-08 Liver Inflammation and Fibrosis (LIF) Scores in a Large Population Study: Normal values by Body Mass Index and Liver Fat

Sunday, Nov. 27 11:55AM - 12:05PM Room: E450B

Participants

Catherine Kelly, MSc,DPhil, Oxford, United Kingdom (*Abstract Co-Author*) Employees, Perspectum Diagnostics
Matt Kelly, PhD, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Perspectum Diagnostics
Rajarshi Banerjee, MD,DPhil, Oxford, United Kingdom (*Presenter*) CEO, Perspectum Diagnostics
Stella Kin, MSc, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Perspectum Diagnostics
Miranda Phillips, BSc, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Perspectum Diagnostics
Amy Herlihy, PhD, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Perspectum Diagnostics

PURPOSE

Multiparametric MRI is increasingly used in the non-invasive assessment of liver physiology, with recent application in the assessment of fatty liver disease (FLD). FLD is characterised by the presence of elevated liver fat which can develop into steatohepatitis and fibrosis. Normal values for hepatic fat (specifically proton density fat fraction - PDFF) are widely established. The Liver Inflammation and Fibrosis (LIF) score is a novel metric for assessing liver inflammation and fibrosis, based on T1 mapping technology corrected for liver iron content. It has been shown to predict clinical outcomes. The purpose of this study was to describe the normal values of LIF using data from the world's largest prospective liver imaging study.

METHOD AND MATERIALS

Three thousand and seventy-one participants aged from 40-59 underwent a multiparametric MRI scan as part of the UK Biobank imaging study. All data were collected on a 1.5T Siemens Aera. The proton density fat fraction (PDFF) and LIF score were calculated from the MRI data. Normality in terms of liver health was defined as a BMI < 25 (BMI is a risk factor for non-alcoholic fatty liver disease) and PDFF < 5% (the clinical threshold for steatosis).

RESULTS

Out of the 3071 initial subjects, 1687 (55%) of the population were defined as obese (BMI > 25) and 618 (20%) had a PDFF measurement of greater than 5%, suggestive of fatty liver disease. This is in agreement with previous reported estimates. 1289 (42%) of the subjects were defined as normal (where PDFF<5% and a BMI < 25). The distribution of LIF values in three populations (not obese, no steatosis and no steatosis AND not obese) is shown in the Figure. For the normal population, the LIF score ranged from 0.3334 and 2.632 with a median value of 0.82 (IQR 0.7106-0.9529) and a mean value of 0.8802 (std dev 0.28).

CONCLUSION

The normal range of LIF values in a population with no indicators for fatty liver disease is 0.7106-0.9529 [IQR] with an upper limit of normal of 1.45 (mean + 2 sd).

CLINICAL RELEVANCE/APPLICATION

The normogram presented in this study can serve as a benchmark for other studies using the LIF score to assess the normality of their population. Previous studies have shown that a cutoff value of 2 predicts clinical outcomes (Pavlidis et al. 2016) with a negative predictive value of 100%. This suggests that maintaining a healthy BMI and liver fat percentage reduces the likelihood of suffering from liver-related clinical outcomes.

SSA09-09 Gastrointestinal Keynote Speaker: Image-based Liver Fibrosis Quantification

Sunday, Nov. 27 12:05PM - 12:15PM Room: E450B

Participants

Claude B. Sirlin, MD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Guerbet SA; ;

SSA10

Genitourinary (Evaluation of Renal Masses)

Sunday, Nov. 27 10:45AM - 12:15PM Room: E351

CT **GU** **MR** **OI**

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

FDA Discussions may include off-label uses.

Participants

Zhen J. Wang, MD, Hillsborough, CA (*Moderator*) Stockholder, Nextrast, Inc
Mitchell E. Tublin, MD, Pittsburgh, PA (*Moderator*) Nothing to Disclose

Sub-Events

SSA10-01 Natural History of Small (< 3 cm) Cystic Renal Lesions: Is Resection Necessary?

Sunday, Nov. 27 10:45AM - 10:55AM Room: E351

Awards

Student Travel Stipend Award

Participants

Hiram Shaish, MD, New York, NY (*Presenter*) Nothing to Disclose
James S. Babb, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Nicole M. Hindman, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the percentage of small (<3cm) complex cystic renal lesions that regress based on follow-up studies and to investigate predictive clinical factors.

METHOD AND MATERIALS

A hospital database was searched from 1/1/10, to 9/2/15, for Bosniak category (BC) 2F, 3 and 4 cysts studied with C+ CT or MRI and with follow up. Two readers independently assigned a BC to the initial and last studies. Demographics and clinical outcome of patients with lesions that regressed from BC 2f, 3 or 4 (or remained stable as BC 2f), were compared with those that progressed. The relationship of progression with age, sex and history of renal cell carcinoma (RCC) was assessed using Fisher's exact test. A subgroup analysis was performed on patients with lesions that were assigned a BC of 2f by both readers. Inter-observer agreement was assessed using Kappa statistics.

RESULTS

106 patients (71:35 M:F, avg. age 61) were identified with a dominant complex cystic renal lesion. 81 of 106 lesions (76.4%) regressed from BC 2f, 3 or 4 (60), or remained stable as a 2f lesion (21) (Kappa = 0.57). Two regressed lesions were resected; one of these regressed from BC 4 to 2f, was resected and was a low grade papillary RCC (this was in a 52 year old female with a history of RCC); the other was benign (renal dysplasia) in a patient without a history of RCC. 8 of the 25 progressed or stable BC 3 or 4 lesions were resected, of which 7 were RCC (87.5%) and 1 benign (cystic nephroma). To date, no patients recurred or had metastatic disease. Progression was associated with a history of RCC (P = .04). Kappa between the 2 readers for assigning a BC 2f was 0.41. 50 lesions (47.1%) were assigned a BC 2f by both readers. Kappa between the 2 readers for progression of these lesions was 0.43. 6 lesions (12%) progressed on follow up imaging. 3 of these were resected and were malignant. All 3 of these occurred in patients with a history of RCC. Progression was associated with history of RCC (p=0.007).

CONCLUSION

Based on this study, 76.4% of small (<3cm) BC 2f, 3 and 4 cystic renal lesions regress. Therefore, small size should be a consideration for conservative management. In the absence of a history of RCC these lesions may be amenable to imaging follow up rather than resection.

CLINICAL RELEVANCE/APPLICATION

In the absence of a history of RCC, small BC 2F, 3 and 4 lesions may be amenable to imaging follow up rather than immediate resection.

SSA10-02 A Cost-Effective Analysis Study Comparing Active Surveillance to Nephron-sparing Surgery for Bosniak III Renal Cysts

Sunday, Nov. 27 10:55AM - 11:05AM Room: E351

Participants

Andrew D. Smith, MD, PhD, Jackson, MS (*Presenter*) Research Grant, Pfizer Inc; President, Radiostics LLC; President, Liver Nodularity LLC; President, Color Enhanced Detection LLC; President, eMASS LLC; Pending patent, Liver Nodularity LLC; Pending patent, Color Enhanced Detection LLC; Pending patent, eMASS LLC;
James D. Carson, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Xu Zhang, PhD, Jackson, MS (*Abstract Co-Author*) Nothing to Disclose
Brian C. Allen, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Rupan Sanyal, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Brian Shuch, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Reza Sirous, MD, MPH, Jackson, MS (*Abstract Co-Author*) Nothing to Disclose
Erick M. Remer, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the relative cost-effectiveness of active surveillance (AS) vs. nephron-sparing surgery (NSS) in patients with Bosniak III renal cysts.

METHOD AND MATERIALS

A decision-analytic Markov model was developed to estimate life expectancy and lifetime costs for 60-year-old male patients with a Bosniak III renal cyst treated with AS or NSS. The model incorporated the yearly probability of metastatic disease and local recurrence (extrapolated from small solid renal neoplasms and adjusted for the 53% prevalence of malignancy in Bosniak III renal cysts), AS with multiphasic renal CT imaging at 6 months and annually for 5 years, and complications from CT imaging or NSS. Reclassification to Bosniak IV renal cysts on AS (1.1% per year) was treated by NSS. An incremental cost-effectiveness analysis (ICER) was performed under an assumed \$50,000 per quality-adjusted liver year (QALY) societal willingness-to-pay threshold level.

RESULTS

Active surveillance yielded an average QALY expectancy of 19.37 years, longer than 19.00 years for NSS (QALY difference of 4.5 months). The lifetime cost for AS of Bosniak III renal cysts was \$19,387, substantially less expensive than \$44,684 for NSS. Given that AS is more effective and substantially less expensive than NSS, the ICER is a negative value, indicating that AS dominates NSS. Results were robust to changes in most model parameters, with metastatic disease contributing substantial average lifetime costs for AS (\$17,142) and NSS (\$22,021).

CONCLUSION

Active surveillance for Bosniak III renal cysts was more effective and substantially less expensive than NSS, suggesting that a change in current recommendations is needed.

CLINICAL RELEVANCE/APPLICATION

Current management of Bosniak III renal cysts is based on the malignancy rate at surgical resection rather than on a survival advantage, and the results of a cost-effective analysis study can inform management recommendations.

SSA10-03 Can Quantitative CT Texture Analysis be used to Differentiate Subtypes of Renal Cell Carcinoma on Multiphasic Multidetector CT Images?

Sunday, Nov. 27 11:05AM - 11:15AM Room: E351

Awards

Student Travel Stipend Award

Participants

Gu Mu Yang Zhang, MD, Beijing, China (*Presenter*) Nothing to Disclose

Hao Sun, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Bing Shi, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Huadan Xue, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Zheng Yu Jin, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Balaji Ganeshan, PhD, London, United Kingdom (*Abstract Co-Author*) CEO, TexRAD Ltd; Director, Feedback plc; Director, Stone Checker Software Ltd; Director, Prostate Checker Ltd

PURPOSE

To investigate whether CT texture analysis (CTTA) can be used to differentiate non clear-cell renal cell carcinoma (non-ccRCC) from clear-cell renal cell carcinoma (ccRCC) and differentiate non-ccRCC subtypes of papillary RCC (pRCC) and chromophobe RCC (chRCC).

METHOD AND MATERIALS

A total of 100 ccRCC and 27 non-ccRCC (12 pRCC and 15 chRCC) lesions were analyzed. CTTA was performed on multiphasic CT images by using TexRAD software. Receiver operating characteristic (ROC) analysis was performed and the area under the ROC curve (AUC) was calculated for texture parameters that were significantly different for the objectives. Sensitivity (Se), specificity (Sp), positive predictive value (PPV), negative predictive value (NPV) and accuracy were calculated by using the cut-off value of texture parameter with the highest AUC.

RESULTS

Compared to ccRCC, non-ccRCC had significantly lower MPP, higher kurtosis at medium texture scales on unenhanced CT images ($P=0.032$) and lower mean, SD, entropy, MPP and higher kurtosis at all texture scales on enhanced CT images ($P=0.000$). A MPP < 66.26 at coarse texture scale on corticomedullary images identified non-ccRCC from ccRCC (AUC=0.92±0.04, Se=85.0%, Sp=92.6%, PPV=97.7%, NPV=62.5%, accuracy=86.6%, $P=0.000$). Compared to chRCC, pRCC had significantly lower mean and MPP at fine texture scale ($P=0.002$). A MPP < 56.06 at fine texture scale on corticomedullary images identified pRCC from chRCC (AUC=0.85±0.08, Se=86.7%, Sp=75.0%, PPV=81.3%, NPV=81.8%, accuracy=81.5%, $P=0.002$).

CONCLUSION

CTTA on multiphasic multidetector CT images could be used to accurately differentiate non-ccRCC from ccRCC, and further differentiate between pRCC and chRCC.

CLINICAL RELEVANCE/APPLICATION

CTTA could be used as a non-invasive tool to classify histological subtypes of RCC and potentially assist in patient management owing to their prognostic significance and guide in treatment selection.

SSA10-04 Differentiation of Papillary Type 1 and Type 2 RCC on CT Textural Analysis

Sunday, Nov. 27 11:15AM - 11:25AM Room: E351

Participants

Diana Kaya, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Balaji Ganeshan, PhD, London, United Kingdom (*Abstract Co-Author*) CEO, TexRAD Ltd; Director, Feedback plc; Director, Stone Checker Software Ltd; Director, Prostate Checker Ltd
Behrang Amini, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Pheroze Tamboli, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Christopher G. Wood, MD, Houston, TX (*Abstract Co-Author*) Consultant, Pfizer Inc Investigator, Pfizer Inc Speaker, Pfizer Inc Consultant, Argos Therapeutics, Inc Investigator, Argos Therapeutics, Inc Investigator, GlaxoSmithKline plc
RaghuNandan Vikram, MBBS, FRCR, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the role of CT texture analysis (CTTA) in distinguishing Papillary Type I and Type II RCC

METHOD AND MATERIALS

Multi phase contrast enhanced CT (CECT) including Non contrast (NC), Corticomedullary (CM), nephrographic (N) and excretory (E) of 93 patients with pathologically proven pRCC (49 Type I and 44 Type II) underwent filtration-histogram based CTTA using a commercially available research software (TexRAD Ltd, www.texrad.com, part of Feedback Plc, Cambridge, UK). Using the DICOM images, filtration step extracted texture features using different spatial scale filters corresponding to fine, medium and coarse texture scales followed by histogram quantification: Mean gray-level pixel intensity, Entropy, Standard-Deviation (SD), Mean of positive pixels (MPP), Kurtosis and Skewness. Non- parametric Mann Whitney test was used to test for significant difference in CTTA between Type I and Type II pRCC using SPSS (IBM) software.

RESULTS

There were statistically significant differences in textural features between Type 1 and 2 in all phases of CECT. This was consistently seen across the phases in entropy with a mean of 13.19 for type 1 and 30.2 for type 2 ($p<0.001$), N phase. Significant differences were seen in SD of type 1 (mean 16.19) and type 2 (mean 28.20) ($p=0.003$), MPP of type 1 (mean 14.67) and type 2 (mean 29.18) ($p<0.001$) in N phase; kurtosis of type 1 (mean 26.31) and type 2 (mean 38.22) ($p=0.01$) in NC phase. Other parameters (Mean and skewness) and phases (CM and E) were also useful in differentiating between the two subtypes.

CONCLUSION

A software based CTTA can reliably stratify type 1 from type 2 RCC on CECT images.

CLINICAL RELEVANCE/APPLICATION

Our study demonstrates the possibility of CT texture analysis as an imaging biomarker for differentiating subtypes of papillary RCC reliably

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/>

RaghuNandan Vikram, MBBS, FRCR - 2012 Honored Educator

SSA10-05 Can Computerized Tumor-Cortex Echointensity Ratio Differentiate Angiomyolipomas from Echogenic Renal Cell Carcinomas?

Sunday, Nov. 27 11:25AM - 11:35AM Room: E351

Participants

Peiman Habibollahi, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Laith R. Sultan, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lisa P. Jones, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Chandra Sehgal, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Anil Chauhan, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hyperechoic renal lesions are a common incidental finding noted on routine ultrasound exams. Even though the majority of hyperechoic renal tumors are angiomyolipomas (AML), hyperechoic renal tumors cannot be characterized as AML based on ultrasound alone because up to one third of renal cell carcinomas (RCC) can be hyperechoic relative to the renal cortex. In the current study, we have evaluated the diagnostic value of renal tumor to cortex echointensity ratio (TCER) for the characterization of hyperechoic renal tumors.

METHOD AND MATERIALS

All the patients who underwent renal ultrasound examination within our health system between 2012-2014, were screened. Patients with adequately characterized hyperechoic renal tumors were included in the study. Contrast enhanced MRI, multiphase CT, 2 year follow up for stability and/or histopathology were considered as reference standard. TCER was defined as the ratio between renal mass echointensity to adjacent renal cortex, as measured by ROI placements. Mazda software (version 4.6, Lodz, Poland) was used for lesion segmentation and echointensity measurements.

RESULTS

A total of 101 tumors in 95 patients were identified. 75 out of 101 tumors (74.3%) were characterized as AML. Mean age of the patients with AML tumors was 63.1 ± 14.7 versus 62.9 ± 10.8 for patients with non-AML tumors ($p>0.05$). AMLs were more prevalent among females (54 females (78.3%) with AML compared to only 9 females (34.6%) with non-AML tumors) ($p<0.001$). Within non-AML tumors, 20 out of 26 were malignant (including 19 RCCs as well as one metastatic papillary thyroid cancer). The mean TCER for AML was significantly higher compared to the other tumors (4.14 ± 2.73 versus 2.19 ± 0.71 , respectively, $p<0.001$). For AML diagnosis, TCER values greater than 2.31 were associated with sensitivity, specificity and positive likelihood ratio of 82.67%, 73.08% and 3.07, respectively; with area under the ROC curve of 0.85. Moreover, TCER values greater than 3.98 resulted in 100%

specificity for AML diagnosis with a sensitivity of 37.33%.

CONCLUSION

These results suggest that computerized echointensity ratio might be a valuable tool for the characterization of hyperechoic renal masses, providing very high specificity for diagnosing AMLs with values greater than 3.98.

CLINICAL RELEVANCE/APPLICATION

Based on these findings, computerized TCER has the potential to decrease the amount and cost of the diagnostic work up for hyperechoic renal tumors.

SSA10-06 CT Texture Analysis of Post-contrast and Non-contrast Images; Early Observations on Differences in Renal Tumor Types

Sunday, Nov. 27 11:35AM - 11:45AM Room: E351

Participants

Azadeh Tabari, Boston, MA (*Presenter*) Nothing to Disclose

Cynthia Cruz, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Abstract Co-Author*) Nothing to Disclose

Sarabjeet Singh, MD, Boston, MA (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Toshiba Corporation; Research Grant, General Electric Company; Research Grant, Koninklijke Philips NV

Debra A. Gervais, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Determine and compare CT texture analysis features between renal masses and define whether image texture can be used to distinguish different subtypes of renal tumors.

METHOD AND MATERIALS

IRB approved retrospective study of consecutive patients from a single institution who had biopsy proven renal cell carcinoma (RCC) and concomitant CT were included. Patients were divided in 5 groups based on the tumor type. Axial contrast-enhanced and unenhanced CT images were contoured manually by an analyst using commercially available software (TexRAD, UK), with 124 ROIs placed over the clear cell RCC (n=59), papillary RCC (n=16), chromophobe RCC (n=21), angiomyolipoma (AML) (n=17) and oncocytoma (n=11). Skewness, kurtosis, entropy, and MPP (mean value of positive pixels) were assessed in all filters. Independent ANOVA tests were used to evaluate for significant differences between groups

RESULTS

28 patients (M:F 18:10, mean age 59 ± 18 years), 12 ccRCC, 4 Pap RCC, 5 AML, 4 cRCC and 3 oncocytoma were identified. 22/28 of patients had small (<4 cm) renal masses. Histogram analysis of CT values using filter number 2 (ssf2) in contrast-enhanced nephrogenic phase showed statistically significant differences in skewness (range 0.5-0.3, f-ratio=3.6, p=0.009) and kurtosis (range 0.4-1.9, f-ratio=3.09, p=0.02) among the individual subtypes. AML and chromophobe showed the highest and lowest values for skewness. Chromophobe and papillary showed the highest and lowest values for kurtosis, respectively (table 1). In unenhanced CT ssf2 mpp (range: 27.7-67.8, f-ratio=3.6, p=0.01) were also significantly different with oncocytomas and papillary presenting the highest and lowest mpp values, respectively (table 1). None of the other evaluated features demonstrated significant differences. When comparing the small and large tumors no significant difference in the evaluated texture features was found

CONCLUSION

Renal lesions demonstrated significantly different texture quantitative parameters on CT, specifically malignant lesions showed significantly different texture skewness and kurtosis on contrast enhanced CT, as well as in texture mpp on unenhanced CT images, regardless of tumor size

CLINICAL RELEVANCE/APPLICATION

Texture analysis features show early promise distinguishing renal tumor types. Ongoing evaluation is needed to determine potential future use as imaging biomarkers

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/>

Debra A. Gervais, MD - 2012 Honored Educator

SSA10-07 Atypical Imaging Features of Central Renal Cell Carcinoma That Mimics Renal Pelvic Urothelial Carcinoma? Utility of Intravoxel Incoherent Motion MR Imaging

Sunday, Nov. 27 11:45AM - 11:55AM Room: E351

Participants

haojie li, Wuhan, China (*Presenter*) Nothing to Disclose

Zhen Li, MD, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance of intravoxel incoherent motion (IVIM)-derived perfusion and diffusion parameters in the differentiation of central renal cell carcinoma (RCC) from renal pelvic urothelial carcinoma, with pathologic examination as the reference standard

METHOD AND MATERIALS

The institutional review board approved this retrospective study and waived the informed consent requirement. A total of 111 patients with either pathologic analysis-confirmed central renal cell carcinoma (n=83) or renal pelvic urothelial carcinoma (n=29) were assessed by using multi-b values DWI (0~1700 sec/mm²) on a 3.0T MRI. IVIM-based parameters (D, pure diffusion; f, perfusion fraction; D*, pseudodiffusion coefficient) were retrospectively compared between central renal cell carcinoma (RCC) and renal pelvic urothelial carcinoma. Receiver-operating characteristic (ROC) analyses were performed to determine the optimal thresholds, the sensitivities, and specificities for differentiation.

RESULTS

Mean f was significantly lower in the renal pelvic urothelial carcinoma group (f=0.242±0.053, P <0.001) than in the central renal cell carcinoma group (f=0.408±0.074). Mean D was significantly lower in the renal pelvic urothelial carcinoma group (D=0.911±0.138×10⁻³ mm²/s, P <0.05) than in the central renal cell carcinoma group (D=1.021±0.187×10⁻³ mm²/s). Mean D* did not significantly differ between the two groups (P =0.172). The AUC, sensitivity, specificity and the cutoff value, respectively, for differentiating central renal cell carcinoma (RCC) from renal pelvic urothelial carcinoma for f, D were as follows: f, 0.972, 100.0%, 89.7%, and 0.298; D, 0.682, 37.3%, 96.6%, and 1.098×10⁻³ mm²/s.

CONCLUSION

IVIM imaging can be used as a noninvasive imaging method to differentiate central renal cell carcinoma (RCC) from renal pelvic urothelial carcinoma. Mean f value is more sensitive than D and D* values in this differentiation.

CLINICAL RELEVANCE/APPLICATION

IVIM imaging can be used as a noninvasive imaging method to differentiate central renal cell carcinoma (RCC) from renal pelvic urothelial carcinoma.

SSA10-08 "Is It Enhancing or Not?" The Effect of Pseudo-enhancement on the Accuracy of Spectral CT Iodine Quantification Measurements and Its Implications for Renal Lesion Diagnosis

Sunday, Nov. 27 11:55AM - 12:05PM Room: E351

Participants

Todd C. Soesbe, PhD, Dallas, TX (*Presenter*) Nothing to Disclose
Lakshmi Ananthakrishnan, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Or Green, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Khaled A. Nasr, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Xinhui Duan, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Matthew A. Lewis, PhD, Dallas, TX (*Abstract Co-Author*) Research collaboration, CMR Naviscan Corporation
Suhny Abbara, MD, Dallas, TX (*Abstract Co-Author*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG
Robert E. Lenkinski, PhD, Dallas, TX (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Consultant, Aspect Imaging;

PURPOSE

To measure the effect of pseudo-enhancement (i.e., the artificial increase in attenuation) on Spectral CT iodine quantification as a function of lesion size, lesion iodine levels, background iodine levels, helical versus axial scanning, and Spectral CT scanner type. To compare the accuracy of Spectral CT iodine quantification algorithms (Siemens image-based versus Philips projection-based) in the presence of pseudo-enhancing backgrounds.

METHOD AND MATERIALS

Pseudo-enhancement effects were studied using a custom-made phantom containing either six small vials (8 mm diameter, 2 mL) or six large vials (27 mm diameter, 50 mL) of aqueous iodine solutions (0, 0.5, 1.0, 2.0, 4.0 and 6.0 mg I/mL). The background iodine concentration was 0, 5, or 10 mg I/mL. The vials simulated renal lesions of various sizes and enhancements, while the background simulated the surrounding renal parenchyma at different phases. Both helical & axial scans were taken using three different Spectral CT scanners (Siemens dual-detector SOMATOM Flash and Force, and Philips detection-based IQon) with the scan parameters consistent between the systems. Data were analyzed using either Siemens syngo.via software or Philips Spectral Diagnostic Suite software. 108 total ROIs were used to measure the average iodine concentration (mg I/mL) of the vials.

RESULTS

Iodine quantification pseudo-enhancement effects are inversely proportional to lesion size and lesion enhancement, and are directly proportional to background attenuation level. These results agree with Conventional CT results. No significant differences between helical and axial scans were observed. The image-based algorithms (Siemens) overestimated the iodine concentrations by 25% to 100% over, while the projection-based algorithm measured the true iodine concentrations within standard deviation error.

CONCLUSION

Pseudo-enhancement artificially increases the Spectral CT iodine quantification levels, most notably for low enhancing lesions (< 5.0 mg I/mL) surrounded by a high attenuating background (10 mg I/mL). The projection-based Spectral CT algorithm outperformed the image-based algorithms for all but the highest background attenuation (10 mg I/mL) with the smallest vial (8 mm diameter).

CLINICAL RELEVANCE/APPLICATION

Iodine quantification measurements, a biomarker for improved renal lesion diagnosis and renal cell carcinoma staging, are more accurate from Spectral CT systems that use projection-based algorithms.

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

SSA10-09 Evaluation of Material Density Thresholds in Complex Cysts and Papillary Renal Cell Carcinomas

Sunday, Nov. 27 12:05PM - 12:15PM Room: E351

Participants

Roberto C. Valentin, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

Jessica G. Zarzour, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

Desmin Milner, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

Janelle West, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

Bradford Jackson, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

Desiree E. Morgan, MD, Birmingham, AL (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company

Jennifer Gordestsky, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

Soroush Rais-Bahrami, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Determine if quantitative material density thresholds can be determined to discriminate papillary renal cell carcinomas from hyperdense cysts using rapid kV-switching dual energy CT (rsDECT)

METHOD AND MATERIALS

IRB approved HIPAA compliant retrospective study of consecutive patients with pathologic diagnosis of renal cell carcinoma who underwent rsDECT at a tertiary care hospital from 2011-2015. Control group included patients with complex cysts with >1 year stability. Calcium, water, and iodine content were recorded for each papillary renal cell carcinoma (n=27) in arterial (n=14) and nephrographic (n=13) phase, and compared to complex cysts (n=54) in the arterial (n=27) and nephrographic phase (n=25). Optimal thresholds were estimated using logistic regression and Youden's J based on maximum specificity and sensitivity.

RESULTS

Complex cysts have lower calcium, water, and iodine content when compared to papillary RCCs. Intralesional calcium content > 805.7 mg/cc can be used to discriminate a papillary RCC from a complex cyst in the nephrographic phase (sens 0.92, spec 0.72, PPV 0.63, NPV 0.95, accuracy 79.0%, p=0.012). Water content > 1010 mg/cc can be used as a threshold between a papillary RCC and a complex cyst in the nephrographic phase (sens 1.0, spec 0.64, PPV 0.59, NPV 1.0, accuracy 76.3%, p=0.012). In the arterial phase, no reliable threshold value for calcium or water content was found. The optimum iodine content threshold was 1.28 mg/cc to distinguish a papillary RCC from a complex cyst in the nephrographic phase (sens 1.0, spec 0.96, PPV 0.92, and NPV 1.0; AUC 0.997, acc 0.97, p<0.0001).

CONCLUSION

rsDECT quantitative material density analysis provides calcium and water intralesional content thresholds that have high sensitivity for discrimination of papillary RCCs from complex cysts, and this has ramifications for unenhanced renal rsDECT applications. However, quantitative iodine content has the most accurate threshold.

CLINICAL RELEVANCE/APPLICATION

Knowledge of the iodine, water, and calcium content in papillary renal cell carcinomas and complex cysts can aid in diagnosis and guide management of the patient.

SSA11

Genitourinary (Imaging of Gynecological Malignancy)

Sunday, Nov. 27 10:45AM - 12:15PM Room: E353B



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

FDA Discussions may include off-label uses.

Participants

Katherine E. Maturen, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Temel Tirkes, MD, Indianapolis, IN (*Moderator*) Nothing to Disclose
Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSA11-01 **FDG PET-CT Identification of Distant Metastatic Disease in Uterine Cervical and Endometrial Cancers: Analysis from ACRIN 6671/GOG0233**

Sunday, Nov. 27 10:45AM - 10:55AM Room: E353B

Participants

Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Presenter*) Nothing to Disclose
Mostafa Atri, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Andriy I. Bandos, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Robert Mannel, MD, Oklahoma City, OK (*Abstract Co-Author*) Nothing to Disclose
Michael Gold, Tulsa, OK (*Abstract Co-Author*) Nothing to Disclose
Susanna I. Lee, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To estimate the accuracy of staging PET-CT for detecting distant metastasis in patients with advanced cervical or high grade endometrial cancer in the ACRIN6671/GOG2033 patient cohort and to compare site and central radiologist test performance.

METHOD AND MATERIALS

In an IRB approved study, PET-CT and clinical data were retrospectively reviewed for all patients enrolled in the ACRIN 6671/GOG0233 trial. Two central readers, blinded to site read and reference standard, rated PET-CTs for distant metastasis (on 1-6 scale; with 4-6 indicating "positive"). Reference standard was pathology and follow-up radiology reports. Diagnostic accuracy of site and central review was estimated and compared using generalized estimating equation models and nonparametric bootstrap for clustered data.

RESULTS

153 cervical and 203 endometrial cancer patients were enrolled at 28 sites. Overall prevalence of distant metastasis was 13.7% (21/153) for cervical and 11.8% (24/203) for endometrial cancer, with most common locations being lung (5.2%) and peritoneum (4.6%) for cervical and peritoneum (6.4%) for endometrial cancer. Site PET-CT reads demonstrated 47.6% sensitivity, 93.9% specificity, 91.9% NPV, 55.6% PPV, and area under the ROC curve (AUC) of 0.75 for detecting cervical cancer metastasis compared with 66.7%/93.9%/95.5%/59.3%/0.84 for endometrial cancer metastasis. The specificity (97.7% and 98.6%) and AUC (0.78 and 0.89) for central readers in detecting cervical and endometrial cancer metastases, respectively, were both higher compared with site review in both cancer groups ($P < 0.01$ for specificity and $P < 0.001$ for AUC).

CONCLUSION

FDG PET-CT demonstrates high specificity and NPV for detecting distant metastasis and should be included in the pretreatment evaluation. Central radiology review offers potential improvement of PET-CT performance for metastatic detection.

CLINICAL RELEVANCE/APPLICATION

Use of pre-treatment FDG PET-CT to detect distant metastasis in cervical and endometrial cancer can spare patients unnecessary aggressive therapy, with a false positive rate $< 5\%$.

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/>

Susanna I. Lee, MD, PhD - 2013 Honored Educator

SSA11-02 **Prevalence of Ovarian Cancer in Adnexal Cysts Initially Identified on CT Exams**

Sunday, Nov. 27 10:55AM - 11:05AM Room: E353B

Participants

Johannes Boos, MD, Boston, MA (*Presenter*) Nothing to Disclose
Olga R. Brook, MD, Boston, MA (*Abstract Co-Author*) Research Grant, Toshiba Medical Systems Corporation
Jieming Fang, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Alexander Brook, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Deborah Levine, MD, Boston, MA (*Abstract Co-Author*) Editor with royalties, UpToDate, Inc; Editor with royalties, Reed Elsevier;

PURPOSE

To assess the clinical outcome of adnexal cysts initially identified on CT, to determine if incidental cysts need follow-up.

METHOD AND MATERIALS

In this HIPAA-compliant, IRB-approved study the institutional database was searched for abdomen and pelvic CTs with or without intravenous contrast between 06/2003 and 12/2010 for female patients that were reported to have adnexal cysts. Imaging appearance of adnexal cysts was obtained from review of CT studies. Patients with known ovarian cysts or cancer were excluded. Clinical outcome was assessed using follow-up imaging studies, medical records, and state cancer registry. Descriptive statistics and 95% confidence intervals were calculated. A power analysis was performed to determine sample size.

RESULTS

2763/42111 (6.6%, 95%CI: 6.3-6.8%) women undergoing abdominal and pelvic CT examinations in the study period (mean age 48.1±18.1 years, range 15-102) had new finding of ovarian cyst. Average follow-up was 5.1±3.8 years (range 0-12.8 years). Median cyst size was 3.1 cm, IQR 2.3-4.3 cm, range 0.8-20.0 cm. 18/2763 (0.7%, 95%CI: 0.4-1.0%) patients were found to have ovarian cancer. 0/1032 (95%CI: 0-0.4%) patients with simple cysts were diagnosed with ovarian cancer. 6/1697 (0.4%, 95%CI: 0.1-0.8%) patients with complex cysts on initial CT (initial cyst size 1.2, 2.3, 4.3, 4.5, 5.6, and 8.4 cm) and age 30, 37, 55, 62, 65, and 71 years, were diagnosed with ovarian cancer after 1-17 months (median 3.5 months) follow up with serous borderline, serous, and seromucinous pathology. 12/34 (35.3%, 95%CI: 19.8-53.5%) of patients with cysts highly suspicious for cancer (omental deposits, a large amount of ascites, or prominent soft tissue nodularity on index CT) had ovarian cancer and 2/34 (5.9%, 95%CI:0.7-19.7%) patients had metastases to the ovary.

CONCLUSION

Prevalence of previously unknown adnexal cysts on CT is 6.6%, with cancer rate at 0.7% (95%CI 0.4-1.0%). All simple cysts were benign (95%CI 99.6-100%). In complex cysts without suspicious features for cancer on index CT the risk to develop cancer was 0.4% (95%CI 0.1-0.8%).

CLINICAL RELEVANCE/APPLICATION

Incidental simple cysts are very unlikely to develop into ovarian cancer, and thus likely do not need follow-up. Complex cysts without features highly suspicious for cancer in women of any age have a low risk of developing into cancer.

SSA11-03 3D Volumetric MRI Higher Order Texture Analysis for Preoperative Risk Stratification of Endometrial Cancer

Sunday, Nov. 27 11:05AM - 11:15AM Room: E353B

Participants

Yoshiko Ueno, MD, PhD, Montreal, QC (*Presenter*) Nothing to Disclose
Martin Vallieres, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Ives R. Levesque, PhD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Foucauld Chamming's, MD, PhD, Montreal, QC (*Abstract Co-Author*) Speaker, Supersonic Imagine
Anthony Dohan, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Caroline Reinhold, MD, MSc, Montreal, QC (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc

PURPOSE

This study aimed to develop a multivariate model based on 3D volumetric MRI higher order texture analysis for the preoperative risk stratification of endometrial cancer.

METHOD AND MATERIALS

Institutional review board was obtained for this retrospective study. We retrospectively analyzed the data of 93 patients (mean age, 65.4 years) who underwent 1.5-T MRI scan before hysterectomy for endometrial cancer. Four non-texture features (volume, size, and shape features) and forty-two texture features (3 first-order, 8 second-order and 31 higher-order features) were extracted from the whole tumour region of MR images (T2WI, DWI at b=500 and 1000 s/mm², ADC map at b=0,500 s/mm² and b=0, 1000 s/mm², early- and equilibrium-phase, post contrast-enhanced images). These features were incorporated into multivariate models by logistic regression for prediction of three binary endpoints: lymphovascular space invasion (LVSI), deep myometrium invasion (MI ≥ 50%), and high tumour grade (Type II histology, grade 3 Type I histology). Prediction performance of each model was estimated with 100 bootstrap testing samples in terms of areas under the receiver-operating characteristic curve (AUC), sensitivity, and specificity.

RESULTS

Forty-seven out of 93 (50.5%) patients had LVSI, 41 (44.0%) had deep MI, and 30 (32.2%) had high tumour grade. Our multivariate prediction models separated the patients into a positive and negative group for each outcome. The AUC of each prediction model was estimated at 0.83, 0.84, and 0.81 for LVSI, deep MI, and high grade tumour, respectively. Sensitivity, specificity, and accuracy of each model was estimated: 74.0%, 74.0%, and 73.7% for LVSI; 78.0%, 73.0%, and 75.0% for deep MI; 69.0%, 75.0%, and 72.0% for high tumour grade.

CONCLUSION

Multivariate models based on 3D volumetric MRI texture achieved good prediction performance for LVSI deep MI, and high grade tumour in the pre-operative assessment of patients with endometrial carcinoma.

CLINICAL RELEVANCE/APPLICATION

3D volumetric MRI texture analysis may be useful for the preoperative risk stratification of endometrial cancer and has the potential to improve treatment planning.

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

SSA11-04 Comparison of the Diagnostic Accuracy of Multiparametric MRI and Fluorine-18 Fluorodeoxyglucose (18F-FDG) Positron Emission Tomography Combined with CT (PET/CT) in the Differentiation between Uterine Sarcoma and Benign Leiomyoma

Sunday, Nov. 27 11:15AM - 11:25AM Room: E353B

Participants

Masataka Nakagawa, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Tomohiro Namimoto, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kie Shimizu, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Fumi Sakamoto, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinya Shiraiishi, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Nakaura, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

To compare the diagnostic accuracy of multiparametric magnetic resonance imaging (MRI) and Fluorine-18 fluorodeoxyglucose (18F-FDG) positron emission tomography combined with CT (PET/CT) in the differentiation between uterine sarcoma and benign leiomyoma.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board. The requirement to obtain informed consent was waived. Eighty-nine consecutive patients diagnosed with benign leiomyoma or uterine sarcoma who underwent pelvic MRI exam at 3T and 18F-FDG PET/CT before surgery were included. Of 89 patients, 11 (12.4%) patients had uterine sarcomas and 78 (87.6%) patients had benign leiomyomas. Two radiologists blinded to the diagnoses of uterine tumors independently evaluated images based on multiparametric MRI (T2-weighted images, T1-weighted images, dynamic MRI, with or without DWI) and rated likelihood of the presence of malignancy on a scale of 1 to 5 (1, definitely absent; 2, probably absent; 3, equivocal; 4, probably present; 5, definitely present). The apparent diffusion coefficients (ADC) values were calculated from $b=0$ and 1000 s/mm². The mean ADC value was also evaluated. The maximum standardized uptake values (SUVmax) of lesions were also measured. Receiver-operating-characteristic (ROC) curve analysis was performed to compare the diagnostic performance among multiparametric MRI with/ without DWI, mean ADC value and SUVmax.

RESULTS

The area under the curves (AUCs) of ROC for multiparametric MRI with DWI, MRI without DWI, SUVmax, and meanADC were 0.963, 0.915, 0.892, and 0.814 for differentiation uterine sarcoma from benign leiomyoma, respectively.

CONCLUSION

Multiparametric MRI with DWI had highest AUC of ROC and can provide accurate information for differentiation between uterine sarcoma and benign leiomyoma.

CLINICAL RELEVANCE/APPLICATION

Multiparametric MRI with DWI had highest AUC of ROC and can provide accurate information for differentiation between uterine sarcoma and benign leiomyoma.

SSA11-05 Texture Analysis as an MR Imaging Biomarker to Identify Histological Features or Tumor Aggressivity and to Predict Tumor Response to Neo-adjuvant Chemotherapy in Patients with Cancer of the Uterine Cervix

Sunday, Nov. 27 11:25AM - 11:35AM Room: E353B

Awards

Student Travel Stipend Award

Participants

Maria Ciolina, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Valeria Vinci, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Rengo, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Lucia Manganaro, 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

To determine the performance of texture analysis, in predicting tumoral response to neo-adjuvant chemotherapy (NACHT) and to assess if a relationship exists between texture tissue heterogeneity and histological type and tumoral grading in patients with cancer of uterine cervix.

METHOD AND MATERIALS

28 patients with local advanced cervical cancer (FIGO IIB-III A), underwent pre-chemotherapy MRI. Texture analysis parameters (*mean, mpp, entropy, skewness e kurtosis*) were quantified using a commercial research software algorithms and delineating a ROI around the tumor margins on T2w sequences. Surgical specimen served as the gold standard. Unpaired t test was used, to evaluate if obtained data were statistically different comparing histological types, G3 and G1-G2 tumors and responders vs non-

responders. ROC curve analysis was performed to assess the discriminatory power of texture parameters.

RESULTS

Mean and *skewness* showed a strong correlation with the histological type: adenocarcinomas presented higher *mean* and *skewness* values (69.8 ± 10.5 e 0.55 ± 0.19) in comparison with squamocellular carcinomas. Using a cut-off value ≥ 29 for *mean* it was possible to differentiate the two histological types with a sensitivity of 100% and a specificity of 81%. *Kurtosis* showed a positive correlation with tumor response to NACHT resulting higher in responder patients (v.m. 5.7 ± 1.1) in comparison with non-responders (v.m. 2.3 ± 0.5). The optimal *Kurtosis* cut-off value for the identification of non-responders tumors was ≤ 3.7 with a sensitivity of 92% and a specificity of 75%.

CONCLUSION

Texture Analysis applied to T2w images of uterine cervical cancer seems to be a promising imaging biomarker of tumor heterogeneity that might be useful to predict response to neo-adjuvant-chemotherapy and that show also a potential role to differentiate histological tumor types.

CLINICAL RELEVANCE/APPLICATION

Texture Analysis applied to uterine cervical cancer seems to be a promising tool to describe tumor heterogeneity. The finding of a correlation between texture parameters and response to therapy might be useful to predict response to neo-adjuvant-chemotherapy with the future aim of obtaining a more personalized therapy protocol.

SSA11-06 The Value of Uterine Artery Hemodynamic Parameters Before Chemotherapy in Predicting Methotrexate Resistance in Low-risk Gestational Trophoblastic Neoplasia

Sunday, Nov. 27 11:35AM - 11:45AM Room: E353B

Participants

Jiale Qin, MD, PhD, Hangzhou, China (*Presenter*) Nothing to Disclose
Xiaodong Wu, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jiamin Luo, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Junmei Wang, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Weiguo Lu, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Xing Xie, Hangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MTX single regimen is commonly used as the initial chemotherapy in low-risk GTN. In practice, about 30% cases become resistant to MTX after several courses, and then switch to other agents. Switching drug after the development of MTX resistance prolongs the overall duration of chemotherapy and accumulates more side effects in normal organs. Therefore, the method to predict MTX resistance prior to treatment is desirable. The mechanism of GTN occurrence is considered trophoblastic cells invading uterine myometrial vessels, resulting in the blood flow changed. Ultrasound, especially Spectral Doppler, is one of real-time blood flow imaging methods to detect the in-vivo hemodynamics. In our study, we analyzed the hemodynamic parameters of vessels in both GTN uterine lesion and uterine artery, to explore the relationship between these sonographic parameters and MTX response in order to find sonographic predictive parameters.

METHOD AND MATERIALS

Prospective analysis was carried out in a total of 80 low-risk GTN patients treated with MTX between September 2012 and March 2016 in our institute. Hemodynamic parameters (PS, ED, TAMax, TAMEan, S/D, PI and RI) in uterine artery were assessed by ultrasound. In the case of GTN uterine lesion detected, tumor size and intratumor hemodynamic parameters in the lesion were additionally measured. The relationships between sonographic parameters and MTX response were analyzed.

RESULTS

The MTX response rate was 68.8%. Univariable logistic regression analysis identified that serum hCG level, FIGO score, the maximal PS, ED, TAMax and TAMEan of uterine artery were the significant predictors for MTX response ($p < 0.05$). Multivariable logistic regression analysis indicated that the maximal PS, TAMax and TAMEan of uterine artery were independent predictors to MTX response. Among them, TAMEan was most powerful to predict MTX response with 0.720 AUC. It had 75.0% sensitivity and 63.2% specificity at the cutoff value of 19.16 cm/s. Interestingly, none of intratumor hemodynamic parameters was significantly correlated with MTX response.

CONCLUSION

The hemodynamic parameters of uterine artery obtained prior to chemotherapy, such as PS, TAMax and TAMEan, could be used as an independent factor for predicting MTX response in the low-risk GTN patients.

CLINICAL RELEVANCE/APPLICATION

Uterine artery hemodynamic parameters before chemotherapy could be applied to select treatment protocols for management of low-risk GTN.

SSA11-07 Preoperative DCE Perfusion-MRI Parameters Predict Aggressive Histology and Tumor Grade in Endometrial Carcinomas

Sunday, Nov. 27 11:45AM - 11:55AM Room: E353B

Participants

Kristine E. Fasmer, Bergen, Norway (*Presenter*) Nothing to Disclose
Atle Bjørnerud, PhD, Oslo, Norway (*Abstract Co-Author*) Intellectual property, Nordic NeuroLab AS Board member, Nordic NeuroLab AS
Sigmund Ytre-Hauge, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Inger Johanne Magnussen, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Renate Gruner, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Jone Trovik, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose

Helga Salvesen, MD, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Ingrid S. Haldorsen, MD, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore measures of tumor microvasculature assessed by preoperative dynamic contrast-enhanced (DCE) - MRI in relation to histological subtype and surgicopathological stage in endometrial carcinomas

METHOD AND MATERIALS

Preoperative pelvic contrast-enhanced DCE-MRI (1.5T) was performed prospectively in 185 consecutive patients with histologically confirmed endometrial carcinomas. Tumor region of interest (ROI) and corresponding normal myometrial ROI was manually drawn on the DCE images at 2 min post-contrast on the slice displaying the largest cross-section tumor area. Parametric maps were generated using the extended Tofts kinetic model combined with a population based arterial input function. Blood flow (Fb), transfer constant from extravascular extracellular space (EES) to blood (Kep), transfer from blood to EES (Ktrans) and volume of EES (Ve) were calculated for both the endometrial tumor and normal myometrium. Statistical analysis was conducted to explore the differences between tumor values and normal myometrial values (Student's paired t-test), correlation of tumor values, histological subtype and the staging parameters (Mann-Whitney U-test) and to evaluate the prognostic value of the DCE-MRI tumor parameters (Kaplan-Meier).

RESULTS

Tumor Fb, Ve and Ktrans were significantly lower in endometrioid tumors compared with normal myometrium ($p \leq 0.001$). Low tumor Fb and Kep were also significantly associated with high risk histologic subtype (histological grade 3 and non-endometrioid tumors) ($p \leq 0.03$). No significant associations were identified between the tumor DCE-MRI values and the staging parameters cervical stroma invasion, myometrial invasion or lymph node metastases. Patients with low tumor Fb tended to have reduced survival ($p = 0.08$).

CONCLUSION

DCE-MRI allows for novel characterization of the tumor microvasculature in endometrial cancer. Non-endometrioid tumors and higher grade endometrial cancers exhibit lower tumor blood flow, which tends to be linked to reduced survival. Our findings suggest that tumor hypoxia may represent a pathogenic mechanism in the subgroup of most aggressive endometrial cancers.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI parameters reflecting tumor microvasculature are associated with aggressive histology and high risk endometrial carcinomas and tend to have an impact on survival.

SSA11-08 The Use of CT Imaging Texture-derived Inter-site Tumor Heterogeneity Metrics to Evaluate BRCA Mutation Status in Patients with Stage III High Grade Serous Ovarian Cancer

Sunday, Nov. 27 11:55AM - 12:05PM Room: E353B

Participants

Andreas A. Meier, MD, New York, NY (*Presenter*) Nothing to Disclose
Stephanie Nougaret, MD, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose
Yuliya Lakhman, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Harini Veeraraghavan, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Duc Fehr, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hedvig Hricak, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Alexandra Snyder, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Evis Sala, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hebert Alberto Vargas, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the association between CT imaging derived inter-site tumor heterogeneity metrics obtained via advanced computational radiomics method and BRCA mutation status in patients with FIGO stage III high grade serous ovarian cancer (HGSO).

METHOD AND MATERIALS

77 women were retrospectively included in this IRB-approved study and underwent computed tomography prior to cytoreductive surgery. All tumor sites were manually segmented. Haralick texture features were computed voxelwise for each volume of interest. Patients were analyzed for differences in 4 inter-tumor heterogeneity metrics: inter-site entropy (SE), inter-site cluster variance (SCV), inter-site cluster shade (SCS) and inter-site cluster prominence (SCP). They were computed by constructing an affinity matrix (AM) that captured the extent of similarity between the textures (energy, entropy, contrast, homogeneity) computed at the different sites. The AM was then converted into the aforementioned features. Mean and standard deviation of the various features were computed for BRCA+ and BRCA- patients. Unpaired Welch T-tests were used to assess the relationship of the features between BRCA+ and BRCA- carriers. Correction for multiple comparisons was applied using false discovery rate.

RESULTS

Tumor heterogeneity features for BRCA+ patients were: SE=2.98±0.48, SCV=1.44±0.72, SCS=594±365, and SCP=5512±3391. For BRCA- patients, the metrics were: SE=3.28±0.66, SCV=2.36±1.94, SCS=1030±940, and SCP=9518±8514. SCV, SCS and SCP proved to be significantly different between BRCA+ and BRCA- patients ($p = 0.0026$ each). SE was not statistically significant between the groups ($p = 0.08$). The same metrics neither correlated with total tumor load nor with complete vs. incomplete resection status.

CONCLUSION

Our radiomics evaluation of different tumor sites in stage III ovarian cancer patients allows for a non-invasive quantitative assessment of inter-site heterogeneity. SCV, SCS, and SCP tumor heterogeneity texture features might be useful to predict BRCA mutation status in patients with stage III HGSO.

CLINICAL RELEVANCE/APPLICATION

The assessment of tumoral heterogeneity in the era of personalized medicine is important, as increased heterogeneity has been associated with distinct genomic abnormalities and worse patient outcomes. Our radiomics approach in these standard-of-care CT scans can have a clinical impact by offering a non-invasive tool that might improve treatment effectivity or predict 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/>

Stephanie Nougaret, MD - 2013 Honored Educator
Evis Sala, MD, PhD - 2013 Honored Educator

SSA11-09 Can Magnetic Resonance Imaging Predict Aggressiveness of Endometrial Cancer?

Sunday, Nov. 27 12:05PM - 12:15PM Room: E353B

Awards

Student Travel Stipend Award

Participants

Mona Ahmed, MD, Houston, TX (*Presenter*) Nothing to Disclose
Jaafar F. Alkhafaji, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Caleb A. Class, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wei Wei, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Revathy B. Iyer, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Priya R. Bhosale, MD, Bellaire, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Patients with endometrial cancer (EC) may undergo pre-operative magnetic resonance imaging (MRI) for treatment planning. The purpose of this study was to evaluate MRI characteristics of EC and correlate with pathology, genomic features and recurrence free survival.

METHOD AND MATERIALS

71 patients with biopsy-proven EC were retrospectively analyzed following IRB approval. 3 radiologists reviewed imaging findings on sagittal dynamic post contrast T1WI (DCE) and sagittal T2WI sequences. Depth of myometrial invasion (DMI) was recorded as <50% and \geq 50%. Qualitative signal intensity (SI) was recorded as >myometrium, =myometrium and

RESULTS

Statistically significant correlation was noted between lower delayed DCE SI and the presence of MSI ($p=0.042$). 3 readers showed substantial agreement (0.62) based on Kappa analysis for qualitative tumor SI on DCE images. Tumors with SI >myometrium on T2WI showed higher DMI ($p=0.028$). 12 patients were lost to follow-up, recurrence-free survival analysis was performed on 59 patients. The patients with delayed DCE SI ROI of >209 , had better recurrence-free survival ($p=0.014$). Based on multivariate analysis, patients with MSI-stable disease and increased delayed DCE SI had better recurrence-free survival ($p=0.027$). We found no correlation between MRI SI and tumor sub-type or grade.

CONCLUSION

Patients with MSI-stable EC showing high SI on delayed DCE had better recurrence-free survival. Tumors with high T2WI SI demonstrated aggressive features on pathology.

CLINICAL RELEVANCE/APPLICATION

MRI may be used as a prognostic indicator in evaluating recurrence free survival and can be used to determine which patients may benefit from comprehensive surgical staging.

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/>

Priya R. Bhosale, MD - 2012 Honored Educator

SSA12

Science Session with Keynote: Informatics (Education and Research)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S403A

IN

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

Participants

George L. Shih, MD, MS, New York, NY (*Moderator*) Consultant, Image Safely, Inc; Stockholder, Image Safely, Inc; Consultant, MD.ai, Inc; Stockholder, MD.ai, Inc;
Luciano M. Prevedello, MD, MPH, Dublin, OH (*Moderator*) Nothing to Disclose

Sub-Events

SSA12-01 Informatics Keynote Speaker: Medical Imaging Annotations for Reporting, Education and Machine Learning

Sunday, Nov. 27 10:45AM - 10:55AM Room: S403A

Participants

George L. Shih, MD, MS, New York, NY (*Presenter*) Consultant, Image Safely, Inc; Stockholder, Image Safely, Inc; Consultant, MD.ai, Inc; Stockholder, MD.ai, Inc;

SSA12-02 eContour.org Improves Contour Agreement and Knowledge of Radiographic Anatomy Among Radiation Oncology Residents in a Multi-Institutional Randomized Trial

Sunday, Nov. 27 10:55AM - 11:05AM Room: S403A

Awards

Student Travel Stipend Award

Participants

Neil Panjwani, BS, San Diego, CA (*Presenter*) Nothing to Disclose
Erin Gillespie, BS, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Daniel W. Golden, MD, Chicago, IL (*Abstract Co-Author*) Manager, RadOnc Questions LLC
Jillian R. Gunther, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Tobias R. Chapman, MD, MS, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey V. Brower, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
Robert Kosztyla, PhD, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose
Vitali Moiseenko, PHD, Surrey, BC (*Abstract Co-Author*) Speaker, Varian Medical Systems, Inc; Travel support, Varian Medical Systems, Inc
Julie Bykowski, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Parag Sanghvi, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
James D. Murphy, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

eContour improves contour agreement as well as knowledge of contour delineation and radiographic anatomy among radiation oncology residents. The usability of a web-based contouring atlas was high compared to existing resources. These data suggest that *eContour* has the potential to improve contour accuracy and ultimately impact quality of radiation delivery.

Background

The delivery of safe and effective radiation therapy increasingly relies on accurate target delineation in the era of highly conformal treatment techniques. Current contouring resources are fragmented and cumbersome to use. To overcome these limitations we created a free interactive web-based atlas called *eContour* (www.eContour.org). This study reports on the efficacy and usability of using *eContour* compared to existing contouring resources in a randomized trial among radiation oncology residents.

Evaluation

We enrolled 27 radiation oncology residents from 5 institutions for a two-phase contouring study. All residents contoured a T1N1 nasopharyngeal cancer case using currently available resources. Participants were then randomized to re-contour the case with (Group A) or without (Group B) access to *eContour*. Contour analysis was performed using conformation number and simultaneous truth and performance level estimation (STAPLE). At the completion of each contouring session, residents completed a multiple choice question (MCQ) knowledge test and a 10-item System Usability Scale (SUS).

Discussion

Twenty-four residents (89%) completed this study (11 in Group A and 13 in Group B). Residents using *eContour* showed greater agreement with both the consensus contour and the expert contour for the high-risk (59.4Gy) clinical target volume (0.63 vs. 0.52, $p < 0.01$), as well as greater agreement with the expert contour for the right parotid (0.57 vs. 0.47, $p < 0.005$) and right cochlea (0.34 vs. 0.18, $p < 0.05$). Residents using *eContour* demonstrated greater knowledge of contour delineation and radiographic anatomy on 8 MCQs (89% vs. 77%, $p < 0.05$). Usability of *eContour* was high compared to a contouring textbook (89 vs. 66, $p < 0.0001$), which was used by the majority of residents (54%).

SSA12-03 From the Notebook to the Cloud: A Personal Web-based Management System for Radiological Cases

Sunday, Nov. 27 11:05AM - 11:15AM Room: S403A

Participants

Julia Calatayud, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Pablo Lopez, Madrid, Spain (*Presenter*) Nothing to Disclose
Diana Exposito, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Gabriel C. Fernandez, MD, Avila, Spain (*Abstract Co-Author*) Nothing to Disclose
Beatriz Alvarez De Sierra Garcia, MD, Mostoles, Spain (*Abstract Co-Author*) Nothing to Disclose
Daniel Castellon, MD, Fuenlabrada, Spain (*Abstract Co-Author*) Nothing to Disclose
Silvia Cisneros Carpio, MD, Durango, Spain (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

ARCASI is a new multilingual web-based application for a personal management of radiological cases, with the ability to access and share cases, images and references from anywhere.

Background

There are many classical ways of archiving interesting radiological cases that we all have used such as notebooks, Excel files or folders. None of them has allowed us to manage and share these cases in an optimal manner, promoting the development of technological-based storage systems. Thus arises ARCASI (ARChive CASes of Interest), a simple web application that allows archiving, managing and sharing cases easily.

Evaluation

ARCASI is a cloud-based multilingual application developed with open source technologies and compliant with web standards and HIPAA rules. It has been created focused on the radiologists and the main reasons to archive cases according to their interest such as learning, teaching, researching, committees, etc. The application was designed in order to classify cases into radiology subspecialties, pathologies and localizations to facilitate searching and organization. Initial and confirmation diagnosis can be saved along with other attributes to keep track of open/closed and correct cases. Users can create tags according to their needs to organize cases by attaching one or many tags to them with the possibility to share them with other users. Many image formats including DICOM can be added and viewed in an integrated viewer that runs on any device with a modern browser. Bibliography can be attached by uploading documents or referencing URLs. All these documents are automatically indexed by the application's search engine. ARCASI has been used in our institution over the last 3 months with more than 700 cases archived.

Discussion

The application has led to an increment in the cases archived by users as well as a continuous tracking of open cases. Full text search within the case and bibliography, classification and tags have allowed users to quickly find and organize related cases. Our solution ensures full access to archived cases from any device with Internet access. It is independent of any PACS while it provides a Restful API for interoperability and system integrations.

SSA12-04 RapRad - A New E-learning Concept with Rapid Case Reading and Instant Feedback to Reduce Chance in Radiology Education

Sunday, Nov. 27 11:15AM - 11:25AM Room: S403A

Participants

Philipp Brantner, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose
Fabienne Steiner, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Safak Korkut, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Sebastian Linxen, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Elmar M. Merkle, MD, Basel, Switzerland (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Research Grant, Guerbet SA; Research Grant, Bracco Group
Tobias Heye, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The fast appreciation of the gist of a scene refers to the detection of essential imaging features in common pathologies. This skill is developed in radiology residency and greatly depends on the encountered spectrum of a certain pathology. However, the spectrum can vary greatly on a daily basis and depends on the type of radiology institution. To standardize radiology education in residency the e-learning platform RapRad was developed with a focus on fast and high-volume exposure to common pathologies combined with instant feedback in a gamification setting. This platform is intended to help residents train the whole spectrum of a pathology in a shorter time period. Secondary goals are to prepare residents for oncall shifts and to help them making a diagnosis with greater confidence and lower error rate.

METHOD AND MATERIALS

A server based, mobile e-learning platform with gamification elements, developed by the University of Applied Sciences Northwestern Switzerland was used. The user, represented by an avatar, has to answer question blocks in rapid succession in order to overcome obstacles and reach the next level. Each block contains the entire difficulty spectrum of one pathology. For each question the pathology (or its absence) has to be identified by placing a marker on its image location. The correct answer is given with a short feedback and the user rapidly proceeds to the next question. Pneumothorax and consolidation detection on chest x-rays were chosen as initial learning objectives.

RESULTS

With RapRad, a mobile web-platform was developed to train the entire spectrum of common radiological pathologies. Users are motivated by an engaging gamification setting and the ability to quickly read a large number of cases. The platform is modular and while two pathologies were implemented for the initial phase, the platform is scalable and can be adapted for a variety of pathologies.

CONCLUSION

RapRad is a new concept in e-learning by simulating radiology workflow and experience through the means of repetitive and fast case reading with instant feedback.

CLINICAL RELEVANCE/APPLICATION

Modern e-learning apps deliver content through means of motivation by gamification; we use this approach combined with rapid

modern e-learning apps deliver content through means of motivation by gamification; we use this approach combined with rapid reading and instant feedback to reduce chance in radiology education.

SSA12-05 Defining Expertise: A Comparison Eye-Tracking Study of Radiologists and 1st Year Medical Students

Sunday, Nov. 27 11:25AM - 11:35AM Room: S403A

Participants

Max P. Rosen, MD, MPH, Worcester, MA (*Presenter*) Stockholder, Everest Scientific Inc; Consultant, PAREXEL International Corporation; Stockholder, Cynvenio Biosystems, Inc; Medical Advisory Board, Cynvenio Biosystems, Inc
Zachary R. Zaniewski, BA, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose
Gregory DiGirolamo, PhD, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We have previously demonstrated unconscious detection of lung nodules among radiologists (RADS). Here, we investigate this phenomenon, as well as eye movement metrics in untrained readers (1st year medical students). This work may lead to improved techniques for training of RADS.

METHOD AND MATERIALS

12 RADS and 12 MS interpreted 18 axial chest CT scans (9 normal and 9 abnormal). There were 16 lung nodules across the abnormal CT scans. An Eye-Link 1000 tracked the location and duration of each gaze. Visual dwell time on healthy tissue vs. on a lung nodule, the number of total eye movements (saccades) and the total number of images viewed were used to evaluate the efficiency of visual search patterns by both groups.

RESULTS

Among nodules consciously detected, both RADS ($p < 0.007$) and MS ($p < 0.03$) dwelled longer on the location of the nodule vs. healthy lung tissue. RADS ($p < 0.03$) also dwelled longer on lung nodules vs. healthy tissue, even when not consciously detected. Unlike RADS, MS did not fixate longer on a lung nodule vs. healthy lung tissue ($t < 1$) when not consciously detected. RADS scrolled through the image set 2.5 times more than MS ($p < 0.004$). RADS made significantly more saccades ($p < 0.0001$) than MS (Average = 376 vs. 215). However, RADS were significantly more efficient, making on average 0.46 saccades per image while MS made 0.62 ($p < 0.02$). MS bounced from one location to another across the entire image set and then moved on from that image and only rarely returned to an image they looked at previously.

CONCLUSION

Unlike RADS, MS do not show unconscious detection of lung nodules. The search pattern and efficiency of search were significantly worse for MS vs. RADS. These data suggest that during the process of radiological training, both conscious and unconscious learning is developed that influence the success of the search, the efficiency of the search, and the pattern in which the search is undertaken. Although some component of radiological learning is the result of specific training and conscious processes, additional unconscious learning likely occurs that influences radiological performance.

CLINICAL RELEVANCE/APPLICATION

Some component of unconscious learning likely contributes to the diagnostic abilities of a radiologist. Although, there is no consensus on perceptual search training, knowing what visual metrics make expert radiologists could help to better specify training protocols in the future.

SSA12-06 Are We "Hacking" the Curve? P-Curve Analysis of the Radiology Literature

Sunday, Nov. 27 11:35AM - 11:45AM Room: S403A

Awards

Student Travel Stipend Award

Participants

Jacob Lewis, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose
Duane Schonlau, MD, Ponte Vedra, FL (*Abstract Co-Author*) Nothing to Disclose
Marcus A. Kater, MD, Kansas City, MO (*Abstract Co-Author*) Nothing to Disclose
Daniel E. Wessell, MD, PhD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Within the scientific literature, it is widely recognized that current publication practices create strong incentives to publish statistically significant results. This leads to two major types of selection bias in the scientific record: publication bias (lower publication rates in studies with non-significant results) and inflation bias or "p-hacking" (researchers perform several different statistical analyses or alter the eligibility specifications for data and report only those that produce significant results). Due to these biases, the scientific record overestimates the size of effects. In this study, we assess for the presence of these biases in the radiology literature over the past decade.

METHOD AND MATERIALS

The top ten radiology journals, without subspecialty emphasis, were selected from a list of the radiology journals ranked by their impact factors for 2014. Using the web-based Scopus search engine, each journal was searched for articles published over the last decade ($n = 26,035$). The abstract of each article was downloaded from Scopus into a database. The database was then parsed using a text-mining program designed to extract all of the p-values listed within each abstract ($n = 28,259$). A p-curve was then generated and analyzed. Pair-wise comparison sign tests were performed on bins of data to assess for statistically significant differences.

RESULTS

The generated p-curve demonstrated a large rightward skew for the data of $p < 0.05$, which is indicative of "evidential value" (non-zero true effect size). Additionally, the p-curve had a notable drop in the number of p-values per bin just above the "statistically significant" level of 0.05, highly suggestive of publication bias. Statistical analysis on the number of p-values per bin just below 0.05, reported to the thousandth decimal place, showed a local peak, which provides evidence of "p-hacking" in the radiology

literature.

CONCLUSION

There is strong evidence that the recent radiology literature is founded on evidential value. There is also strong evidence of a publication bias for statistically significant results. Lastly, the p-curve suggests that there is "p-hacking" in the radiology literature.

CLINICAL RELEVANCE/APPLICATION

Analysis of the p-curve, based on recent radiology literature, shows that the literature is founded on evidential value and suggests the presence of both publication and inflation ("p-hacking") bias.

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 E. Wessell, MD, PhD - 2013 Honored Educator

SSA12-07 Why Women Shy Away from Radiology: Understanding Gender Preferences when Choosing a Medical Specialty

Sunday, Nov. 27 11:45AM - 11:55AM Room: S403A

Awards

Student Travel Stipend Award

Participants

Holly J. Jumper, MD, Little Rock, AR (*Presenter*) Nothing to Disclose
Roopa Ram, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Sumera Ali, MBBS, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Shelly Lensing, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Philip J. Kenney, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate gender differences in factors influencing specialty choice in 4th year medical students choosing Radiology and other specialties. Women have historically been and continue to be underrepresented in diagnostic radiology. According to the AAMC 2012 Physician Specialty Data Book, women made up only 22% of the field of radiology in 2010. We aim to investigate how factors influencing specialty choices differ for medical female students planning to pursue a residency in radiology versus other specialties and examine gender differences within radiology.

METHOD AND MATERIALS

Data from the Association of American Medical College's (AAMC) Graduation Questionnaires (GQ) from 2011, 2012, 2013 and 2014 will be used. The GQ asks fourth year medical students to rate various aspects of their medical education and includes questions about clinical experiences and career intentions, including factors influencing their choice of specialty such as mentor, salary, debt, family considerations, and fit with interests/skills. We will use de-identified data to evaluate which factors influence a medical student's decision to pursue a career in radiology and which factor influences are affected by gender. The 10 largest specialty choices with at least 1,000 respondents each will be comparison groups. Females choosing radiology will be compared to females in each of the other specialties in terms of factors influencing choice of specialty. Females will also be compared to males choosing radiology. The UAMS IRB determined this study has exempt status.

RESULTS

We will report our analysis of student data as categorized by gender and then specialty with a focus on radiology.

CONCLUSION

Findings will be useful for understanding the gender gap in radiology.

CLINICAL RELEVANCE/APPLICATION

Based on the results of this study, we aim to identify factors that influence specialty choice. With this information, strategies can be employed within the field of radiology to close the gender gap.

SSA12-08 Targeted QA: Creating a PACS based Teaching File using Pareto Analysis of Trainee Discrepancies

Sunday, Nov. 27 11:55AM - 12:05PM Room: S403A

Participants

Hriday Shah, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
John Mongan, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Spouse, Employee, Thermo Fisher Scientific Inc
Eric C. Ehman, MD, Pacifica, CA (*Abstract Co-Author*) Nothing to Disclose
Javier Villanueva-Meyer, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Soonmee Cha, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Jason F. Talbott, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Data Safety Monitoring Board, StemCells, Inc

PURPOSE

To develop a high yield PACS based teaching file using Pareto Analysis of our institutional QA Module

METHOD AND MATERIALS

A retrospective analysis of all preliminary interpretations from the the institutional quality assurance (QA) database was conducted

for data between July 1, 2010 - June 30, 2015. All cases were categorized by a board-certified radiologist as "No Discrepancy", "Questionable discrepancy", "Minor Discrepancy-unlikely to affect management" or "Major Discrepancy-likely to affect management". All CT related "Major Discrepancies" were reviewed and sub-classified into 3 primary specialties (Chest Imaging, Abdominal Imaging, Neuroradiology) to create a Pareto chart. MSK QAs were excluded due to rare frequency. Additionally, all major discrepancy errors were classified as being related to interpretation (finding seen but misinterpreted) versus perception (finding not seen).

RESULTS

Of the 78,256 studies (all modalities) reviewed on our institutional QA module over a five-year period, the questionable discrepancy rate was 1.2%, the minor discrepancy rate was 3.1%, and the major discrepancy rate was less than 0.5%. 76% of errors were related to perception and 24% were related to interpretation. Sub-classification of discrepancies was performed for Pareto analysis. 50% (95% CI: 40.7-58.6) of neuroradiology discrepancies related to hemorrhage, post-operative complications or ischemic infarcts on head CT. 49% (95% CI: 36.5-62.0) of abdominal imaging discrepancies related to bowel, vascular findings or thoracic findings. 80% (95% CI: 63.0-92.1) of chest imaging discrepancies related to pulmonary emboli, cardiac findings or aortic pathology. A list of high yield cases was generated based on Pareto analysis. These cases were anonymized using the RSNA CTP anonymization tool and made available for review on the in-hospital PACS as well as a web-based PACS.

CONCLUSION

QA related Pareto analysis can be successfully used to create a high yield PACS based teaching file. At our institution, this anonymized PACS based teaching file has been fully implemented as part of a pre-call preparatory curriculum.

CLINICAL RELEVANCE/APPLICATION

Pareto analysis of discrepancies allows identification of high yield discrepancies, which can subsequently be reviewed in an anonymized fashion on PACS as part of a pre-call preparatory curriculum.

SSA12-09 Radiology-Pathology Correlation within the PACS

Sunday, Nov. 27 12:05PM - 12:15PM Room: S403A

Participants

Jonelle M. Petscavage-Thomas, MD, MPH, Hummelstown, PA (*Presenter*) Consultant, Medical Metrics, Inc
Eric A. Walker, MD, MHA, Hummelstown, PA (*Abstract Co-Author*) Research Consultant, Medical Metrics, Inc
Teresa Ganz, Hershey, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Radiologists perform image guided procedures to obtain tissue for histological evaluation. Typically there is no direct linkage between the radiology and pathology reporting systems. The radiologist must keep a log of the biopsies performed and manually search the EMR to obtain final pathologic diagnosis. This is inefficient and shows a lack of enterprise information integration. The purpose of our study was to implement a method of providing final pathology reports directly to the PACS queue of the radiologist who performed the procedure.

METHOD AND MATERIALS

A list was created of all RIS procedure codes. This list was used to identify cases wherein a pathology report would be generated. This list was submitted to a 3rd party system that has an established API to our PACS. In the radiology-pathology correlation workflow, the 3rd party system receives a copy of the pathology result HL7 feed ('ORU' message type) sent to the EMR. When received, it is evaluated for 1) a matching patient in the RIS based on MRN, visit number, and specimen receive date is +/- 3 days of the radiology exam date, and 2) exam code matching the RIS list. When the criteria match, a RadMail is sent to the radiologist in the PACS with the pathology report text and a link to the images. Over a four week period, a log of sent Radmails was recorded and a list was run of all radiology procedures with pathology generated. The two lists were compared to determine percentage of pathology reports successfully being automatically sent to the radiologist.

RESULTS

A total of 120 radiology procedures were performed over the four week period. 88 (73.3%) of these cases had a confirmed RadMail. Radiologist feedback was positive, with comments including that, "the system was nicely integrated", "was only one mouse click", "saved them time", and "was helpful to relaunch the images in context of the pathology report." In the failed cases, issues included the RIS missing new examination codes and date match between the pathology specimen date and the RIS examination date was outside of the +/- 3 days range.

CONCLUSION

The set-up with the HL7 messages between IT systems was successful and could easily be replicated by other radiology departments

CLINICAL RELEVANCE/APPLICATION

Radiology-Pathology correlation within the PACS is an effective way of providing more complete patient care, saving radiologist time, and integrating enterprise IT systems effectively.

SSA13

Molecular Imaging (Cardiovascular/Nanoparticles)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S504CD

MI

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

Participants

Markus Schwaiger, MD, Munich, Germany (*Moderator*) Research Grant, Siemens AG; Speaker, Siemens AG
Jan Grimm, MD, PhD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSA13-01 Accelerated Blood Clearance Phenomenon Reduces Passive Targeting of Nanoparticles in Peripheral Arterial Disease

Sunday, Nov. 27 10:45AM - 10:55AM Room: S504CD

Participants

Hyung-Jun Im, MD, Madison, WI (*Presenter*) Nothing to Disclose
Christopher England, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Reinier Hernandez, MSc, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Steve Cho, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Robert J. Nickles, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Dong Soo Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Accelerated blood clearance (ABC) phenomenon refers to losing long circulating characteristics of polyethylene glycol (PEG) conjugated nanomaterials, when the nanomaterials are injected twice in the same animal. The phenomenon is of concern for in vivo imaging and drug delivery using nanomaterials, but has only been evaluated using lipid based or polymeric nanomaterials. We tested if ABC phenomenon occurs by long circulating hybrid nanoparticles, and if the phenomenon affects the passive targeting in the murine model of peripheral arterial disease (PAD).

METHOD AND MATERIALS

Hindlimb ischemia was induced by ligation and cut of the femoral artery. ⁶⁴Cu labeled PEGylated reduced graphene oxide – iron oxide nanoparticles (⁶⁴Cu-RGO-IONP-PEG) were prepared for imaging of PAD. At post-surgery day 3, 10, and 17, positron emission tomography (PET) was performed until 72 h after injection of the nanoparticles. At post-surgery day 10 and 17, non-injected mice were used for Naïve group, and the mice which were injected at post-surgery day 3 were used for Re-injection group. To confirm the existence of the integral nanoparticles in the liver tissues, photoacoustic (PA) imaging and Prussian blue staining of liver were performed.

RESULTS

At post-surgery day 3, the nanoparticles showed a long circulation time (> 30 h) and high accumulation in the ischemic hindlimb. At post-surgery day 10 and 17, Re-injection group showed significantly shorter circulation time and lower accumulation of the nanoparticles in the ischemic hindlimb than naïve group (Day 10: P < 0.001, Day 17: P < 0.001). Also, liver uptake was significantly higher in the Re-injection group (Day 10: P < 0.001, Day 17: P < 0.05), indicating that the nanoparticles were cleared by the liver. Furthermore, increased PA signal in the liver and positive Prussian blue staining in the liver tissue confirmed the accumulation of the integral nanoparticles.

CONCLUSION

ABC phenomenon appeared when hybrid nanoparticles (⁶⁴Cu-RGO-IONP-PEG) were re-injected. The phenomenon reduced efficiency of the passive targeting of the nanoparticles in the murine model of PAD.

CLINICAL RELEVANCE/APPLICATION

Our findings may be valuable information for future translational in vivo imaging and drug delivery applications using the long circulating nanoparticles in PAD.

SSA13-02 Re-assessing the Enhanced Permeability and Retention Effect in Peripheral Arterial Disease with ⁶⁴Cu-labeled Long Circulating Nanoparticles

Sunday, Nov. 27 10:55AM - 11:05AM Room: S504CD

Participants

Christopher England, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Hyung-Jun Im, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Reinier Hernandez, MSc, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Steve Cho, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Robert J. Nickles, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Dong Soo Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It has been claimed that nanoparticles can passively accumulate in ischemic tissues through the enhanced permeability and retention (EPR) effect. As peripheral arterial disease (PAD) results in muscle ischemia and neovascularization, nanoparticle

accumulation may allow for molecular imaging of PAD. At this time, a quantitative evaluation of the passive targeting capabilities of nanoparticles has not been reported in PAD.

METHOD AND MATERIALS

Using a murine model of hindlimb ischemia, we quantitatively assessed the passive targeting capabilities of ⁶⁴Cu-labeled PEGylated reduced graphene oxide – iron oxide nanoparticles (⁶⁴Cu-RGO-IONP-PEG) through the EPR effect using positron emission tomography (PET) imaging. A surgical procedure recreated the conditions found in PAD patients, and as the ischemic hindlimb healed (15–20 days), blood flow was restored to normal in the diseased hindlimb. Serial laser Doppler imaging was performed to monitor changes in blood perfusion upon surgical induction of ischemia. In addition, photoacoustic imaging confirmed the accumulation of nanoparticles in ischemic tissues.

RESULTS

Nanoparticle accumulation was assessed at 3, 10, and 17 days post-surgery and found to be highest at 3 days post-surgery, with the ischemic hindlimb displaying an accumulation of 14.7 ± 0.5 percent injected dose per gram (%ID/g). Accumulation of ⁶⁴Cu-RGO-IONP-PEG was lowest at 17 days post-surgery, with the ischemic hindlimb displaying only 5.1 ± 0.5 %ID/g. Furthermore, nanoparticle accumulation was confirmed by photoacoustic imaging (PA), showing increased PA signal in the ischemic hindlimb. The combination of PET and serial Doppler imaging showed that nanoparticle accumulation in the ischemic hindlimb negatively correlated with blood perfusion.

CONCLUSION

Thus, we quantitatively confirmed that ⁶⁴Cu-RGO-IONP-PEG passively accumulated in ischemic tissue via the EPR effect, which is reduced as the perfusion normalizes. As ⁶⁴Cu-RGO-IONP-PEG displayed substantial accumulation in the ischemic tissue, this nanoparticle platform may function as a future theranostic agent, providing both imaging and therapeutic applications.

CLINICAL RELEVANCE/APPLICATION

Nanoparticles passively accumulate in ischemic tissues via the EPR effect; thus, long circulating nanoparticles may be employed for drug delivery and therapeutic monitoring in ischemia-related diseases.

SSA13-03 High-Performance Upconversion Nanoprobes for Rats' MR Angiography Imaging

Sunday, Nov. 27 11:05AM - 11:15AM Room: S504CD

Participants

Jing Wang, Shanghai, China (*Presenter*) Nothing to Disclose
Yue Wu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Tianyong Xu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Zhenwei Yao, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To address the low T1 relaxivity, short circulation time and high leakage rate of clinical used MR contrast agents which hindered the contrast enhanced MR angiography (MRA).

METHOD AND MATERIALS

Firstly, we synthesize UCNPs of core/shell structure (NaYF₄:Yb/Er@NaGdF₄) through a two-step pyrolysis process. Then, PEG was used to modify UCNPs. Cell Counting Kit-8 assay was used to test cytotoxicity using Murine macrophage cells (RAW264.7), Brain capillary endothelial cells (BCECs) and Buffalo rat liver cells (BRL). To investigate the amount of PEG-UCNPs and Magnevist leaking through the vessel walls, *in vitro* transwell assay was used with the transwell filters seeded with a compact BCECs monolayer. Relaxivities of PEG-UCNPs were measured using a 3.0 T MR scanner (Discovery MR 750, GE Medical Systems, Milwaukee, WI, USA). Healthy male SD rats (mean weight, 250 g) were used for *in vivo* MRA imaging. Time-resolved magnetic resonance imaging of contrast kinetics (TRICKS-MRA) was acquired in coronal view after the injection of CAs at a rate of 1 mL/s.

RESULTS

PEG-UCNPs were successfully synthesized with high monodispersity and stability (Figure a-c), which possess superior advantages over Magnevist, such as higher relaxivity ($r_1 = 12.01 \text{ mM}^{-1}\text{s}^{-1}$), longer circulation time ($t_{1/2} = 79.8 \text{ min}$), and lower leakage rate (Figure g), which guarantee better imaging efficiency. Cellular viabilities of all three types of cells are around 90% after 24 h of incubation with a relatively high concentration (1 mg/mL) of PEG-UCNPs (Figure d-f). The upconversion luminescence of PEG-UCNPs under 980 nm NIR excitation is observed in the cytoplasm of RAW264.7 cells after 4 h of co-incubation (Figure h). Remarkably, an extremely small dosage (5 mg Gd/kg) of PEG-UCNPs (Figure i) provides high-resolution MRA imaging with the vascular system delineated much clearer than the Magnevist with clinical dosage as high as 108 mg Gd/kg (Figure j).

CONCLUSION

In summary, the PEG-UCNPs with high T1 relaxivity have been proved as efficient MR CAs. The PEG-UCNPs can be used for MRA at a small dosage of 5 mg Gd/kg with the vascular system delineated much clearer than that using clinical MR CAs at clinical dosage.

CLINICAL RELEVANCE/APPLICATION

PEG-UCNPs are expected to be a promising candidate for substituting clinical Magnevist in MRA, which will significantly lengthen the imaging time window and improve the overall diagnostic efficiency.

SSA13-04 In Vivo Quantitative Dynamic Angiography with Gold Nanoparticles and Spectral Photon-Counting Computed Tomography K-Edge Imaging

Sunday, Nov. 27 11:15AM - 11:25AM Room: S504CD

Participants

Salim Si-Mohamed, Bron, France (*Presenter*) Nothing to Disclose
David P. Cormode, DPhil, MS, Philadelphia, PA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;
Monica Sigovan, PhD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose

Daniel Bar-Ness, Bron, France (*Abstract Co-Author*) Nothing to Disclose
Philippe Coulon, PhD, Suresnes, France (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Pratap Naha, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Jean-Baptiste Langlois, Bron, France (*Abstract Co-Author*) Nothing to Disclose
Franck Lavenne, Bron, France (*Abstract Co-Author*) Nothing to Disclose
Matthias Bartels, PhD, DIPLPHYS, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Bernhard Brendel, Hamburg, Germany (*Abstract Co-Author*) Researcher, Koninklijke Philips NV
Heiner Daerr, DIPLPHYS, Hambrg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Axel Thran, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ewald Roessl, PhD, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Michal Rokni, PhD, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ira Blevis, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Loic Bousel, MD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Philippe C. Douek, MD, PhD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the potential of spectral photon-counting computed tomography (SPCCT) in performing quantitative dynamic angiography with gold nanoparticles in order to obtain absolute quantification for arterial input function assessment.

METHOD AND MATERIALS

We used SPCCT with multiple energy bins (Philips Healthcare, Haifa, Israel), anode tube current of 100 mA, tube voltage of 120 kVp and gantry rotation time of 1 second. In vitro, imaging was first performed on a phantom containing a range of dilutions of gold nanoparticles (0 to 65 mg/mL) to validate the quantification of gold using K-edge data. In vivo, SPCCT was used to acquire at the level of the heart every 2 seconds over a period of 30 seconds starting 2 seconds after iv administration of 12 ml of 18 nm blood pool gold nanoparticles at 1 ml/s (dose 250 mg Au/kg) in two NZW rabbits, following approval by an ethics committee. Regions of interest were manually drawn in the thoracic vessels, the cardiac cavities, the myocardium and the pulmonary parenchyma for measuring gold concentration.

RESULTS

In vitro, phantom imaging showed that concentrations measured on the K-edge specific images correlated well with known concentrations ($R2 = 0.98$, slope = 1.02). In vivo, K-edge specific imaging of gold allowed the visualization of the blood compartment (thoracic vessels, cardiac cavities, myocardial and pulmonary perfusion) with the benefit of the removal of all other anatomical structures. Peak gold concentration decreased from 25.6 ± 0.8 mg/ml (right ventricle) to 17.1 ± 1.0 mg/ml and 16.7 ± 0.3 mg/ml (pulmonary artery, left ventricle) to 13.0 ± 0.9 mg/ml (aorta), 6.0 ± 0.7 mg/ml (myocardium) and 4.9 ± 0.9 mg/ml (lung). After 30 seconds, mean concentration (6.7 ± 0.4 mg/mL) was similar between all systemic vessels, with an early steady state in the myocardium at 3.6 ± 0.5 mg/mL during the last 16 seconds.

CONCLUSION

SPCCT allows specific quantification of blood pool gold nanoparticles concentration during first-pass dynamic angiography.

CLINICAL RELEVANCE/APPLICATION

Absolute quantification of contrast media is achievable by K-edge gold dynamic angiography for assessment of arterial input function for potential quantification of abnormal tissue perfusion

SSA13-05 Dynamic Positron Emission Tomography Imaging of Renal Clearable Gold Nanoparticles

Sunday, Nov. 27 11:25AM - 11:35AM Room: S504CD

Participants

Shreya Goel, Madison, WI (*Presenter*) Nothing to Disclose
Feng Chen, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Reinier Hernandez, MSc, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Stephen Graves, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Robert J. Nickles, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the dynamic distribution patterns of ultra-small gold (Au) nanoparticles by labeling them with copper-64 (^{64}Cu , $t_{1/2}=12.7$ h) and using dynamic positron emission tomography imaging (PET) imaging.

METHOD AND MATERIALS

Glutathione (GSH)-capped ultra-small Au nanoparticles (Au-GSH) were synthesized by reacting gold(III) chloride trihydrate ($\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$) with reduced glutathione in a 90 °C water bath for 35 min followed by conjugation of NOTA (a chelator for labeling ^{64}Cu). $^{64}\text{CuCl}_2$ diluted in 0.1 M sodium acetate buffer (pH 6.5) was reacted with NOTA-Au-GSH at 37 °C for 30 min. For PET imaging, healthy BALB/c mice were injected with 5-10 MBq of ^{64}Cu -NOTA-Au-GSH intravenously. For PET/CT imaging, a mixture of ^{64}Cu -NOTA-Au-GSH (hot) and NOTA-Au-GSH (cold) was used. A 60-min dynamic scan was performed and framed into 46 frames. Image reconstruction, and region of interest (ROI) analysis of the PET data were then performed.

RESULTS

Au-GSH with a hydrodynamic (HD) size of 2.5 ± 0.1 nm was synthesized. The dynamic light scattering measurement showed slightly increased HD to 2.6 ± 0.1 nm after NOTA conjugation. The labeling yield of ^{64}Cu to NOTA-Au-GSH was estimated to be over 90% within 30 min. Serum stability study showed a high radio-stability with <5% of ^{64}Cu being detached after 24 h incubation. Systematic characterization demonstrated efficient renal clearance of nanoparticles with >75 %ID ^{64}Cu -NOTA-Au-GSH being cleared at 24 h post-injection. The majority of ^{64}Cu -NOTA-Au-GSH was found in mouse kidney and liver with their uptake measured to be 1.69 ± 0.54 and 0.33 ± 0.22 %ID/g at 24 h post-injection, respectively. Dynamic PET imaging provided more accurate information regarding the rapid clearance kinetics of nanoparticles in organs, such as heart, kidneys and liver. The elimination half-life of ^{64}Cu -NOTA-Au-GSH was calculated to be less than 6 min.

CONCLUSION

In conclusion, the dynamic PET imaging of ⁶⁴Cu-NOTA-Au-GSH addresses the current challenges in accurate and non-invasive imaging of the organ kinetics, and provides a highly useful tool for studying renal clearance mechanism of other ultra-small nanoparticles, as well as the diagnosis of kidney diseases in the future.

CLINICAL RELEVANCE/APPLICATION

The study provides a highly useful tool for studying renal clearance mechanism of other ultra-small nanoparticles, as well as the diagnosis of kidney diseases in the future.

SSA13-06 In Vivo Quantification of Gold Nanoparticles Biodistribution Kinetics with Spectral Photon-Counting Computed Tomography K-Edge Imaging

Sunday, Nov. 27 11:35AM - 11:45AM Room: S504CD

Participants

David P. Cormode, DPhil, MS, Philadelphia, PA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;
Salim Si-Mohamed, Bron, France (*Presenter*) Nothing to Disclose
Daniel Bar-Ness, Bron, France (*Abstract Co-Author*) Nothing to Disclose
Monica Sigovan, PhD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Caroline Bouillot, Bron, France (*Abstract Co-Author*) Nothing to Disclose
Pratap Naha, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Franck Lavenne, Bron, France (*Abstract Co-Author*) Nothing to Disclose
Philippe Coulon, PhD, Suresnes, France (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Matthias Bartels, PhD, DIPLPHYS, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Bernhard Brendel, Hamburg, Germany (*Abstract Co-Author*) Researcher, Koninklijke Philips NV
Heiner Daerr, DIPLPHYS, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Axel Thran, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ewald Roessli, PhD, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Michal Rokni, PhD, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ira Bleviss, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Loic Bousset, MD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Philippe C. Douek, MD, PhD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the capabilities of spectral photon-counting computed tomography (SPCCT) to quantify the organ biodistribution kinetics of gold nanoparticles in vivo.

METHOD AND MATERIALS

Imaging was performed with SPCCT with multiple energy bins (Philips Healthcare, Haifa, Israel), anode tube current of 100 mA, tube voltage of 120 kVp and gantry rotation time of 1 second, first on a phantom containing a range of dilutions of gold nanoparticles (0 to 65 mg/mL, 18 nm) to validate the quantification of gold using K-edge data. In vivo imaging was then performed on 3 NZW rabbits, following approval by an ethics committee. The rabbits were iv injected with gold nanoparticles (250 mg Au/kg). The aorta, liver, spleen, kidneys and bone marrow were imaged before and after injection at different time points from 30 seconds to 30 min, one week and one month. Regions of interest (ROIs) were manually drawn in the organs on K-edge specific images to measure gold concentrations.

RESULTS

Phantom imaging showed that concentrations measured on the K-edge specific images correlated well with known concentrations ($R^2 = 0.98$, slope = 1.02). In vivo, gold K-edge specific images showed differential temporal uptake between organs: gold nanoparticles remained at high concentrations in blood up to the 30 min post injection (4.9 ± 0.5 mg/mL) and decreased at 1 week (1.8 ± 0.6 mg/mL) to same value at 1 month (1.9 ± 0.5 mg/mL). Two concentration peaks were observed for liver and spleen, one related to the vascular phase (3.1 ± 0.6 mg/mL and 4.3 ± 0.5 mg/mL at 2 min) and one related to tissue uptake that increased from 30 min (2.7 ± 0.5 mg/mL and 4.1 ± 0.3 mg/mL) to similar values at 1 week (5.61 ± 0.61 mg/mL and 5.6 ± 0.5 mg/mL) and 1 month (5.9 ± 0.6 mg/mL and 5.4 ± 0.3 mg/mL). Compared to liver and spleen, bone marrow showed slower uptake in the early phase (<30 min, 2.2 ± 0.9 mg/mL) and similar values at 1 week and 1 month.

CONCLUSION

SPCCT is capable of assessing distribution of gold nanoparticles and quantitative in-vivo imaging of pharmacokinetics in organs over time.

CLINICAL RELEVANCE/APPLICATION

SPCCT may result in clinically applicable imaging protocols for specific detection, and assessment of biodistribution and quantification of contrast media.

SSA13-07 Lisinopril-functionalized near Infrared Fluorescent (NIRF) Nanoparticles for Molecular Imaging of Angiotensin-converting Enzyme (ACE) Expression

Sunday, Nov. 27 11:45AM - 11:55AM Room: S504CD

Participants

Stefan Harmsen, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jason Gardenier, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ilker Medine, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Raghu P. Kataru, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Gabriela Garcia Nores, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Thorsten R. Fleiter, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Oguz Akin, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mehrra Babak, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Omer Aras, MD, New York, NY (*Presenter*) Nothing to Disclose

PURPOSE

Optical imaging is a highly sensitive modality that provides multiscale imaging capabilities. Here we demonstrate the an application of NIRF nanoparticles for molecular imaging of ACE expression.

METHOD AND MATERIALS

NIRF nanoparticles were synthesized by a modified Stöber reaction in the presence of silane-functionalized dye. The as-synthesized NIRF nanoparticles were functionalized with thiol-groups, which were used to conjugate a lisinopril-modified linker to the NIRF nanoparticles yielding to yield the ACE-targeted NIRF nanoparticles. NIRF nanoparticles dispersions were characterized by transmission electron microscopy (TEM), nanoparticle tracking analysis (NTA), and NIRF imaging. The ACE-targeted NIRF ($\lambda_{\text{ex}}=800\text{nm}$) and control NIRF nanoparticles ($\lambda_{\text{ex}}=700\text{nm}$) were evaluated in vivo in wild-type mice (N=5) and molecular images were obtained by differential imaging of ACE-targeted NIRF and control-NIRF nanoparticles on the Odyssey small animal fluorescent imaging system.

RESULTS

Both the ACE-targeted and control NIRF nanoparticles were narrowly dispersed with a mean hydrodynamic diameter of 100 nm. The limit of detection for both nanoparticles was 100 fM. Wild type animals injected with 100 μL 25 nM mixture of ACE-targeted and control NIRF nanoparticles (1:1). The next day, the organs were excised and imaged ex vivo at $\lambda_{\text{ex}}=700\text{nm}$ and 800 nm. While the control NIRF nanoparticles demonstrated typical nanoparticle pharmacokinetics with high accumulation in organs of the mononuclear phagocytic system such as liver and spleen, the ACE-targeted NIRF nanoparticles accumulated in the lungs as well, which express high levels of ACE relative to other organs. To enable ACE-specific molecular imaging, a differential image was generated by subtracting the control NIRF nanoparticle signal from the ACE-targeted NIRF nanoparticle signal.

CONCLUSION

Highly specific molecular imaging of ACE was achieved by differential NIRF imaging of control and ACE-targeted NIRF nanoparticles in wild type animals.

CLINICAL RELEVANCE/APPLICATION

The Lisinopril conjugated NIRF particles have the potential to simultaneously enhance optical imaging contrast and facilitate tissue ACE tracking in the number of different disease processes.

SSA13-08 Molecular Imaging of Atherosclerosis using A Combined Magnetic Resonance and MALDI Imaging Approach

Sunday, Nov. 27 11:55AM - 12:05PM Room: S504CD

Awards

Student Travel Stipend Award

Participants

Fabian Lohoefer, MD, Munich, Germany (*Presenter*) Nothing to Disclose

Almut Glinzer, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Laura Hoffmann, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Franz Schilling, Munchen, Germany (*Abstract Co-Author*) Nothing to Disclose

Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Moritz Wildgruber, MD, PhD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluation of Gadofluorine P enhanced molecular magnetic resonance imaging (MRI) in a mouse model of atherosclerosis by Matrix Assisted Laser Desorption Ionization (MALDI) Imaging

METHOD AND MATERIALS

In this longitudinal study low density lipoprotein receptor deficient mice (LDLr^{-/-}) were fed a Western Type diet. After 4, 8 and 16 weeks mice were imaged by high-field 7 Tesla MRI after injection of Gadofluorine P at a dosage of 0.1mmol/kg body weight. Age matched C57BL/6 mice on a chow diet were used as control group. Imaging planes were planned in line with the aortic arch. Vessel wall contrast enhancement was assessed by Late Gadolinium Enhancement (LGE) and quantified by T1-mapping. T1/R1 values were calculated from T1 maps based on a Look-Locker sequence. T1 images were calculated from source images based on a 3-parameter Levenberg-Marquardt curve fitting procedure with a correction for read-out-induced attenuation of the relaxation curve. Mice from each time point were sacrificed after completion of imaging. The aortic arch was further processed for immunohistochemistry and MALDI-IMS. Tissue slices were cut in line with the aortic arch accordingly to in vivo MRI. MALDI-IMS was performed for quantification of Gadofluorine P ex vivo.

RESULTS

R1 values in atherosclerotic plaques located in the aortic root peaked 30min after Gadofluorine P injection. A kinetic study showed that R1 values of the vessel wall returned to baseline levels after ~5h. R1 values in the aortic root in LDLr^{-/-} mice were significantly higher compared to the control group. Contrast enhancement of the vessel wall increased over the time period of the high fat diet. Gadofluorine P accumulation in the atherosclerotic plaque and increase over the time of the high fat diet was confirmed by MALDI-IMS ex vivo.

CONCLUSION

Gadofluorine P enhanced MR imaging allows capturing of plaques even at early stages of atherosclerosis in mice. T1 mapping at high field strength allows semi-quantitative assessment of contrast agent accumulation in plaques in vivo, which can be further evaluated by ex vivo MALDI imaging.

CLINICAL RELEVANCE/APPLICATION

Preclinical study in a mouse model of atherosclerosis

SSA13-09 Assessment and Precise Quantification of Post-Infarction Scar Remodeling using a Combined Molecular Magnetic Resonance and MALDI Imaging Approach

Sunday, Nov. 27 12:05PM - 12:15PM Room: S504CD

Participants

Fabian Lohoefer, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Laura Hoffmann, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Almut Glinzer, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Katja Kosanke, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose
Franz Schilling, Munchen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Moritz Wildgruber, MD, PhD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study is to evaluate molecular magnetic resonance imaging (MRI) combined with Matrix assisted laser desorption ionization (MALDI) imaging approach using a collagen-targeted contrast agent to analyze and quantify mechanisms of myocardial remodeling and scar formation in a murine myocardial infarction model.

METHOD AND MATERIALS

In-vivo accumulation of Gadofluorine P, targeting collagen, tenascin and proteoglycans within the infarct scar, was investigated in a mouse model of myocardial infarction. C57BL/6J mice were scanned by in-vivo MRI at 7 Tesla 1 and 6 weeks after coronary artery ligation. Gadofluorine P was injected at a dose of 0.1mmol/kg body weight and compared to conventional Gd-DTPA. Contrast enhancement of infarcted myocardium was assessed using Late Gadolinium Enhancement (LGE) and T1 mapping. T1/R1 values were calculated from T1 maps based on a Look-Locker sequence. T1 images were calculated from source images based on a 3-parameter Levenberg-Marquardt curve fitting procedure with a correction for read-out-induced attenuation of the relaxation curve. Cardiac function parameters were assessed by volumetric analysis based on short axis views in CINE sequences. Mice from each time point were sacrificed after completion of imaging. The heart was removed and further processed for immunohistochemistry and matrix-assisted laser desorption ionization imaging (MALDI) to quantify Gadofluorine P accumulation ex-vivo.

RESULTS

R1 values in myocardial infarction peaked 15min after Gadofluorine P injection. A slow linear decrease was seen over a time period of 1h. R1 values in vivo in infarcted myocardium were significantly higher 6 weeks after myocardial infarction compared to 1 week. This was confirmed by MALDI-IMS ex vivo. Gadofluorine P accumulation showed a positive correlation with the ejection fraction of the heart.

CONCLUSION

MR imaging using collagen-targeted Gadofluorine P allows capturing of extracellular matrix components in remodeling and scar formation after myocardial infarction. T1 mapping at high field strength enables a more precise quantification of signal enhancement which can be further evaluated and fully quantified by MALDI Imaging.

CLINICAL RELEVANCE/APPLICATION

Preclinical animal study

SSA14

Science Session with Keynote: Musculoskeletal (Metabolic and Systemic Processes: Effects on the Musculoskeletal System and Beyond)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S406A



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

FDA Discussions may include off-label uses.

Participants

Anne Cotten, MD, Lille, France (*Moderator*) Nothing to Disclose
Linda Probyn, MD, Toronto, ON (*Moderator*) Nothing to Disclose

Sub-Events

SSA14-01 Musculoskeletal Keynote Speaker: Metabolic and Systemic Disease Targets in the Musculoskeletal System: Imaging Considerations

Sunday, Nov. 27 10:45AM - 11:05AM Room: S406A

Participants

Martin Torriani, MD, Boston, MA (*Presenter*) Nothing to Disclose

SSA14-03 Defining Sarcopenia with MRI - Establishing Threshold Values within a Large-Scale Population Study

Sunday, Nov. 27 11:05AM - 11:15AM Room: S406A

Participants

Anette Karlsson, Linköping, Sweden (*Abstract Co-Author*) Stockholder, AMRA AB
Jennifer Linge, Linköping, Sweden (*Abstract Co-Author*) Employee, AMRA AB
Janne West, MSc, PhD, Linköping, Sweden (*Abstract Co-Author*) Employee, AMRA AB; Stockholder, AMRA AB
Jimmy D. Bell, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Magnus Borga, PhD, Linköping, Sweden (*Abstract Co-Author*) Stockholder, AMRA AB
Olof Dahlqvist Leinhard, PhD, Linköping, Sweden (*Presenter*) Stockholder, AMRA AB; Employee, AMRA AB

PURPOSE

To identify gender specific threshold values for sarcopenia detection for lean thigh muscle tissue volume quantified using MRI.

METHOD AND MATERIALS

Current gender-specific thresholds for sarcopenia detection are based on quantification on appendicular lean tissue normalized with height² using DXA (7.26 kg/m² for men and 5.45 kg/m² for women). In this study 3514 subjects (1548 males and 1966 females) in the imaging subcohort of UK Biobank with paired DXA and MRI scans were included. The age range was 45 to 78 years. The total lean thigh volume normalized with height² (TTVi) was determined with a 6 minutes neck to knee 2-point Dixon MRI protocol using a 1.5T MR-scanner (Siemens, Germany) followed by analysis with AMRA® Profiler (AMRA, Sweden). The appendicular lean tissue mass normalized with height² (ALTMi) was assessed using DXA (GE-Lunar iDXA). Subjects with ALTMi lower than the gender specific threshold were categorized as sarcopenic. Gender specific threshold values were determined for detection of sarcopenic subjects based on TTVi optimizing sensitivity and specificity. Area under receiver operator curve (AUROC) was calculated as well as the linear correlation between TTVi and ALTMi.

RESULTS

A threshold value of TTVi = 3.64 l/m² provided a sensitivity and specificity of 0.88 for sarcopenia detection in males. The AUROC was 0.96. Similarly, a TTVi < 2.76 l/m² identified sarcopenic female subjects with a sensitivity and specificity of 0.89. The corresponding AUROC was 0.96. The linear correlation between TTVi and ALTMi was 0.93 (99%CI: 0.93-0.94).

CONCLUSION

MRI-based quantification of total lean thigh volume normalized with height² could be used to categorize sarcopenia in the study group. Threshold values are suggested.

CLINICAL RELEVANCE/APPLICATION

The study suggests that sarcopenia can be diagnosed using a rapid MRI scan with high sensitivity and specificity.

SSA14-04 Sarcopenia Predicts One-Year Mortality in Elderly Patients Undergoing Emergency Abdominal Surgery: A Pilot Study of Six Computed Tomography Techniques

Sunday, Nov. 27 11:15AM - 11:25AM Room: S406A

Participants

Jennifer W. Uyeda, MD, Boston, MA (*Presenter*) Nothing to Disclose
Arturo Rios Diaz, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ritam Chowdhury, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Aaron D. Sodickson, MD, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, Siemens AG; Consultant, Bayer AG
Erika L. Rangel, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Frailty is an independent predictor of mortality in elderly patients undergoing emergency abdominal surgery (EAS), but is difficult to

Frailty is an independent predictor of mortality in elderly patients undergoing emergency abdominal surgery (EAS), but is difficult to measure. Sarcopenia, the loss of lean muscle mass, has been used as a surrogate for frailty. We evaluated 6 different methods of measuring sarcopenia by preoperative CT, and sought to determine whether they predicted 1 year mortality among elderly patients undergoing EAS.

METHOD AND MATERIALS

Patients >70 years who had EAS (2006-2011) after preoperative CT were followed for a year. Six distinct methods were used to define sarcopenia based on CT at the L3 level: 1) Average (avg) bilateral psoas cross-sectional area (PSA) normalized for height; 2) Avg bilateral psoas Hounsfield unit (HU); 3) Weighted avg HU based on muscle size; 4) Composite index of HU x PSA; 5) AP x LAT pseudoarea; 6) Pseudoarea x HU. For each method, sarcopenia was defined as the lowest sex-specific quartile. Percent overlap between sarcopenic cohorts were calculated compared with method 1. Cox proportional hazards regression models adjusting for potential confounders assessed 1-year mortality hazard in sarcopenic vs. nonsarcopenic patients independently for each method.

RESULTS

For the 297 patients (94 deaths) analyzed, patients defined as being sarcopenic differed greatly between methods, with sarcopenia cohort overlap ranging between 28 - 67%. We found no significant differences in age, gender, race, comorbidities, malignancy, American Association of Anesthesiology score, operation urgency and severity, and discharge disposition. Sarcopenic patients had longer length of stay and greater need for ICU admission ($p < 0.05$). Sarcopenic patients had a higher hazard of mortality in all methods used for defining sarcopenia, with hazard ratios varying between 1.96 - 3.06 (all $p < 0.003$).

CONCLUSION

In this sample, all sarcopenia assessment methods were predictive of 1-year mortality in elderly patients undergoing EAS, although it is noteworthy that the patients classified as sarcopenic differed substantially between methods. Future studies must examine each method's unique contribution to patient outcome to build a composite sarcopenia measure most predictive of long term mortality.

CLINICAL RELEVANCE/APPLICATION

Sarcopenia is an objective measure of frailty that can be measured by CT and used to identify vulnerable elderly patients who will benefit from early discussion about goals of care and consideration of less invasive approaches.

Honored Educators

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

Aaron D. Sodickson, MD, PhD - 2014 Honored Educator

SSA14-05 Correlation of Body Mass Index with Paraspinal Muscle Atrophy in Patients with Lumbar Spinal Canal Stenosis

Sunday, Nov. 27 11:25AM - 11:35AM Room: S406A

Participants

Vartolomeu N. Bolog, MD, Munchenstein, Switzerland (*Presenter*) Nothing to Disclose
Jakob Burgstaller, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Ulrike Held, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Tim Finkenstaedt, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Filippo Del Grande, MD, MBA, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Johann Steurer, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Gustav Andreisek, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Sebastian Winklhofer, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Aim of the study was to investigate the degree of paraspinal muscle atrophy assessed with magnetic resonance imaging (MRI) in a large patient group with lumbar spinal stenosis (LSS) and to assess for body mass index (BMI) related differences.

METHOD AND MATERIALS

MR images of 763 patients (395 female, mean age 73 years) with LSS from the multicenter lumbar stenosis outcome study (LSOS) were analyzed in this institutional review board-approved study. Atrophy of the lumbar paraspinal musculature was staged independently by two radiologists according to an adapted Goutallier classification (grades 0 to 4) and correlation between degree of atrophy and BMI was assessed.

RESULTS

The mean BMI was 27.5 ± 5.1 (range 15-49.3). The median muscle atrophy grade was 1 (interquartile range 1 to 2). Muscle grade was assessed as follows: grade 0: n=153 (20%), grade 1: n=292 (38%), grade 2: n=245 (32%), grade 3: n=48 (6%), grade 4: n=25 (3%). Pearson correlation analysis demonstrated a significant positive correlation between BMI and muscle atrophy ($p > 0.01$). The BMI was significantly higher in patients with remarkable muscle atrophy (grade 2-4) (mean BMI 28.3 ± 5.6) compared to patients without remarkable muscle atrophy (grade 0-1) (mean BMI 26.9 ± 4.6).

CONCLUSION

The positive correlation between higher BMI and higher degrees of muscle atrophy implies that overweight is an important potential source of paraspinal muscle atrophy in patients with LSS.

CLINICAL RELEVANCE/APPLICATION

High BMI is supposed to be a co-morbidity in patients with lumbar spinal stenosis due to the atrophy of the paraspinal musculature.

SSA14-06 MRI Biomarkers of Muscle Hypoxia in Diabetic Foot Ulcers

Sunday, Nov. 27 11:35AM - 11:45AM Room: S406A

Participants

Xiang He, PhD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Kenneth T. Wengler, MS, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Kevin S. Baker, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Chien-Hung Lin, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Mingqian Huang, MD, Syosset, NY (*Presenter*) Nothing to Disclose
Elaine S. Gould, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Mark E. Schweitzer, MD, Stony Brook, NY (*Abstract Co-Author*) Consultant, MMI Munich Medical International GmbH Data Safety Monitoring Board, Histogenics Corporation

PURPOSE

Diabetic foot ulcer (DFU) is a major source of morbidity and health care cost in patients with diabetes mellitus (DM). DFU can lead to osteomyelitis, amputation and even death if un-treated. Hypoxia is associated with diabetic wounds/ulcer and accentuates the infection cascade. The purpose of this study is to evaluate two potential MRI biomarkers of foot muscle ischemia in DFU.

METHOD AND MATERIALS

Functional imaging of the plantar aspect of the forefoot (T1w and T2w anatomical images, chemical shift imaging (CSI), diffusion tensor imaging (DTI), and quantitative BOLD (qBOLD)) was performed in 8 healthy volunteers and two diabetic foot patients at 3T magnets with foot RF coils. The ratio between intra- vs. extra- myocellular lipids (IMCL/EMCL) was estimated from CSI data after incorporating the IMCL/EMCL resonance frequency difference calculated based on the muscle fibers orientation (DTI). MSK qBOLD provided an estimation of foot muscle oxygen extraction fraction (OEF) and transverse relaxation rate (R2*).

RESULTS

The IMCL/EMCL ratio was 0.89 ± 0.19 and 1.42 ± 0.34 in control and patients, respectively. The mean baseline foot muscle OEF was $65 \pm 13\%$ in control subjects, which is higher than the published value in calf muscle ($\sim 40\text{-}50\%$). Even with the difficulties caused by B0 inhomogeneity in peripheral areas and areas close with bones, we are still able to obtain useful 2D CSI and qBOLD data in major foot muscles. DM patients had higher baseline foot muscle OEF ($87 \pm 1\%$), consistent with diabetes-related muscle hypoxia. This was further confirmed by the elevated R2* in DM patients ($47 \pm 4\text{s}^{-1}$ vs. $39 \pm 3\text{s}^{-1}$).

CONCLUSION

The preliminary study demonstrated the feasibility of using multi-voxel MRS and foot qBOLD as MRI biomarkers of regional muscle hypoxia in DFU. This is a key imaging advance as the foot, not the calf is the clinical location for diabetic complications. DFU patients exhibited an increased IMCL/EMCL ratio as well as elevated OEF and R2*. The elevated level of IMCL/EMCL in DFU patients is consistent with the published findings from calf muscles, which has been associated with insulin resistance caused by mitochondrial dysfunction.

CLINICAL RELEVANCE/APPLICATION

The purpose of this study is to evaluate two potential MRI biomarkers of foot muscle ischemia in diabetic foot ulcer: IMCL/EMCL ratio and muscle oxygenation.

SSA14-07 Progressive Depletion of Skeletal Muscle and of Muscle Quality Predicts Survival of Colorectal Cancer Patients

Sunday, Nov. 27 11:45AM - 11:55AM Room: S406A

Participants

Colm J. McMahon, MBBCh, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yu-Ching Lin, MD, Tao Yuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
ChihYing Deng, Tao Yuan, Taiwan (*Presenter*) Nothing to Disclose
Kun-Yun Yeh, Keelung, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Yun-Chung Cheung, MD, Kwei Shan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Jim S. Wu, MD, Boston, MA (*Abstract Co-Author*) Research Grant, Kaneka Corporation

PURPOSE

Sarcopenia (low skeletal muscle mass) is associated with poorer prognosis of colorectal cancer patients. The goal of this study was to evaluate the effect on survival of progressive loss of muscle mass at 1 year follow up after diagnosis.

METHOD AND MATERIALS

Patients diagnosed with colorectal cancer between 2007 and 2011 were included and were followed for at least 5 years. CT at baseline and 1 year after diagnosis were analyzed. Skeletal Muscle Index (SMI) of psoas and paraspinal muscles, and mean Hounsfield Units (HU) were measured at baseline, and at 1 year. Interval change in parameters between baseline and 1 year were calculated. Measurements were taken at L4 level. Univariate Cox proportional hazard regression was used to evaluate relationship to overall and progression-free survival.

RESULTS

= $p < 0.05$ 148 patients were included, mean (\pm -SD) age 65.1 (\pm -13.5) years, 51 females. Overall survival: Hazard Ratio (HR) of psoas SMI was 0.60, 0.41, 7.51* for baseline, 1 year, interval change respectively. HR for psoas HU was 0.98, 0.93*, 1.14* for baseline, 1 year, interval change respectively. HR for paraspinal SMI was 0.67*, 0.58*, 2.19* for baseline, 1 year, interval change respectively. HR for paraspinal HU was 1.00, 0.99, 1.18* for baseline, 1 year, interval change respectively. Progression-free survival: HR for psoas SMI was 0.67, 0.59*, 2.45 for baseline, 1 year, interval change respectively. HR for psoas HU was 0.98, 0.95, 1.10* for baseline, 1 year, interval change respectively. HR for paraspinal SMI was 0.88, 0.79, 1.92 for baseline, 1 year, interval change respectively. HR for paraspinal HU was 1.00, 0.99, 1.20* for baseline, 1 year, interval change respectively.

CONCLUSION

Progressive depletion of muscle mass and of muscle quality at 1 year compared to baseline at diagnosis of colorectal cancer is predictive of poorer overall and progression free survival.

CLINICAL RELEVANCE/APPLICATION

This study identifies the importance of changes in skeletal muscle index and muscle density as a biomarker for colorectal cancer prognosis.

SSA14-08 Quantitative Assessment of Trabecular Bone Microarchitecture Using High-Resolution Extremities Cone-Beam CT

Sunday, Nov. 27 11:55AM - 12:05PM Room: S406A

Participants

Michael Brehler, Baltimore, MD (*Presenter*) Research funded, Siemens AG
Eugenio Marinetto, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Qian Cao, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Sisniega, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Carestream Health, Inc
Joseph W. Stayman, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Elekta AB Research Grant, Varian Medical Systems, Inc
John Yorkston, PhD, Rochester, NY (*Abstract Co-Author*) Employee, Carestream Health, Inc
Shadpour Demehri, MD, Baltimore, MD (*Abstract Co-Author*) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation;
Jeffrey H. Siewerdsen, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Carestream Health, Inc; Advisory Board, Siemens AG; Advisory Board, Carestream Health, Inc; License agreement, Carestream Health, Inc; License agreement, Elekta AB; ; ;
Wojciech Zbijewski, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Carestream Health, Inc

PURPOSE

Bone microstructure is a potential biomarker in osteoporosis and osteoarthritis. Extremities cone-beam CT (CBCT) is a compelling platform for in-vivo bone morphometrics owing to the high resolution of flat-panel detectors (FPDs) that supports assessment of trabeculae. Improvement in spatial resolution of extremities CBCT is anticipated with CMOS detectors that offer smaller pixel sizes than FPDs. We investigate performance of FPD- and CMOS-based extremities CBCT in bone morphometry.

METHOD AND MATERIALS

Data were acquired on a CBCT test-bench in the geometry of extremities CBCT with a 0.4 FS x-ray source (90 kVp, 0.25 mAs/frame). A cadaveric hand was imaged with a DALSA Xineos 3030 CMOS detector (100 μm pixels, $\sim 600 \mu\text{m}$ CsI scintillator) and with a Varian PaxScan 4030CB FPD (192 μm pixels, $\sim 600 \mu\text{m}$ CsI). Reconstruction voxel size was 75 μm . Excised wrist bones from the same cadaver hand were imaged on a micro-CT (14 μm voxels). In the ulna, 25 regions of interest (ROIs) of 4 mm³ each were generated and registered between micro-CT, CMOS-CBCT and FPD-CBCT. Otsu's segmentation was applied to detect the trabeculae. Conventional metrics of microarchitecture (e.g. Trabecular Spacing Tb.Sp, Bone Volume Fraction BV/TV) were computed.

RESULTS

Enhanced delineation of trabeculae was achieved with CMOS-CBCT compared to FPD-CBCT. The Dice coefficient between the trabecular segmentations obtained from FPD-CBCT and gold-standard micro-CT was 0.52 (median of the ROIs) and increased to 0.59 for CMOS-CBCT. The improved segmentation resulted in better correlation with micro-CT morphometrics for CMOS-CBCT compared to FPD-CBCT. For CMOS-CBCT, the correlation coefficient (measured across all ROIs) was 0.88 for BV/TV and 0.85 for Tb.Sp. Correlations for FPD-CBCT were 0.57 for BV/TV and 0.63 for Tb.Sp.

CONCLUSION

Both CMOS- and FPD-based extremities CBCT allow visualization of trabecular structure and assessment of quantitative metrics of bone architecture. CMOS-CBCT shows better correlation with micro-CT and thus enhanced capability for detecting change in bone health. A clinical prototype of CMOS-based extremities CBCT is under development for applications in early detection of osteoporosis and osteoarthritis.

CLINICAL RELEVANCE/APPLICATION

Major improvement in spatial resolution of extremities CBCT is achieved with a CMOS detector, enabling in-vivo quantitative trabecular morphometry for early detection of osteoporosis and osteoarthritis.

SSA14-09 The Canadian Multicentre Osteoporosis Study (CaMos) and Vertebral Fractures

Sunday, Nov. 27 12:05PM - 12:15PM Room: S406A

Participants

Brian C. Lentle, MD, Victoria, BC (*Abstract Co-Author*) Speaker, Amgen Inc
Linda Probyn, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Claudie Berger, DPhil, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Jacques Brown, MD, FRCPC, Quebec, QC (*Abstract Co-Author*) Speakers Bureau, Amgen Inc; Speakers Bureau, Mantra Pharma; Research Consultant, Amgen Inc; Research Consultant, Eli Lilly and Company; Research Consultant, Merck & Co, Inc; Research Grant, Amgen Inc; Research Grant, DAIICHI SANKYO Group; Research Grant, Eli Lilly and Company; Research Grant, Takeda Pharmaceutical Company Limited
Lisa Langsetmo, PhD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Doneal Thomas, BSc, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Benjamin Fine, MD, MS, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Kevin Lian, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Arvind Shergill, MBBS, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Jacques Trollip, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
William (Bill) Leslie, MD, FRCPC, Winnipeg, MB (*Abstract Co-Author*) Nothing to Disclose
Stephanie Kaiser, MD, FRCPC, Halifax, NS (*Abstract Co-Author*) Nothing to Disclose

Jonathan D. Adachi, MD, Hamilton, ON (*Abstract Co-Author*) Consultant, Actavis, Inc; Consultant, Amgen Inc; Consultant, Eli Lilly and Company; Consultant, Merck & Co, Inc; Consultant, Novartis AG; Speaker, Actavis, Inc ; Speaker, Amgen Inc; Speaker, Eli Lilly and Company; Speaker, Merck & Co, Inc; Speaker, Novartis AG; Research Grant, Amgen Inc; Research Grant, Eli Lilly and Company; Research Grant, Merck & Co, Inc; Research Grant, Novartis AG
Tanveer Towheed, MD,FRCPC, Kingston, ON (*Abstract Co-Author*) Nothing to Disclose
David Hanley, MD,FRCPC, Calgary, AB (*Abstract Co-Author*) Speaker, Amgen Inc; Researcher, Amgen Inc
Shawn Davison, PhD, Saskatoon, SK (*Abstract Co-Author*) Nothing to Disclose
Jerilynn Prior, MD,FRCPC, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
David Golzman, MD,FRCPC, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We compared the Genant Semi-Quantitative (GSQ) method and Algorithm-based Qualitative method modified to include cortical buckling (mABQ) for diagnosing prevalent and incident vertebral fractures (VF) in 3149 participants with 6927 serial X-rays.

METHOD AND MATERIALS

Spine images (T4-L4) of CaMos men and women > 50 years old at baseline, Year 5, 10 and 16 follow-ups were included. Two trained technologists triaged participants into those with and without GSQ VF (any grade). A single radiologist reviewed serial X-rays for participants with any triaged GSQ VF and a random sample without GSQ VF for presence of VF using GSQ, with or without mABQ signs. Sex stratified linear and logistic regressions, adjusted for age, BMI and height, tested the association of prevalent VF with femoral neck (FN) BMD and incident VF.

RESULTS

Using GSQ, the prevalence of VF was 13.6% (95%CI: 12.1; 15.1) in women and 15.5% (13.0; 18.0) in men; using mABQ it was 6.7% (5.6; 7.8) in women and 4.7% (3.3; 6.2) in men. Incident VF rates (per 1000 person-years) were 5.8 (4.7; 7.2) in women and 4.9 (3.3; 7.2) in men using GSQ, and 5.7 (4.6; 7.2) in women and 4.7 (3.2; 7.0) in men using mABQ. Incident and prevalent VF show different distributions when plotted by vertebral segment (Fig 1). For GSQ-defined VF, the adjusted FN BMD was 0.042g/cm² (0.029; 0.056) lower in women and 0.036 g/cm² (0.013; 0.058) in men. For mABQ-defined VF, adjusted FN-BMD was 0.061g/cm² (0.042; 0.80) lower in women and 0.075g/cm² (0.034; 0.116) in men. Compared with participants with GSQ VF alone, women and men with prevalent mABQ VF had lower FN BMD by 0.037g/cm² (0.012; 0.065) and 0.075g/cm² (0.025; 0.125). Participants with prevalent GSQ VF were 5.1 (3.3; 7.8) times more likely than normals to have incident GSQ VF; those with prevalent mABQ VF were 9.9 (6.0; 16.4) times more likely to have incident mABQ VF than normals.

CONCLUSION

Our 16-year VF data demonstrate reductions in FN BMD in those with VF by mABQ and GSQ methods; more conservative estimates of VF prevalence with mABQ; equivalent estimates of VF incidence with both methods; but a higher likelihood for future VF with the mABQ method.

CLINICAL RELEVANCE/APPLICATION

Given the continuing uncertainty about the diagnosis of vertebral fracture this work is intended to provide a preliminary comparison of qualitative and quantitative methods.

SSA15

Science Session with Keynote: Musculoskeletal (Upper Extremity)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S406B



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

Participants

Laura W. Bancroft, MD, Orlando, FL (*Moderator*) Author with royalties, Wolters Kluwer nv
Brady K. Huang, MD, San Diego, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSA15-01 Musculoskeletal Keynote Speaker: Wrist and Shoulder Essentials

Sunday, Nov. 27 10:45AM - 11:05AM Room: S406B

Participants

Lynne S. Steinbach, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

SSA15-03 Accuracy of the MRI Diagnosis of Adhesive Capsulitis in an Academic Musculoskeletal Radiology Division

Sunday, Nov. 27 11:05AM - 11:15AM Room: S406B

Participants

Erin F. Alaia, MD, New York, NY (*Presenter*) Nothing to Disclose
Michael Alaia, MD, New York, NY (*Abstract Co-Author*) Speaker, Jubilant Life Sciences Ltd
Soterios Gyftopoulos, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate accuracy of MRI for adhesive capsulitis in an academic musculoskeletal radiology division. To examine orthopedic MRI referral for adhesive capsulitis, and whether positive imaging findings impact treatment in the absence of clinical disease.

METHOD AND MATERIALS

150 shoulder MRI reports were assessed for presence of: 1. thickened axillary recess capsule, 2. thickened coracohumeral ligament, 3. subcoracoid fat infiltration, and 4. impression of adhesive capsulitis, with orthopedic clinical diagnosis serving as the reference standard. Sensitivity, specificity, negative predictive value, positive predictive value, and accuracy were calculated, and Fisher exact tests determined whether each MRI finding predisposed to a false positive diagnosis. Follow-up in false positive cases was obtained to determine whether imaging findings impacted treatment, and whether patients subsequently developed clinical adhesive capsulitis.

RESULTS

5% of MRI cases had a clinical diagnosis of adhesive capsulitis, and 21% of MRI cases were interpreted as positive. Sensitivity was 38%, specificity 80%, negative predictive value 96%, positive predictive value 9%, and accuracy was 77%. Infiltration of rotator interval fat, thickening of the joint capsule at the axillary recess, and thickening of the coracohumeral ligament were all significantly ($p < 0.001$) predictive of a false positive MRI diagnosis. In false positive cases, 5% of orthopedic follow-up notes mentioned the imaging diagnosis, and only one patient subsequently developed clinical adhesive capsulitis.

CONCLUSION

Findings previously found to be associated with adhesive capsulitis are present in a high proportion of clinically asymptomatic patients. Radiologists should exercise caution in making an imaging diagnosis without considering clinical findings.

CLINICAL RELEVANCE/APPLICATION

MRI findings of adhesive capsulitis are present in a high proportion of clinically asymptomatic patients.

SSA15-04 Imaging Features of Glenoid Bare Area in a Pediatric Population

Sunday, Nov. 27 11:15AM - 11:25AM Room: S406B

Participants

Sahlya Djebbar, MD, NYC, NY (*Presenter*) Nothing to Disclose
Zehava S. Rosenberg, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ignacio Rossi, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Christoph A. Agten, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Erin F. Alaia, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jonathan Zember, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The bare area (BA) is a central, well-circumscribed focal defect in the articular surface of the glenoid, with reported adult incidence of 1-2%. The adult literature supports a developmental etiology, however, a recent imaging study, based on a pediatric patient population, suggested a similar incidence of BA but advocated a traumatic origin. The purpose of our study was to reassess the prevalence and MRI appearance of the glenoid bare area in the pediatric population.

METHOD AND MATERIALS

A retrospective review of our digital database from June 2014 to October 2015 was performed at our institution, using the keywords "shoulder" and "MRI" in patients ranging in age from 10 to 25. 4 cases were excluded, with a final cohort of patients divided into 3 age groups: group 1, 10-15 years (n=75), group 2, 15-18 years (n=75) and group 3, 18-25 years (n=75). All cases were reviewed in consensus by 2 MSK radiologists. The bare area was defined as a well marginated, central defect, of increased signal in the articular surface of the glenoid, seen on at least 2 imaging planes, without evidence of underlying glenoid pathology. The presence, location and size of the BA were documented in each group.

RESULTS

A total of 22 BA were identified, 15 (20%) in the younger group, 4 (5%) in the intermediary group and 3 in the older group (4%), with a significantly higher incidence in the younger group ($p=0.007$ in comparison with group 2, and $p=0.002$ in comparison with group 3, using Chi Square Test). Location was mainly central (12 (80%) in group 10-15 yo, 3 (75%) in group 15-18yo, 3 (100%) in group 18-25 yo. The mean size was 3.44 mm, range 1.5-7.5mm, in the young children group, significantly bigger than in the two older groups (mean size of 2.47 mm, range 1.6-3.2 mm in the intermediary group 2; mean size of 3.23 mm, range 2-4 mm in the young adults group).

CONCLUSION

The incidence of the BA in children ranging from 10-15 years of age is significantly higher than in older children and higher than the reported incidence in adults. The BA is also larger in the younger compared to the older pediatric age group. Our findings may be explained by the centripetal pattern of ossification of the glenoid and, thus, give support to the normal developmental theory.

CLINICAL RELEVANCE/APPLICATION

Familiarity with the MR appearance of the BA should obviate misinterpreting as a pathologic condition in the pediatric patient 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/>

Zehava S. Rosenberg, MD - 2014 Honored Educator

SSA15-05 One-year Survey of Different Treatment Approach to Tendinopathy of the Supraspinatus Tendon: PRP, Needling or Physical Therapy?

Sunday, Nov. 27 11:25AM - 11:35AM Room: S406B

Participants

Alice La Marra, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Federico Bruno, MD, LAquila, Italy (*Presenter*) Nothing to Disclose
Silvia Mariani, 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
Luigi Zugaro, 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 clinical and morphological results 1 year after treatment in patients with chronic tendinopathy of the supraspinatus tendon, treated with Platelet-rich Plasma (PRP), needling or submitted to medical and physical therapy alone

METHOD AND MATERIALS

We retrospectively evaluated through clinical and MRI examination 60 patients with degenerative disease of the supraspinatus tendon: 20 patients were treated a year before with PRP (group A), 20 with needling (group B) and 20 were submitted over a 1 year period to medical and physical therapy alone (group C). The instrumental evaluation included MRI scans performed before and 1 year after treatment. The patients were also evaluated with both clinical and functional examinations by mean of VAS and Constant scores.

RESULTS

We recorded an improvement in the overall MRI appearance of the supraspinatus tendon in 75% of patients of group A, 63% of group B and in only 20% of group C; in 18% of group A, 52% of group B and 57% of group C MRI findings showed stationary conditions of the tendinopathy. In 7% of patients of group A, 5% of group B and 23% of group C MRI examinations showed worsening of the imaging findings. A VAS improvement of 83.5% in group A, 69% in group B and 25% in group C was observed. Constant score improvement was of 63% in group A, 50% in group B and 15% in group C.

CONCLUSION

PRP injection and needling can delay the degenerative changes of the tendons as documented by pain relief and functional improvement with better results after PRP injection therapy compared to needling. MRI imaging findings are an important evidence of the effectiveness of this therapy, because they confirm the clinical evidence.

CLINICAL RELEVANCE/APPLICATION

Our experience suggests that intratendinous injections of PRP and tendon needling can modify the natural history of supraspinatus tendon tendinopathy compared to medical and physical therapies alone and can be effective and minimally invasive treatments suitable for a large range of patients.

SSA15-06 Carpal Tunnel Syndrome: Diagnosis with Additive Diffusion-Tensor Imaging to Standard MR Imaging

at 3 T

Sunday, Nov. 27 11:35AM - 11:45AM Room: S406B

Participants

Hokun Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Won-Hee Jee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Investigator, Bayer AG; Research support, Bayer AG ;
Joon-Yong Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong In Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Mun-Young Paek, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Siemens AG
In-Seong Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Han Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the added value of diffusion-tensor imaging (DTI) to standard magnetic resonance (MR) imaging to diagnose carpal tunnel syndrome (CTS) at 3 T.

METHOD AND MATERIALS

The institutional review board approved this retrospective study and informed consent was waived. From September 2014 through March 2016, 128 patients underwent 3-T MR imaging of the wrist including DTI (b values of 0 and 1200 sec/mm²). Among them 24 patients performed median nerve conduction test and carpal tunnel syndrome was proved in nine patients. First, two independent musculoskeletal radiologists retrospectively scored the standard MR imaging. Second, they measured fractional anisotropy (FA) values and apparent diffusion coefficient (ADC) of the median nerve at three locations: the levels of the distal radioulnar joint, pisiform bone, and hamate bone. Then, they assessed a combination of standard MR imaging and DTI. Interobserver agreement for FA and ADC was assessed using intraclass correlation coefficient (ICC). The receiver operating characteristic curve with areas under the curve (AUC) was obtained.

RESULTS

In quantitative analysis of median nerve DTI at three locations (distal radioulnar joint, pisiform bone, and hamate bone), mean FA values of two readers were 0.64±0.15, 0.54±0.11, and 0.47±0.11, respectively. Mean ADCs were 946±221, 1132±164, and 1211±172 μm²/sec at three locations, respectively. Interobserver agreements of two readers at three locations were substantial (ICC=0.78, 0.74) and very good (ICC=0.86) for FA values; moderate (ICC=0.54) and substantial (ICC=0.71, 0.79) for ADCs, respectively. Sensitivity, specificity and accuracy of each reader were 100%, 20%, and 50%; 67%, 53%, and 58% on standard MR imaging alone, whereas 100%, 73%, and 83%; 67%, 60%, and 63% on standard MR imaging combined DTI, respectively. AUCs of a combination of standard MR imaging and DTI were higher than those of standard MR imaging alone: 0.867 vs 0.600 (P =.0001) for reader 1 and 0.633 vs 0.600 (P=.7684) for reader 2, respectively. With FA cutoff value of 0.64 at distal radioulnar joint level in reader 2, sensitivity, specificity and accuracy were 89%, 80%, and 83%, respectively.

CONCLUSION

The addition of DTI to standard MR imaging improves the diagnostic accuracy for the diagnosis of carpal tunnel syndrome at 3 T.

CLINICAL RELEVANCE/APPLICATION

DTI should be added to standard MR imaging protocol to help diagnose of carpal tunnel syndrome.

SSA15-07 Comparison of the Diagnostic Accuracy of Cone Beam Computed Tomography and Radiography for Scaphoid Fractures

Sunday, Nov. 27 11:45AM - 11:55AM Room: S406B

Participants

Jakob Neubauer, MD, Freiburg, Germany (*Presenter*) Nothing to Disclose
Sebastian Goerke, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Benndorf, MD, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Tayfun Yilmaz, MD, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Kilian Reising, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Claudia Ehrhrt-Braun, MD, 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

PURPOSE

To evaluate and compare the diagnostic accuracy of cone beam computed tomography (CBCT) and radiography for the detection of scaphoid fractures.

METHOD AND MATERIALS

Retrospective analysis of patients who received both radiography and CBCT examinations within 5 days to rule out a scaphoid fracture over a 2 year period in our institution. Data relating to age and findings were collected from the hospital imaging database and electronic records. Patients were excluded if the documentation was lacking. 4 blinded radiologist and orthopedic surgeons (1 board approved and 1 senior residents of each specialty) independently rated the images regarding the presence of a scaphoid fracture. The CBCT images were read at least 6 weeks after the radiographs to avoid recall bias. The gold standard was evaluated in a consensus reading of all images and the electronic records by two radiologists. Inter-rater correlation was evaluated with Fleiss' s kappa and compared with Z-test. Pooled sensitivity, specificity and negative predictive values were calculated and compared with McNemar's test and generalized score statistic. A P-value <.05 was considered to denote statistical significance. Confidence intervals (CI) were stated at the 95% level.

RESULTS

113 patients met the inclusion criteria. The inter-rater correlation was higher in the CBCT with 0.75 compared to radiography with 0.50 (P<.001). Pooled sensitivity was higher for CBCT with 0.92 (CI 0.89-0.95) compared to radiography with 0.87 (CI 0.83-0.91) (P=.03). Pooled specificity was higher for CBCT with 0.97 (CI 0.94-0.99) compared to radiography with 0.78 (CI 0.72-0.83)

($P < .001$). The pooled negative predictive value was higher for CBCT with 0.90 (CI 0.87-0.94) compared to radiography with 0.83 (CI 0.78-0.89) ($P = .006$).

CONCLUSION

CBCT shows a higher diagnostic accuracy for scaphoid fractures than radiography.

CLINICAL RELEVANCE/APPLICATION

In the clinical case of suspected scaphoid fracture and negative radiographs the CBCT as a new low dose technique in trauma imaging of the extremities can have a substantial benefit to the diagnostic workup.

SSA15-08 Ultra High Resolution C-arm CT Arthrography of the Wrist: Radiation Dose and Image Quality compared to Conventional Computed Tomography

Sunday, Nov. 27 11:55AM - 12:05PM Room: S406B

Participants

Thomas Werncke, MD, Dipl Phys, Hannover, Germany (*Presenter*) Nothing to Disclose
Bernhard C. Meyer, Hannover, Germany (*Abstract Co-Author*) Research Consultant, Pro Medicus Limited
Lena Sonnow, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Luepke, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Jan Hinrichs, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank K. Wacker, MD, Hannover, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Pro Medicus Limited; Research Grant, Delcath Systems, Inc;
Christian Von Falck, MD, Hannover, Germany (*Abstract Co-Author*) Research Grant, Pro Medicus Limited Research Grant, Siemens AG

PURPOSE

Objective of this phantom and cadaveric study was to compare effective radiation dose (ED) and image quality (IQ) between C-Arm CT (CACT) and computed tomography (CT) arthrography of the wrist.

METHOD AND MATERIALS

ED was determined with TLD dosimetry according to ICRP 103 using an anthropomorphic phantom representing a 70-kg male (Atom, CIRSinc, Norfolk, USA) placed in the "superman" position. Imaging of the phantom and 10 human cadaveric wrists after tri-compartmental injection of diluted iodinated contrast material was conducted using an angiographic system (Artis zeego Q, Siemens Healthcare, Erlangen, Germany) with an ultra-high resolution 1x1 detector binning using a normal (CACT1) and sharp (CACT2) reconstruction kernel. CT was conducted with a standard wrist protocol (LightSpeed 16, GE Healthcare, Chalfont St. Giles, UK). Quantitative IQ was assessed in terms of high and low contrast performance by calculating the modulation transfer function (MTF), image noise and contrast-to-noise ratio (CNR). MTF was assessed in a wire phantom. Image noise and CNR were assessed by 1 reader in the cadaveric wrists and compared with Anova-test. Qualitative IQ was assessed by 3 readers independently in terms of depictability of anatomical wrist structures, and occurrence of artifacts using a 5 point Likert scale, and compared with a Wilcoxon test. Interobserver reliability was calculated using the intra class correlation coefficient (ICC 2,1).

RESULTS

ED of CT was comparable to CACT (male/female 4.1/4.1 μ Sv vs: 3.4/3.6 μ Sv). Best spatial resolution was noted for CACT2 (10% MTF, CT/CACT1/CACT2:11.5/25.0/35.2 lp/cm. Low contrast performance was best for CT and decreased ($p < .001$) to CACT1 and CACT2 (Image Noise [HU]:CT:42 \pm 8 CACT1:60 \pm 9, CACT2:127 \pm 10; CNR: MDCT:69 \pm 16 CACT1:62 \pm 14,CACT2:28 \pm 5). Interobserver agreement for assessment of anatomical IQ and artifacts was good (ICC:0.69/0.68). Anatomical IQ was best for CACT2 (1.3 \pm 0.5) and decreased ($p < .001$) to CACT1 (1.9 \pm 0.6) and CT (3.5 \pm 0.6). Image artifacts were only reported for CACT and were not significantly different between CACT1 (2.0 \pm 0.2) and CACT2 (2.1 \pm 0.2).

CONCLUSION

Ultra high resolution C-arm CT arthrography of the wrist allows for a superior depiction of the anatomical structures as compared to CT arthrography at a comparable radiation dose.

CLINICAL RELEVANCE/APPLICATION

Ultra high resolution C-arm CT arthrography of the wrist has the potential to replace CT arthrography in a workflow-optimized procedure.

SSA15-09 Kinematic Analysis of the Distal Radioulnar Joint in Asymptomatic Wrists- Normal Motion Pattern and Inter-reader Reliability

Sunday, Nov. 27 12:05PM - 12:15PM Room: S406B

Participants

Nima Hafezi Nejad, MD, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose
John N. Morelli, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Uma Thakur, MD, Watchung, NJ (*Abstract Co-Author*) Nothing to Disclose
John A. Carrino, MD, MPH, New York, NY (*Abstract Co-Author*) Research Consultant, BioClinica, Inc; Research Consultant, Pfizer Inc; Research Consultant, Carestream Health, Inc; Advisory Board, General Electric Company; Advisory Board, Halyard Health, Inc;
; Shadpour Demehri, MD, Baltimore, MD (*Abstract Co-Author*) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation;

PURPOSE

To determine the normal motion pattern of distal radioulnar joint (DRUJ) during wrist supination-pronation motion and observer performance of measurements using four-dimensional (4D) CT acquisitions in asymptomatic contralateral joints of patients with unilateral wrist pain.

METHOD AND MATERIALS

In this IRB-approved, retrospective study of patients with chronic wrist pain, 4DCT examination of the bilateral wrists was performed in 10 patients (mean age: 40.1 y/o, M/F:5/5); the asymptomatic contralateral joints were included in this analysis. Using a double-oblique multiplanar reformation (MPR) technique to define the true axial plane relative to the DRUJ, two independent readers performed measurements for assessment of DRUJ alignment using the modified radioulnar line (mRU) and epicenter (Epi) methods. Wilcoxon rank sum test was used to determine the significance of measurement changes between pronation and supination. Interobserver agreement was assessed using Interclass Correlation Coefficients (ICC).

RESULTS

For the above measurements, volar subluxation of the ulnar corresponds with negative values, whereas dorsal ulnar subluxation corresponds with positive values. DRUJ mRU method measurements obtained in wrist pronation (observer-1: 0.03, 0.0-0.2 (median, range); observer-2: 0.08, 0.0-0.3) were significantly larger than measurements obtained during wrist supination (observer-1: -0.10, -0.2-0.0 p=0.01; observer-2: -0.11, -0.2-0.0 p=0.008). DRUJ Epi method measurements obtained in wrist pronation (observer-1: 0.03, -0.1-0.1; observer-2: 0.05, -0.9-0.13) did not significantly differ from those obtained in wrist supination (observer-1: 0.06, -0.02-0.1; observer-2: 0.06, -0.04-0.1). There was high interobserver agreement between the two observers using both methods in pronation (mRU:(ICC: 0.982; P<0.001), Epi:(ICC: 0.898; P<0.001)), midpoint (mRU:(ICC: 0.994; P<0.001), Epi:(ICC: 0.827; P:0.005)) and supination (mRU:(ICC: 0.989; P<0.001), Epi (ICC: 0.972; P<0.001)) positions.

CONCLUSION

Using 4D CT acquisition, DRUJ kinematics in asymptomatic wrists demonstrate increased volar ulnar subluxation with supination as calculated by the mRU method but not the Epi method. Both methods showed high interobserver agreements.

CLINICAL RELEVANCE/APPLICATION

4DCT with MPR technique provides reliable assessments of DRUJ during active wrist motions. This study provides normal range of expected changes in DRUJ measurements in asymptomatic wrists.

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

SSA16

Nuclear Medicine (Genitourinary Imaging)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S505AB



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

FDA Discussions may include off-label uses.

Participants

Matthias J. Eiber, MD, Muenchen, Germany (*Moderator*) Nothing to Disclose
Phillip J. Koo, MD, Phoenix, AZ (*Moderator*) Advisory Board, Bayer AG; ;

Sub-Events

SSA16-01 Selective Inhibition and Enhancement of Anti-3-[18F] FACBC (Fluciclovine) Transport in Prostate Carcinoma Xenografts

Sunday, Nov. 27 10:45AM - 10:55AM Room: S505AB

Participants

Funmilayo I. Tade, MD, MPH, Atlanta, GA (*Presenter*) Nothing to Disclose
Walter G Wiles IV, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Guolan Lu, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Birdal Bilir, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jeong Seok Lee, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Baowei Fei, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Carlos Moreno, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Weiping Yu, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Ronald Voll, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Shuntaro Oka, Sodegaura, Japan (*Abstract Co-Author*) Employee, Nihon Medi-Physics Co, Ltd
Hiroyuki Okudaira, Sodegaura, Japan (*Abstract Co-Author*) Employee, Nihon Medi-Physics Co, Ltd
Mark M. Goodman, PhD, Atlanta, GA (*Abstract Co-Author*) Royalties, Nihon Medi-Physics Co, Ltd
David M. Schuster, MD, Atlanta, GA (*Abstract Co-Author*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Consultant, WellPoint, Inc; ;

PURPOSE

Fluciclovine is an amino acid analogue PET radiotracer believed to be transported mainly via system L (LAT1), but subsequent in-vitro data showed primary transport via system ASC (ASCT2). In contradiction to in-vitro studies, mRNA expression of amino acid transporter genes shows strong correlation of fluciclovine uptake with the proton dependent transporter PAT1. We set out to determine the effect of intratumoral injection of the system L inhibitor BCH and PAT1 inhibitor MeAIB on fluciclovine uptake in a prostate cancer xenograft model

METHOD AND MATERIALS

50:50 PC3-Luciferase cells and matrigel were injected into both flanks of 18 SCID mice. At average tumor size of 5mm, intratumoral injection of BCH, MeAIB or saline (6 mice/group) was completed in one xenograft with the contralateral as control. After 60 mins, 4.6±0.1 MBq fluciclovine was injected via tail vein for a 60-minute dynamic microPET-CT. Time activity curves were plotted from ROIs drawn on the xenografts. Tumor viability was assessed by bioluminescence. Differences in fluciclovine uptake between the injected tumors and controls were compared using T-test and analysis of variance as appropriate with significance at p<0.05

RESULTS

5 mice (1 MeAIB and 3 saline) were excluded due to loss of tumor viability. Thus 6 BCH, 5 MeAIB and 2 saline injected mice were analyzed. Compared to controls, mean fluciclovine SUVmax was 37(±5.3) % lower in BCH injected tumors and 52(±10.6) % higher in MeAIB injected tumors (p<0.0001). There was no significant difference between mean fluciclovine SUVmax in saline injected tumors and their controls (P=0.8) as well as among all controls (P=0.3).

CONCLUSION

BCH injection has only partial inhibitory effect on fluciclovine uptake, confirming that system L (LAT1) plays a lesser role in transport. Lack of inhibition with MeAIB confirms no direct role of PAT1 with fluciclovine transport. The unexpected finding of enhanced fluciclovine uptake after MeAIB injection deserves further study, and may involve the complex interplay of decreased glutamine uptake via MeAIB system A transporter inhibition and downstream interaction with intracellular leucine and the mTOR cascade.

CLINICAL RELEVANCE/APPLICATION

This study suggests mechanisms that could be explored for increasing amino acid based radiotracer uptake for PET imaging of cancer and the interaction of amino acid transport with mTOR dynamics.

SSA16-02 A Comparison of Positivity Rates of Anti-3-[18F]FACBC PET-CT (Fluciclovine) in Recurrent Prostate Cancer Patients on Androgen Deprivation Therapy (ADT) vs ADT-Naïve Patients

Sunday, Nov. 27 10:55AM - 11:05AM Room: S505AB

Participants

Oladunni O. Akin-Akintayo, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Ashesh B. Jani, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

Funmilayo I. Tade, MD, MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Ijeoma Ibeanu, MD, MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Mark M. Goodman, PhD, Atlanta, GA (*Abstract Co-Author*) Royalties, Nihon Medi-Physics Co, Ltd
Raghuvveer K. Halkar, MD, Atlanta, GA (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Gilead Sciences, Inc Royalties, General Electric Company
Peter J. Rossi, MD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Shelton, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
David M. Schuster, MD, Atlanta, GA (*Abstract Co-Author*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Consultant, WellPoint, Inc; ;

PURPOSE

Fluciclovine is a fluorinated synthetic amino acid radiotracer with utility in prostate cancer imaging. As part of an ongoing randomized controlled trial involving post-prostatectomy recurrent prostate cancer patients, we explored the effect of ADT on prostate cancer detection by evaluating fluciclovine positivity rates in patients on ADT and ADT-naïve patients.

METHOD AND MATERIALS

Fifty one patients underwent fluciclovine PET-CT as part of a prospective clinical trial. Fluciclovine uptake was recorded and descriptive statistics computed. Four equivocal scan interpretations were analyzed as positive for this study. Two-sample T-test and Fisher's exact test were used to determine statistical significance of differences in means of background data and proportion of fluciclovine positive patients respectively.

RESULTS

Of the 51 patients who underwent fluciclovine PET-CT, 8 were on ADT at the time of the scan. 2 ADT patients were excluded from final analysis as PET-CT was within 2 days of starting ADT. Average (\pm SD, range) duration of ADT was 25.3 (\pm 41.9, 5.14-110.7) weeks. Mean PSA (\pm SD, range) was 3.15 (\pm 2.99, 0.02-7.75) ng/ml in the ADT group and 2.35 (\pm 5.26, 0.05-31) ng/ml in the ADT-naïve group. PSA values were not significantly different between both groups ($P=0.59$). Median (range) Gleason Score was 9 (7-9) in the ADT group and 7 (6-10) in the non-ADT group. Overall fluciclovine positivity rate was lower in the ADT group (66.67 %) compared to the non-ADT group (83.72%). This difference was however not statistically significant ($P=0.30$). Positivity rates increased with PSA in both groups with rates in the ADT-naïve group being 79.41%, and 100% at PSA levels <2 and ≥ 2 ng/ml, respectively; and in the ADT group 33.33% and 100% at PSA levels <2 and ≥ 2 ng/ml, respectively. Differences in positivity across PSA levels were not statistically significant ($p=0.14$ and $P=1.00$ at PSA levels <2 and ≥ 2 ng/ml, respectively), though sample size was small in each sub-category.

CONCLUSION

Fluciclovine PET-CT was able to detect prostate cancer recurrence in patients on ADT, though there seems to be a lower detection rate at PSA levels <2 ng/ml. Further study is required with greater sample size.

CLINICAL RELEVANCE/APPLICATION

Validity of radiological imaging after commencement of ADT is often queried. Our study shows that fluciclovine may be of use in this regard though detection rate may be reduced at lower PSA levels.

SSA16-03 Multiparametric [^{11}C]Acetate Positron Emission Tomography/Magnetic Resonance Imaging in the Assessment of the Prostate Cancer

Sunday, Nov. 27 11:05AM - 11:15AM Room: S505AB

Participants

Stephan H. Polanec, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Piotr Andrzejewski, MA, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medcor, Inc Research Grant, Siemens AG Research Grant, C. R. Bard, Inc
Dietmar Georg, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georgios Karanikas, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Gero Kramer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Wadsak, Vienna, Austria (*Abstract Co-Author*) Speaker, General Electric Company; Consultant, THP Medical Products Vertriebs-GmbH; Research Grant, ABX GmbH; Research Grant, Rotem GmbH
Markus Mitterhauser, Vienna, Austria (*Abstract Co-Author*) Speaker, General Electric Company
Martin Susani, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Peter Brader, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To demonstrate the feasibility of fused multiparametric [^{11}C]Acetate ([^{11}C]Ace) positron emission tomography/magnetic resonance imaging (MP [^{11}C]Ace PET/MRI) for insight into tumor biology and to investigate the value of MRI and PET parameters for primary prostate cancer (PCa) detection, local and distant staging.

METHOD AND MATERIALS

56 consecutive patients ($\bar{\text{age}}$ 67y) who fulfilled the following inclusion criteria, were included in this IRB approved prospective study: elevated PSA levels, suspicious findings at digital rectal examination or TRUS, histopathological verification. MRI protocol consisted of a T2-weighted(T2w), diffusion-weighted(DWI), dynamic contrast-enhanced(DCE), and 3D proton MR spectroscopic(1H-MRSI) MRI. Patients were injected with approx. 800MBq [^{11}C]Ace and underwent PET/CT scanning(Siemens Biograph). CT data was used for attenuation correction. Co-registration of imaging data and image fusion were performed using dedicated software. Appropriate statistical test were used to determine diagnostic accuracy of MP [^{11}C]Ace PET/MRI for prostate cancer, local and distant staging.

RESULTS

Histopathology classified 40/56(71.4%) as PCa and 16/56(28.6%) as benign. MP imaging with two parameters(T2w+DWI) achieved

the highest sensitivity, specificity and diagnostic accuracy of 95%, 68.8% and 88%, with an AUC of 0.82 for primary PCa. Neither assessments with a single parameter(AUC, 0.54-0.79), nor different combinations with two parameters(AUC, 0.67-0.76), three parameters(AUC, 0.69-0.79), four parameters(AUC, 0.73-0.76) nor five parameters(AUC, 0.731) achieved equally good results. MP[11C]Ace PET/MRI improved local staging with a sensitivity, specificity and diagnostic accuracy of 100%, 96% and 97% compared to MRI alone with 72.2%, 100% and 95.5. MP [11C]Ace PET/MRI correctly detected osseous and liver metastases in five patients.

CONCLUSION

MP[11C]AcePET/MRI is feasible, merges morphologic with functional information and allows insights in molecular and metabolic processes involved in cancer development. MP[11C]AcePET/MRI with two MRI derived parameters(T2 +DWI) yields the highest diagnostic accuracy. The addition of more parameters doesn't improve diagnostic accuracy of primary PCa detection.MP[11C]Ace PET/MRI facilitates an improved local and distant staging.

CLINICAL RELEVANCE/APPLICATION

MP [11C]Ace PET/MRI provides a "one-stop" staging in patients with primary PCa and thus has the potential to improve [M1] therapy.

SSA16-04 Comparison of MRI and 18F-FDG PET/MRI for Pretherapeutic Tumor Staging of Patients with Primary Cancer of the Uterine Cervix

Sunday, Nov. 27 11:15AM - 11:25AM Room: S505AB

Participants

Johannes Grueneisen, Essen, Germany (*Presenter*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Heubner, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG

PURPOSE

The aim of this study was to assess and compare the diagnostic potential of MRI and integrated 18F-FDG PET/MRI for the evaluation of the primary tumors as well as whole-body tumor staging of patients with cervical cancer.

METHOD AND MATERIALS

A total of 44 consecutive patients with histopathologically confirmed cervical cancer were prospectively enrolled for a whole-body 18F-FDG PET/MR examination prior to therapy. After written informed consent was obtained, all patients underwent an integrated whole-body PET/MRI examination, which comprised a diagnostic, contrast-enhanced whole-body MR protocol including dedicated imaging of the female pelvis. Two radiologists separately evaluated the MRI data, followed by readings of the PET/MRI datasets, regarding the determination of the local tumor spread of primary tumors of the uterine cervix as well as detection of nodal and distant metastases.

RESULTS

MRI and PET/MRI enabled the correct detection of 43 of the 44 primary cervical tumors, while in one patient with FIGO stage Ia, the tumor could not be identified based on either imaging technique. Furthermore, both, MRI and PET/MRI allowed for a correct determination of the T-stage in 38 (86%) out of the 44 patients. In 19 of the 44 patients lymph node metastases were present. PET/MRI revealed higher values for sensitivity (84% vs. 68%), specificity (92% vs. 87%) and diagnostic accuracy (89% vs. 80%) in comparison to MRI for the identification of nodal positive patients. In 3 patients distant metastases were present and could be detected in both imaging modalities.

CONCLUSION

The present study demonstrates the usefulness of 18F-FDG PET data as a valuable additive to MR imaging for more accurate nodal staging of patients with cervical cancer. For the determination of the local tumor spread 18F-FDG PET data does not provide an additional benefit to MRI.

CLINICAL RELEVANCE/APPLICATION

Combining high-quality MR and simultaneous PET-imaging, integrated PET/MRI enables an accurate TNM staging of tumors of the uterine cervix and may serve as a valuable alternative/adjunct for the clinical work-up in a pretreatment setting.

SSA16-05 Diffusion-weighted Whole-body Imaging with Background Body Signal Suppression (DWIBS) Co-registered with Digital FDG PET for Lymph Node Staging of Bladder Cancer

Sunday, Nov. 27 11:25AM - 11:35AM Room: S505AB

Participants

Michael V. Knopp, MD, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Huyen T. Nguyen, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Kamal S. Pohar, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Debra Zynger, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Amir Mortazavi, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop and assess the diagnostic value of a combined PET MRI protocol that uses diffusion-weighted whole-body imaging with background body signal suppression (DWIBS) and low-dose digital PET for lymph node staging in bladder cancer.

METHOD AND MATERIALS

In this prospective study we have currently 60 patients enrolled with muscle-invasive bladder cancer to undergo neoadjuvant

In this prospective study, we have evaluated 30 patients suspected with metastatic prostate cancer to undergo registration chemotherapy and functional, multi-modal MRI. Patients with suspected metastasis were recruited to a PET imaging add-on that included both conventional cPET (Gemini TF 64) and next generation digital dPET (Vereos) FDG wholebody imaging. All MRI and PET were done before radical cystectomy. Diffusion-weighted whole-body imaging with background body signal suppression (DWIBS) was performed in a 3T MRI system (Ingenia CX) after anatomical imaging and before post Gadolinium contrast imaging. High definition and ultra-high definition reconstruction using a 2-mm and 1-mm voxel volume was performed for all dPET acquisitions. Patient positioning was optimized for the co-registration of lymph nodes with high signal intensity on DWIBS with those on PET revealing elevated metabolic activity. Using blinded readers, the lesions were correlated, measured and the SUVmax recorded.

RESULTS

The sequential PET / MR imaging was successfully completed and co-registered. Image quality of dPET was consistently better than cPET and UHD recon provided the best delineation and highest measurable uptake in metabolically active nodes. UHD dPET detectable, metabolically active nodes of 5mm and larger could be matched to visible lymph nodes on DWIBS images which consistently appeared to be larger. DWIBS revealed a large number of visible lymph nodes that did not reveal any metabolic uptake even on UHD dPET. Overall, DWIBS led to an overestimation of metastatic lymph nodes compared to dPET.

CONCLUSION

Co-registered DWIBS MRI with UHD FDG dPET was readily achievable and enabled a comprehensive node mapping. dPET appears to outperform cPET with exceptional imaging quality and detectability of metabolic lymph nodes of 5mm and above indicating a substantial potential to improvement for nodal staging.

CLINICAL RELEVANCE/APPLICATION

Combined DWIBS MRI and FDG dPET imaging enables comprehensive nodal mapping. dPET using ultra high definition reconstruction appears to leap n-staging forward based on a new level of precision.

SSA16-06 A Retrospective Comparative Study of Sodium Fluoride (NaF-18)-PET/CT and Fluorocholine (F-18-CH) PET/CT in the Evaluation Skeletal Metastases in Metastatic Prostate Cancer using a Volumetric 3-D Analysis

Sunday, Nov. 27 11:35AM - 11:45AM Room: S505AB

Participants

Kalevi J. Kairemo, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Srinivas C. Kappadath, PhD, Houston, TX (*Abstract Co-Author*) Research Grant, General Electric Company
Timo Joensuu, Helsinki, Finland (*Abstract Co-Author*) Nothing to Disclose
Homer A. Macapinlac, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

FCH and NaF have been used to assess prostate cancer (PCa) bone metastases in thousands of patients. These tracers have different mechanisms of uptake – cell membrane synthesis and bone mineralization. Here we aim to characterize their difference in skeletal distribution.

METHOD AND MATERIALS

12 patients with advanced skeletal PCa (>5 lesions) who had had routinely PET/CT both with FCH and NaF on consecutive days were analyzed. Bone regions in CT were used to co-register the two PET/CT scans. Whole skeleton VOI was defined on CT of PET with HU>150, and sclerotic/dense bone as HU>600. Additional VOIs were defined for FCH and NaF PET uptakes. PET based FCH and NaF VOIs that overlapped with the CT based skeletal and sclerotic VOIs were separately generated and analyzed. Pathologic bone volumes (CT, HU>600), NaF (SUV>10) and FCH (SUV >3.5) were created. For comparison we had 5 patients diagnosed with PCa with no skeletal disease.

RESULTS

There was no statistical between the sclerosis on CT in patients with metastases and in patients with no metastases. In analogue to TLG (total lesion glycolysis), we also analyzed total choline kinase activity for FCH (TCA) and total bone demineralization activity for NaF (TBA). The TCA varied from 0.57 to 4.85 [kg] in patients with metastases, i.e. up to 16.1% of skeletal volume and this was <0.3% of skeletal volume in a PCa control patients with no metastases. The TBA varied from 0.94 to 13.6 [kg] in patients with metastases, i.e. up to 17.1% of skeletal volume. The TBA was <1.5 % of skeletal volume in PCa control patients. The sclerotic bone volume represented <3% of the pathologic FCH volume and <7% of the NaF volume in patients with multiple metastases. In the control PCa patients pathologic FCH was <0.5 % of the sclerotic bone volume and pathologic NaF volume <1 % of sclerotic bone. There was a significant correlation between TCA and S-PSA (p<0.02), indicating that FCH could be best to evaluate active skeletal disease.

CONCLUSION

Our results suggests that CT can not be used for assessment of the extent of active metastatic skeletal disease in PCa. NaF and FCH give different information about the skeletal disease. Active sites on NaF or FCH differed less from each other than sclerotic bone regions from PET activity.

CLINICAL RELEVANCE/APPLICATION

CT can not be used for assessment of the extent of active metastatic skeletal disease in PCa. Different PET modalities give substantially different information in similar disease.

SSA16-07 Comparison of FDG PET Metabolic Tumor Volume versus ADC Histogram: Prognostic Value of Tumor Treatment Response and Survival in Patients with Locally Advanced Uterine Cervical Cancer

Sunday, Nov. 27 11:45AM - 11:55AM Room: S505AB

Participants

Yoshiko Ueno, MD, PhD, Montreal, QC (*Presenter*) Nothing to Disclose
Robert Lisbona, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

Tsutomu Tamada, MD, PhD, Kurashiki, Japan (*Abstract Co-Author*) Nothing to Disclose
Amer Alaref, MD, Montreal, QC (*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
Caroline Reinhold, MD, MSc, Montreal, QC (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc

PURPOSE

To evaluate the prognostic utility of volume-based quantitative imaging parameters of fluorine 18 fluorodeoxyglucose positron emission tomography (18F-FDG PET) and apparent diffusion coefficient (ADC) histogram analysis, for tumour response to therapy and event-free survival (EFS), in patients with uterine cervical cancer receiving chemoradiotherapy (CRT).

METHOD AND MATERIALS

The study included 21 patients diagnosed with locally advanced uterine cervical cancer who underwent pre-treatment MRI and 18F-FDG PET and were treated with concurrent CRT. 18F-FDG parameters: Maximum and mean standardized uptake value (SUVmax, and SUVmean); metabolic tumour volume (MTV); total lesion glycolysis (TLG); ADC parameters: Maximum, mean, and minimum value (ADCmax, ADCmean, ADCmin); percentile ADC values (10th, 25th, 50th, 75th, 90th); skewness and kurtosis of ADC were measured and compared between the responder and non-responder groups using a Tukey's test. The Cox regression analysis was performed and Kaplan-Meier survival curves were used for EFS analysis.

RESULTS

In the non-responder group, MTV and TLG of the primary tumour were significantly higher than those of the responder group ($p = 0.04$ and $p = 0.01$, respectively). Applying Cox regression multivariate analysis, MTV (Hazard ratio [HR], 4.725; $p=0.036$), TLG (HR, 4.725; $p=0.036$), and 10th percentile ADC (HR, 5.207; $p=0.048$) showed a statistically significant association with EFS. When an optimal cut-off value was applied for MTV and TLG using ROC curve analysis, the EFS rates above the cut-off value were significantly lower than that below the cut-off value ($p=0.002$ and $p=0.002$, respectively).

CONCLUSION

Pre-treatment volume-based quantitative parameters of 18F-FDG PET may have better potential compared to ADC histogram for predicting treatment response and EFS in patients with locally advanced cervical cancer.

CLINICAL RELEVANCE/APPLICATION

Our study clearly showed that MTV and TLG can be used to identify patients with advanced uterine cervical cancer treated with CRT at high risk for recurrence. Our results also suggest that volume-based 18F-FDG PET/CT analysis could provide more effective information than volume-based ADC histogram analysis for predicting treatment outcome for patients with advanced uterine cervical cancer.

Honored Educators

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

Caroline Reinhold, MD, MSc - 2013 Honored Educator
Caroline Reinhold, MD, MSc - 2014 Honored Educator

SSA16-08 Long Term Results of A Comparative PET/CT and PET/MRI Study of 11C-Acetate and 18F-Fluorocholine for Restaging Recurrent Prostate Cancer With Low PSA

Sunday, Nov. 27 11:55AM - 12:05PM Room: S505AB

Participants

Valentina Garibotto, MD, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Thomas Zilli, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Claire Tabouret-Viaud, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Giorgio Lamanna, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Olivier Rager, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sandra Jorcano, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Hans-Joerg Veas, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Yann Seimille, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Habib Zaidi, MSc, PhD, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Osman Ratib, MD, PhD, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Raymond Miralbell, MD, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Franz Buchegger, MD, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Karl-Olof Lovblad, MD, Geneva, Switzerland (*Presenter*) Nothing to Disclose

PURPOSE

18F-fluorocholine (FCH) and 11C-acetate (ACE) are validated PET tracers for restaging of recurrent prostate cancer (PCa), targeting a common metabolic pathway (cellular membrane synthesis). Superiority in local staging is expected for ACE, given the absence of urinary excretion. Aim of this study was an intra-individual comparison of the two tracers to identify recurrent PCa at low PSA values (i.e., ≤ 3 ng/ml after surgery and ≤ 5 ng/ml after radiotherapy, RT), using clinical and imaging follow up data as gold standard.

METHOD AND MATERIALS

We included 33 subject, 29 evaluated by PET/CT and 4 by PET/MR, the same hybrid modality being used for the two tracers. Among these 5 patients were relapsing after surgery, 8 after RT and 20 after surgery and salvage RT. The gold standard was the result of the clinical and imaging follow-up at 41 months (median value: range 17-51), including biopsy of the suspected sites when indicated (6 cases). In 9 cases the recurrence was not identified (1 lost to follow-up, 2 treated with palliative androgen therapy and 6 under surveillance but negative at additional imaging).

RESULTS

The positivity rate for ACE was 66% and for FCH was 60%. The clinical and imaging follow-up confirmed that the recurrent disease was local in 11 cases, loco-regional in 4 cases, and metastatic in 9 cases (6 M1a and 3 M1b). Results were concordant in 82 % of the cases (26/33) and discordant in 7/33 cases, 6 PET/CT and 1 PET/MR. All discordant cases concerned nodal localizations: in 4 cases ACE showed additional nodal uptake (3 true positive –TP– and 1 undetermined at follow-up) and in 2 cases FCH (1 TP and 1 false positive at follow-up), while in 1 case with multiple nodal localizations 2 different nodes were positive (both TP). The discordant lymph nodes were retroperitoneal (5), pararectal (1) and external iliac (2).

CONCLUSION

In patients with recurrent PCa at low PSA values, ACE and FCH showed minor discrepancies for nodal staging, mainly in the retroperitoneal area, the majority of which confirmed as TP at follow-up. Both tracers performed equally for local recurrences.

CLINICAL RELEVANCE/APPLICATION

In relapsing patients with low PSA, 11C-acetate and 18F-choline show minor discrepancies for nodal staging, while the local and distant staging provided by the two tracers is equivalent.

SSA16-09 Impact of Imaging on Decision Making in Patients with High-Risk and Recurrent Prostate Cancer

Sunday, Nov. 27 12:05PM - 12:15PM Room: S505AB

Participants

Christina Pfannenberg, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Ferdinand F. Seith, BSC, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Susann-Cathrin Olthof, MD, Tuebingen, Germany (*Presenter*) Research Grant, Siemens AG

Christian la Fougere, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

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

Daniel Zips, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose

Arndt-Christian Muller, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare therapy management based on conventional imaging (CT/MRI/bone scan) vs. Choline/ PSMA-PET/CT in patients with high-risk or recurrent prostate cancer (PC).

METHOD AND MATERIALS

In 50 patients with high-risk or recurrent PC (=biochemical relapse) 11C-Choline- or 68Ga-PSMA-PET/CT was performed before radiotherapy planning within a prospective registry study. Only patients with conventional staging (CT/MRI/bone scan) before PET/CT (n= 36) were included in this subgroup analysis to compare management decisions before and after PET/CT concerning treatment intent (curative vs palliative) and target volume (TV) definition.

RESULTS

17 patients with high-risk PC, 12 patients with biochemical relapse after surgery and 7 patients with biochemical relapse after surgery and salvage radiotherapy were evaluated. PET/CT resulted in a change of management in 82% of patients with high-risk PC (TNM- and TV changes, n=12/17; treatment changes, n=14/17), in 66% of patients with recurrent PC (TNM- and TV changes, n=8/12) and in 85% of patients with recurrence after surgery and salvage radiotherapy (TNM- and treatment changes, n=6/7). In 2 patients who were stratified as M1 after conventional imaging PET/CT led to downstaging (M0) or detected oligometastatic disease, enabling curative therapy in both patients. In 12 patients, initially planned for curative treatment the detection of N1 (n=3) or M1 disease (n=9) shifted the treatment goal to palliative. Although patients with recurrence after surgery plus salvage radiotherapy were usually in a palliative situation, PET/CT enabled in 28% (2/7) of these patients disease localization and a curative approach. In 30% (8/27) of patients, originally considered as curable, PET/CT was useful to avoid overtreatment due to early visualization of an incurable disease. Main limitation of the study is the lack of histological verification.

CONCLUSION

PET/CT had a great impact on decision making in radiotherapy planning of patients with high-risk or recurrent prostate cancer by improving staging accuracy and preventing overtreatment. Therefore we suggest that PET/CT should be included in the work-up in specific clinical situations.

CLINICAL RELEVANCE/APPLICATION

PET/CT significantly influences therapeutic management in patients with high-risk or recurrent prostate cancer.

SSA17

Neuroradiology (Brain Tumors)

Sunday, Nov. 27 10:45AM - 12:15PM Room: N230B



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

FDA Discussions may include off-label uses.

Participants

Shinji Naganawa, MD, Nagoya, Japan (*Moderator*) Nothing to Disclose
Whitney B. Pope, MD, PhD, Los Angeles, CA (*Moderator*) Research Consultant, F. Hoffmann-La Roche Ltd; Research Consultant, Amgen Inc; Research Consultant, Tocagen Inc; ;

Sub-Events

SSA17-01 Sequential MR Diffusion for Assessment of Tumor Progression in Follow Up of Patients with Low-Grade Glioma

Sunday, Nov. 27 10:45AM - 10:55AM Room: N230B

Participants

Iris Chen, MS, New York, NY (*Presenter*) Nothing to Disclose
Marco Hefti, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Amish H. Doshi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Nadejda Tsankova, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Bradley N. Delman, MD, New York, NY (*Abstract Co-Author*) Consultant, Bayer AG; Speaker, Bayer AG
Adilia Hormigo, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Kambiz Nael, MD, New York, NY (*Abstract Co-Author*) Research Consultant, Olea Medical

PURPOSE

Apparent diffusion coefficient (ADC) has been shown to inversely correlate with tumor cellular density. Conventional imaging using serial MRIs is often challenging in evaluating progression of low-grade gliomas (LGG). The purpose of this study was to assess the role of MR diffusion in serial imaging of patients with LGG as a parameter of stability vs. high-grade transformation (HGT).

METHOD AND MATERIALS

Patients with histologically proven LGG were included in this retrospective study if they had consecutive clinical and imaging follow-up from the initial diagnosis until they underwent second surgical biopsy. All available MR exams were coregistered and ADC histogram measures determined for each patient using volume-of-interest from the FLAIR hyperintense tumor volume. Normalized ADC-10th percentile values were obtained for each time point, data were plotted over time for each patient and scored to evaluate whether values fit within the expected pattern: HGT (interval decrease in ADC); Stable (plateau, or interval increase in ADC).

RESULTS

Twenty patients with histologically proven LGG (Grade II oligodendroglioma, n=11; Grade II oligoastrocytoma n=4; Grade I-II astrocytomas, n=5) were followed up for a median of 3 years (range, 1.2 -5.5 years). A total of 60 MRI studies were evaluated (3 MRIs per patient). Based on surgical pathology on repeat biopsy, histological grade in 7 patients remained stable (grade II), while 13 patients transformed to a high-grade (Grade III n=11, grade IV n=2). Progressive downward trend of ADC was significantly associated with HGT (p=0.01, Odds Ratio:45). Sequential ADC analysis showed progressive downward trend in 10/13 (77%) in patients with HGT and remained stable/plateau in all patients who continued to be histologically stable (7/7). There was significant correlation between downward trend of ADC and HGT (r=0.74, p=0.002). Increase tumor volume measured from volumetric analysis from FLAIR imaging was not a significant association with HGT (p=0.6, Odds ratio:0.9).

CONCLUSION

Sequential ADC analysis in patients with LGG can help to identify tumor progression. Downward trend of ADC values can predict HGT despite apparent stability of tumor size and extent on conventional imaging.

CLINICAL RELEVANCE/APPLICATION

Sequential progressive decrease in ADC values is a helpful imaging parameter for follow up of patients with low-grade glioma and is highly associated with high-grade transformation.

SSA17-02 Glioma Magnetic Resonance Imaging Practices in Europe: Results From the European Society for Neuroradiology (ESNR) Diagnostic Subcommittee Survey on Glioma Imaging

Sunday, Nov. 27 10:55AM - 11:05AM Room: N230B

Participants

Stefanie C. Thust, MD,FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Tarek Yousry, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nuria Bargallo, PhD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Meike W. Vernooij, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marion Smits, MD, PhD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

PURPOSE

To assess current practices of glioma imaging throughout Europe, in particular to identify controversies, uncertainties and potential technical hurdles.

METHOD AND MATERIALS

Survey invitations were emailed to ESNR members (n=1662) and known associates (n=6400), European national radiologists' societies and posted via social media. To avoid duplicate bias, participants were instructed to supply institution details or confirm they were the only person answering from their center. The questionnaire featured 87 individual items divided into multiple choice, single best choice and free text questions on personal practice and preferred techniques.

RESULTS

224 individuals responded by 1/4/2016. Demographics: 79.9% were neuroradiologists, 9.4% general radiologists, 6.3% trainees and 4.5% other professions. More worked at academic (59.2%) than general (37.7%) hospitals with varied science support (none 39.3%, general physics 36.2%, neurophysics 23.2%). Conventional MRI: 99.1% read DWI, but methods to determine restriction differed (visual 76.8%, ADC measurement 17.4%, advanced analysis 3.1%). 82.1% performed 3D acquisitions, mostly T1 and FLAIR. Advanced MRI: 85.3% used perfusion (PWI), (83.2% DSC, 28.3% DCE, 11.5% ASL), with 48.7% acquiring PWI universally. 81.2% used MRS (single voxel 72.4%, multi-voxel 62.4%), but less routinely (21.5%). fMRI was added by 48.9% and DTI by 63.7% with around 60% results integrated into navigation systems. Among barriers to progress, lack of facility or software, time constraints and no clinician requests outweighed reimbursement issues. Scenarios: PWI was the favoured modality to identify pseudoprogression (56.1%). 22.9% used a report template, 59.9% issued qualitative reports and 27.9% obtained RANO measures. Postoperative imaging was routinely performed by 74.8% within 24-72hrs, and 17.2% reported a percent measure of resection.

CONCLUSION

This survey gathered valuable information on differences of equipment, levels of experience, financial and healthcare economic factors, which may determine the practicality of guidelines.

CLINICAL RELEVANCE/APPLICATION

The results of this analysis will inform and support the publication of practical recommendations to image glioma patients with MRI.

SSA17-03 Initial Area Under the Curve Derived from Dynamic Contrast-Enhanced MRI Combined with MGMT Promoter Methylation Status as a Predictor of Survival Outcome in Patients with Glioblastoma

Sunday, Nov. 27 11:05AM - 11:15AM Room: N230B

Participants

Yoon Seong Choi, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ho Joon Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Soo Ahn, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jinna Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung-Koo Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yaewon Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sohi Bae, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Tyler Hyungtaek Rim, Gyeonggi-do,, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the value of initial area under the curve (IAUC) derived from dynamic contrast-enhanced magnetic resonance imaging (DCE MRI) combined with MGMT promoter methylation status for predicting survival outcome in patients with glioblastoma (GBM).

METHOD AND MATERIALS

This retrospective study included 88 patients with GBM who underwent preoperative DCE MRI. The mean and 75th percentile (p75) of IAUC values at 30 (IAUC30) and 60 seconds (IAUC60) were acquired from the entire enhancing tumors. Univariate survival analyses were performed for overall survival (OS) and progression-free survival (PFS) with IAUC, MGMT, other clinical factors, and conventional MRI findings using the Kaplan-Meier method and Cox regression. Subgroup univariate analyses were performed with IAUC according to MGMT status. The multivariate models were built with and without IAUC parameters. The diagnostic accuracy and improvement in 1.5-year OS and 1-year PFS prediction of the models after adding the IAUC parameters were evaluated using receiver operating characteristic (ROC) analyses and net reclassification index (NRI). The IAUC parameters were compared according to MGMT status.

RESULTS

High IAUC parameters were associated with worse OS and PFS in the unmethylated MGMT group, but not in the methylated group and in the entire cohort. In the unmethylated MGMT group, the diagnostic accuracies for 1.5-year OS and 1-year PFS prediction were improved when IAUC parameters were added (OS area under the ROC curve [AUC], 0.87 - 0.90 and PFS AUC, 0.69 - 0.71) to the models with clinical factors and conventional MRI findings. (OS AUC, 0.77 and PFS AUC, 0.66). This improvement was significant for 1.5-year OS when the mean and 75th percentile of IAUC30, and the 75th percentile of IAUC60 were added (P = 0.001, 0.001, and 0.056 by NRI, respectively). IAUC parameters were higher in the methylated MGMT group than the unmethylated group (P < 0.05 for all).

CONCLUSION

IAUC parameters combined with MGMT status can be useful for predicting survival outcome in patients with GBM, allowing more accurate prognostication of GBM with unmethylated MGMT promoter.

CLINICAL RELEVANCE/APPLICATION

IAUC parameters combined with MGMT status can be used postoperatively as a predictor of survival outcome of GBM, allowing more accurate prognostication of GBM with unmethylated MGMT.

SSA17-04 Non-invasive 1H MR Oximetry Imaging of Human Brain Tumors at 3.0T

Sunday, Nov. 27 11:15AM - 11:25AM Room: N230B

Participants

Zhongwei Zhang, MD, PhD, Winston-Salam, NC (*Presenter*) Nothing to Disclose
Dawen Zhao, Winston Salam, NC (*Abstract Co-Author*) Nothing to Disclose
Christopher T. Whitlow, MD, PhD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Mark E. Schweitzer, MD, Stony Brook, NY (*Abstract Co-Author*) Consultant, MMI Munich Medical International GmbH Data Safety Monitoring Board, Histogenics Corporation

PURPOSE

There is increasing evidence that hypoxia (lack of oxygen) is associated with tumor aggressive, resistance to radiation therapy and increased likelihood of biochemical failure and metastatic spread. Brain tissue oxygen tension (pO₂) measurement is essential for characterizing the relationship between O₂ and metabolism, and for assessing the consequences resulting from an inadequate supply. The purpose of this study was to non-invasively measure human brain tumors oxygen tension (pO₂) using 1H MR Oximetry Imaging (MOXI).

METHOD AND MATERIALS

A total of 16 patients with histologically confirmed brain tumors were included in this study. All subjects underwent 1H MRI at 3.0 T including anatomic MR imaging, quantitative T1, T2 mappings and multiple b-value single-shot EPI diffusion measurements. T1 mapping was acquired using variable flip angle gradient echo sequence with 4 flip angles (2°, 7°, 15°, 25°), TR: 5ms. T2 mapping was acquired with a standard CPMG sequence with parameters: TR = 2500ms, 20 echoes ranging from 10ms to 200ms with 10ms echo spacing. EPI diffusion parameters are: TR/TE_{eff} = 4500/98ms and 10 b values with 0, 50, 100, 150, 200, 300, 450, 600, 900 and 1200 seconds/mm². The brain tumor pO₂ was determined using MOXI algorithm which the accuracy was validated by 19F MRI. MOXI for pO₂ estimation is based on IVIM diffusion MRI and the dependence of the blood R₂ relaxation rate on the inter-echo spacing measured using a multiple spin-echo CPMG sequence and weak-field diffusion model.

RESULTS

Representative brain tumor pO₂ maps were shown in Figure (Fig.A Glioblastoma III and Fig.B Meningioma). Noticeable heterogeneity in pO₂ levels was observed throughout the different tumor types with large pO₂ variations. The intratumoral and peritumoral pO₂ distribution can be clearly revealed by MOXI.

CONCLUSION

This study demonstrated the feasibility of determining brain tumor pO₂ by the use of MOXI. The non-invasive nature of this approach makes it particularly attractive for longitudinally assessing pO₂ in tumor. Findings of this pilot study will support MOXI as a promising tool for monitoring individual tumor oxygenation with potential applications for prognostic indicator of therapeutic response.

CLINICAL RELEVANCE/APPLICATION

MOXI provides a non-invasive promising tool for monitoring brain tumor oxygenation.

SSA17-05 In Vivo Molecular Profiling of Human Glioma by Means of Diffusion Kurtosis Imaging

Sunday, Nov. 27 11:25AM - 11:35AM Room: N230B

Participants

Johann-Martin Hempel, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose
Sotirios Bisdas, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Jens Schittenhelm, MD, PhD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Cornelia Brendle, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Benjamin Bender, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Henk Wassmann, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Marco Skardelly, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ghazaleh Tabatabai, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Salvador Castaneda Vega, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ulrike Ernemann, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Uwe Klose, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the diagnostic performance of diffusion kurtosis imaging (DKI) for in vivo molecular profiling of human glioma.

METHOD AND MATERIALS

Mean kurtosis (MK) and mean diffusivity (MD) metrics from DKI were prospectively assessed in 44 patients with histopathologically confirmed glioma. The results were compared in regard to WHO-based histological findings and molecular characteristics: isocitrate-dehydrogenase (IDH1/2) mutation status, alpha-thalassemia/mental retardation syndrome X-linked (ATRX) expression, chromosome 1p/19q loss of heterozygosity (LOH), and O6-methylguanine DNA methyltransferase (MGMT) promoter methylation status.

RESULTS

MK was significantly lower in patients with IDH1/2 mutation (0.55 ± 0.12 , $p=0.002$) and ATRX loss of expression (0.54 ± 0.15 , $p=0.036$) than in those with IDH1/2 wild type (0.69 ± 0.13) and ATRX retained expression (0.62 ± 0.13), respectively. Regarding the "integrated" molecular diagnosis, MK was significantly higher in primary glioblastoma (0.70 ± 0.13 , $p=0.002$) than in astrocytoma (0.51 ± 0.14).

CONCLUSION

MK may be used to provide insights into the molecular profile of human glioma.

CLINICAL RELEVANCE/APPLICATION

Considering the diagnostic and prognostic significance of IDH1/2 mutation status and ATRX expression, MK appears as a promising in vivo biomarker for glioma. The diagnostic performance of MK seems to fit more with the "integrated" molecular approach than the conventional histological findings of the current WHO 2007 classification.

SSA17-06 Contrast-Enhanced MRI versus Contrast-Enhanced Ultrasound: A Comparison in Glioblastoma Surgery using Intra-Operative Fusion Imaging

Sunday, Nov. 27 11:35AM - 11:45AM Room: N230B

Participants

Francesco Prada, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Valerio Vitale, MD, lecco, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimiliano Del Bene, Legnano, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Boffano, MD, Alba, Italy (*Abstract Co-Author*) Nothing to Disclose
Giovanni Mauri, MD, Milan, Italy (*Abstract Co-Author*) Consultant, Esaote SpA
Luca Maria Sconfienza, MD, PhD, Milano, Italy (*Abstract Co-Author*) Travel support, Bracco Group
Ludovico D'Incerti, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Luigi Solbiati, MD, Rozzano, Italy (*Abstract Co-Author*) Nothing to Disclose
Georgios Sakas, PhD, Darmstadt, Germany (*Abstract Co-Author*) Nothing to Disclose
Francesco DiMeco, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare intraoperative contrast enhanced ultrasound (CEUS) images to the correspondent co-planar T1 weighted contrast-enhanced magnetic resonance images (gdMRI) using fusion imaging between CEUS and pre-op MRI in glioblastoma (GBM).

METHOD AND MATERIALS

Ten patients with GBM diagnosis were retrospectively enrolled. All patients underwent tumor excision guided by navigated intra-operative US (ioUS) based on fusion imaging between ioUS and pre-operative MRI. Navigated CEUS scans were performed after intravenous administration of ultrasound contrast agents (CA), before tumor resection. Using fusion imaging we compared CEUS contrast enhancement (location, morphology, margins, dimensions, and pattern) to that of gdMRI

RESULTS

Registration between pre-operative gdMRI and ioUS demonstrated an error less than 2mm. In all cases CEUS highlighted the lesion. Contrast enhancement of gdMRI and CEUS was superimposable in all cases for location, margins, dimensions, and morphology while the pattern was the same in 9/10 cases; in one case the pattern was different.

CONCLUSION

CEUS contrast enhancement location, margins, morphology, and dimensions are superimposable to that provided by pre-operative gdMRI in all cases; while the pattern is the same in most of the cases. Taking into account that the goal of GBM resection is to remove all the gdMRI enhanced area, the information obtained with CEUS are of paramount importance in surgical management of GBM.

CLINICAL RELEVANCE/APPLICATION

CEUS permits to have in intra-operative setting information on location, morphology, margins, and dimensions of the GBM identical to that obtained pre-operatively with gdMRI, and can be used as an intra-operative guidance in GBMs removal

SSA17-07 Utility of Perfusion Fraction of Cerebral Blood Flow Before Temozolomide Treatment in Predicting Progression of Glioblastoma

Sunday, Nov. 27 11:45AM - 11:55AM Room: N230B

Participants

Ji Eun Park, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ho Sung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Joon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Chai Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Choong Gon Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if cerebral blood flow (CBF) could have predictive role in patients with glioblastoma with ongoing adjuvant temozolomide (TMZ) at first-line treatment and determine usefulness of perfusion fraction of CBF for an entire contrast enhancing lesion.

METHOD AND MATERIALS

Forty-seven patients with glioblastoma ongoing adjuvant TMZ cycles underwent arterial spin labeling (ASL) MR immediately after concurrent TMZ-radiation therapy (CCRT), and followed up clinically with MR imaging (median follow up, 250 days). Region-of-interests were drawn on ASL where increased CBF compared to contralateral normal gray matter and volume-based perfusion fraction of increased CBF for an entire contrast material-enhanced lesion was calculated. Then, patients were dichotomized to positive- or negative-CBF according to 5, 25, 75, and 95 percentile perfusion fraction cutoffs. Log-rank tests were used to evaluate the association between dichotomized CBF and time to progression by using Kaplan-Meier curves.

RESULTS

Patients with positive-CBF group showed significantly longer median TTP compared to negative-CBF group, and using 75 percentile perfusion fraction cutoff provided best prediction to TTP (positive-CBF group = 4 months vs negative-CBF group = 10 months; log-rank test, $P < .0001$). Longer median TTP in positive- CBF group was observed using 5, 25, 50, and 95 percentile perfusion fraction cutoffs (positive-CBF group = 4-7 months vs negative-CBF group = 10-21 months; log-rank test, all $P = < .001$).

CONCLUSION

Cerebral blood flow can be used to stratify progression in patients with glioblastoma with ongoing adjuvant TMZ, and perfusion fraction of CBF showed robust result on stratifying positive- and negative-CBF group.

CLINICAL RELEVANCE/APPLICATION

Positive-and negative-CBF group might be used to predict progression in patients with glioblastoma with ongoing adjuvant TMZ at their first line treatment. Not only qualitative evaluation of CBF, semiquantitative CBF measurements using volume-based perfusion fraction showed robust result on stratifying positive- and negative- CBF group.

SSA17-08 Imaging Biomarkers Predict Distinct Molecular Subgroups of Lower Grade Glioma

Sunday, Nov. 27 11:55AM - 12:05PM Room: N230B

Awards

Student Travel Stipend Award

Participants

Rachel L. Delfanti, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Carrie R. McDonald, PhD, La Jolla, CA (*Abstract Co-Author*) Consultant, CorTechs Labs, Inc
Kelly Leyden, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Anithapriya Krishnan, PhD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
David Piccioni, MD, PhD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Nikdokht Farid, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Jason Handwerker, MD, Oceanside, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tumor genotyping in neuro-oncology holds promise to differentiate histologically similar tumors and provide prognostic information. Isocitrate dehydrogenase (IDH) status has been validated as a prognostic and predictive marker, with IDH wildtype (WT) lower grade gliomas behaving analogous to glioblastoma. Similarly, codeletion of 1p19q (1p19qcode1) is established as both a prognostic and predictive marker. A novel marker, inactivating mutations of alpha-thalassemia/mental retardation syndrome X-linked (ATRX) gene is associated with IDH mutations and is mutually exclusive with 1p19qcode1. Collectively, these markers comprise three distinct molecular groups of lower grade glioma: 1) IDH wildtype (WT); 2) IDH mutant (MT)-1p19qcode1-ATRX intact; 3) IDH MT-1p19q intact-ATRX loss. Therefore, we aim to determine if these molecular subgroups can be predicted by distinct imaging characteristics.

METHOD AND MATERIALS

Pre-treatment brain MRIs were analyzed for 42 patients with pathologically proven lower grade gliomas (WHO grade II or III) by a neuroradiologist, blinded to the pathologic diagnosis and molecular status. FLAIR, post-contrast, and diffusion-weighted sequences were quantitatively evaluated and ranked. The Fisher exact test was used to evaluate the relationship of these parameters with respect to molecular status.

RESULTS

IDH WT tumors were significantly associated with an infiltrative tumor border pattern on FLAIR, whereas the IDH MT tumors demonstrated either well-defined or ill-defined borders on FLAIR ($p < 0.001$). There was no significant difference between the two IDH MT groups with regards to FLAIR tumor border pattern; however, there was a trend towards restricted diffusion among tumors with 1p19q intact-ATRX loss ($p = 0.06$). Contrast enhancement had no significant associations.

CONCLUSION

IDH WT lower grade gliomas are more likely to demonstrate an infiltrative pattern on FLAIR compared to IDH MT, corresponding to their worse prognosis. Among IDH MT tumors, there was a trend towards restricted diffusion in tumors with ATRX loss. Further forays into advanced imaging may be able to delineate these three molecular subgroups and provide essential prognostic information at initial MR diagnosis.

CLINICAL RELEVANCE/APPLICATION

With the molecular revolution in neuro-oncology underway, initial diagnostic imaging may be able to predict molecular subgroups of lower grade glioma thereby influencing upfront treatment decisions.

SSA17-09 Correlation of Major Genetic Profiles with Imaging Features in Glioblastoma for Prognosis Prediction

Sunday, Nov. 27 12:05PM - 12:15PM Room: N230B

Awards

Student Travel Stipend Award

Participants

Eun Kyoung Hong, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seung Hong Choi, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to assess major genomic profiles of glioblastoma and correlate genetic information with radiologic features including volumetrics, normalized cerebral blood volume (nCBV) and normalized apparent diffusion coefficient (nADC), and progression free survival (PFS).

METHOD AND MATERIALS

We retrospectively enrolled total of 219 patients with histopathologically diagnosed with glioblastoma, who performed conventional brain MR images, DSC PWI and DWI before treatment. Major genetic information of the tumor (e.g. IDH mutation, 1p deletion, 19q deletion, EGFR amplification, PTEN loss, ATRX loss, and p53 mutation) was analyzed in all patients. Volume of tumor on FLAIR images and enhancing portion on contrast enhanced T1-weighted (CET1) image, ratio of the two volumes and volume of necrosis within tumors were measured. The nCBV and nADC histogram parameters were calculated based on both FLAIR image and CE-T1 images. Measured parameters and PFS in different genetic profiles were compared by using independent samples t test, Mann-Whitney test and ANOVA.

RESULTS

Of 190 patients with available IDH mutation information, IDH mutation was observed in 28 cases and was absent in 162 cases. IDH mutation positive group showed higher volume ratio between FLAIR and CET1 images (8.27 vs. 3.38, $p=0.025$), and lower mean nCBV (3.89 vs. 5.21, $p=0.02$) than IDH mutation negative group. ATRX loss group revealed higher 5th percentile nADC value (1.10 vs. 1.02, $p=0.048$) than group without ATRX loss. In comparison between the three groups (IDH mutation positive, IDH mutation negative with and without ATRX loss), the 5th percentile nADC value demonstrated a significant difference (1.12 vs. 1.10 vs. 1.01, $p=0.019$). Additionally, volume ratio between FLAIR and CET1 images and 5th percentile nADC showed a positive correlation with PFS ($p=0.0018$, and <0.0001 , respectively), which was independent of genetic markers.

CONCLUSION

We found that the major genetic markers of glioblastoma including IDH mutation and ATRX loss could be predicted by using imaging biomarkers. In addition, volumetrics and nADC can be used for the prognosis prediction.

CLINICAL RELEVANCE/APPLICATION

We found a definite correlation between radiologic parameters, such as volumetrics, normalized CBV and ADC, and major genomic profiles and some radiologic parameters were feasible predictors of prognosis in glioblastoma patients.

Neuroradiology/Head and Neck (Head and Neck Tumors)

Sunday, Nov. 27 10:45AM - 12:15PM Room: N227B



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

ParticipantsRichard H. Wiggins III, MD, Salt Lake City, UT (*Moderator*) Nothing to DiscloseDan T. Nguyen, MD, Hummelstown, PA (*Moderator*) Nothing to Disclose**Sub-Events****SSA18-01 Correlation Between Quantitative Perfusion/Diffusion MRI Parameters and Human Papillomavirus Status in Oropharyngeal Squamous Cell Carcinoma**

Sunday, Nov. 27 10:45AM - 10:55AM Room: N227B

ParticipantsMiran Han, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to DisclosePae Sun Suh, Suwon, Korea, Republic Of (*Presenter*) Nothing to DiscloseTaeyang Ha, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to DiscloseSun Yong Kim, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to DiscloseJin Wook Choi, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose**PURPOSE**

Patients with oropharyngeal squamous cell carcinoma (OPSCC) that are human papillomavirus (HPV)-positive show more favorable treatment response rates and prognosis as compared to patients with HPV-negative OPSCC. This study was designed to investigate the differences in perfusion parameters from dynamic contrast enhanced MR imaging (DCE-MRI) and ADC values from DWI according to the presence of biologically active HPV in OPSCC.

METHOD AND MATERIALS

46 patients (median age 62 years, IQR = 54–72) with pathologically confirmed OPSCC and underwent pretreatment DCE-MRI and DWI were enrolled and analyzed in this retrospective study. The DCE-MR and diffusion images were post-processed by using commercially available software (nordicICE, NordicNEuroLab). Quantitative parameters (*K_{trans}*, *K_{ep}*, *V_e*, *V_p*, *AUC₆₀*-area under the signal intensity-time curve at initial 60s) from DCE-MRI and ADC value from DWI were calculated within the manually placed ROI plotted around the main tumor on every image slice. Histogram parameters consisting of mean, median, 25th, 75th percentile value, skewness and kurtosis of DCE-MRI parameters and ADC values were compared between the HPV-positive and HPV-negative groups using the Mann-Whitney U test.

RESULTS

16 patients were HPV-positive (34.8%). Patient's age ($p=0.021$) and T stage of OPSCC ($p=0.012$) are significantly different between HPV-positive and HPV-negative group. Among quantitative parameters from DCE-MRI and DWI, skewness of *K_{ep}* ($p=0.016$) and skewness ($p=0.005$), Kurtosis ($p=0.015$) of ADC show statistically significant difference between HPV-positive and HPV-negative OPSCC.

CONCLUSION

Tumor heterogeneity factor, skewness and kurtosis of ADC value show significant difference between HPV-positive and HPV-negative group. Our preliminary evidence promise imaging parameters could reflect HPV status in OPSCC.

CLINICAL RELEVANCE/APPLICATION

Tumor heterogeneity factor from imaging parameters could reflect HPV status in oropharyngeal squamous cell carcinoma.

SSA18-02 The Use of Imaging, PET/CT and MRI, for Prognostication and Risk Stratification of Patients with Nasopharyngeal Carcinoma

Sunday, Nov. 27 10:55AM - 11:05AM Room: N227B

ParticipantsHui Yuan, MBBS, MMed, Hong Kong, Hong Kong (*Presenter*) Nothing to DiscloseQi-Yong Ai, MBBS, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to DiscloseDora Kwong, MD, MBBS, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to DiscloseDaniel Y. Fong, PhD, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to DiscloseAnn D. King, MD, Shatin, Hong Kong (*Abstract Co-Author*) Nothing to DiscloseVictor H. Lee, MD, MBBS, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to DisclosePek Lan Khong, MBBS, FRCR, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose**PURPOSE**

To compare and evaluate the roles of metabolic and morphological parameters using PET/CT and MRI for prognostication and risk stratification of patients with nasopharyngeal carcinoma (NPC).

METHOD AND MATERIALS

Newly diagnosed non-metastatic NPC patients who underwent 18F-FDG PET/CT and contrast-enhanced MRI for staging were recruited. Primary tumor and nodal lesions were identified and segmented, using a threshold of $SUV=2.5$ on PET and standardized

morphological criteria including size for nodes on MRI, by two independent teams. T stage was assessed based on MRI while N stage was based on both MRI and PET/CT (AJCC-TNM 7th edition). SUVmax, Metabolic Tumor Volume (MTV) and morphological tumor volume (VOL) of the lesions were computed. Cox-regression model (univariable followed by multivariable) was used for survival analysis with overall survival (OS) and recurrence-free survival (RFS) as end points. Classification And Regression Tree (CART) was adopted for risk-stratification, with risk-layers verified using Kaplan-Meier model. p-value <0.05 was considered statistically significant.

RESULTS

A total of 201 patients (148 male) aged 49.7±13.5 years old (mean ± SD) were included. Sixteen, 49, 81 and 55 patients were in stage I, II, III and IV respectively. TNM stage (HR=2.350, 95%CI: 1.119-4.936, p=0.024) and nodal VOL (HR=1.034, 95%CI: 1.034-1.014, p=0.001) were independently predictive of RFS while only nodal VOL (HR=1.030, 95%CI: 1.006-1.054, P=0.013) was independently predictive of OS. Three risk layers were identified for RFS (P<0.001 for log-rank): Stage I and II with nodal VOL<18cc (HR=1), stage III and IV with nodal VOL<18cc (HR=2.903), and nodal VOL>18cc (HR=7.956) regardless of disease stage. For OS, only two risk layers were identified (p=0.001): nodal VOL<18cc (HR=1) and nodal VOL>18cc (HR=4.265).

CONCLUSION

Nodal volume is an important factor in prognostication and risk stratification of newly diagnosed NPC patients, and when exceeding 18cc over-rides TNM stage. This has potential implications on patient management.

CLINICAL RELEVANCE/APPLICATION

Nodal volume is important in prognostication and risk stratification of newly diagnosed NPC, and when exceeding 18cc over-rides TNM stage. This has potential implications on patient management.

SSA18-03 Metastatic Nodes Injected with Talimogene Laherparepvec in Patients with Melanoma: Increased Size Does Not Necessarily Indicate Progression

Sunday, Nov. 27 11:05AM - 11:15AM Room: N227B

Participants

Carlos Zamora, MD, PhD, Chapel Hill, NC (*Presenter*) Nothing to Disclose
Edward M. Lopez, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Frances Collichio, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Mauricio Castillo, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the imaging response of metastatic nodes injected with talimogene laherparepvec in patients with melanoma.

METHOD AND MATERIALS

Twelve locally injected nodes in 7 patients were followed with serial contrast-enhanced CT and compared with baseline. Node size and margins (smooth vs. infiltrative) were recorded.

RESULTS

Median follow up was 277 days. Two major growth patterns were observed. Six of 12 nodes (50%, pattern 1, figure 1a) showed increase in size followed by decreased size, with size at final follow up smaller than baseline. Five of 12 nodes (42%, pattern 2, figure 1b) showed a downward trend in size. Two of these showed minor increases in size during follow up but never larger than baseline. Two of 5 were non-measurable at last follow up CT. Finally, 1 separate node showed an upward trend (marked with an asterisk, figure 1a) but could not be followed after 184 days as the patient was placed under hospice care due to disease progression. Nine of 12 nodes (75%) had smooth margins at baseline and the rest were infiltrative. Six of 9 nodes eventually developed infiltrative margins at some point, including five nodes with final decreased size at follow up.

CONCLUSION

Nodes injected with talimogene laherparepvec can increase in size and develop infiltrative margins. Such changes can be seen even in lesions with ultimate treatment response.

CLINICAL RELEVANCE/APPLICATION

Increase in size of nodes injected with talimogene laherparepvec does not necessarily indicate progression. Infiltrative margins are also frequently seen and may be confused with extracapsular spread.

SSA18-04 Maxilla and Mandible Tumors: Combined Quantitative MRI Assessment and Conventional MRI for Differentiation of Tumors of Different Historical Types

Sunday, Nov. 27 11:15AM - 11:25AM Room: N227B

Participants

Yingwei Wu, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Xiao-Feng Tao, MD, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of quantitative parameters from diffusion-weighted MR imaging (DWI), dynamic contrast enhanced MR imaging (DCE-MRI), and MR spectrum (MRS) in patients with maxilla and mandible neoplasm.

METHOD AND MATERIALS

Materials and Methods: Total 524 patients (327 benign and 197 tumors) from 2002-2012 with maxilla and mandible neoplasm were recruited. All patients were underwent surgery and histology evaluation. Routine maxillofacial MRI was performed on all patients prior to surgery. Demographic information (age, sex) was searched in medical history. MR findings (size, margin, shape, envelope and signal of masses, bone destruction) were observed and recorded. DWI with b factor of 0 and 1000 s/mm², DCE-MRI and MRS was performed on 79 patients (49 benign and 30 malignant tumors). Quantitative parameters included ADC value, time-intensity

curve (TIC) with parameters and Cho peak were obtained from the MR imaging. Single or combined parameters were fitted to single or multiple logistic regression models, respectively.

RESULTS

In the cohort of 524 patients, tumor size (malignant: 3.9cm vs benign: 2.6cm), unclear margin (malignant: 87% vs benign: 41%) and bone destruction (malignant: 79% vs benign: 34%) were found significantly different between benign and malignant group. For quantitative assessment in 79 patients, ADC value lower than cut-off point of $0.91 \times 10^{-3} \text{mm}^2/\text{s}$, TIC pattern with time to peak less than 120s and low washout ratio (<30%) and increased Cho peak were the valuable parameters for predicting malignancy. A combination of those parameters yielded a sensitivity, specificity and diagnostic accuracy and of 93.9%, 96.0% and 97.9%, respectively. Positive predictive value and negative predictive value for distinguishing benign and malignant tumors are 94.6% and 97% respectively.

CONCLUSION

Quantitative assessment was more valuable for predicting malignancy in maxilla and mandible neoplasm than routine MR findings. Using combination of quantitative parameters could greatly improve diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

combined quantitative MRI assessment and conventional MRI may help preoperatively characterize maxilla and mandible tumors and help predict the benignity and malignancy of the tumors.

SSA18-05 MR Imaging of Parotid Gland Tumors: Added Value of Permeability MR Imaging

Sunday, Nov. 27 11:25AM - 11:35AM Room: N227B

Participants

Hidetake Yabuuchi, MD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Satoshi Kawanami, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Kamitani, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Sagiyama, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuzo Yamasaki, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Shunsuke Kamei, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine added value of permeability MR imaging to T2-weighted images (T2WI), time intensity curve (TIC) analysis, and intra-voxel incoherent motion -diffusion-weighted imaging (IVIM-DWI) in characterization of parotid tumors.

METHOD AND MATERIALS

Sixty-one patients with pathologically proven parotid tumors who underwent T2WI, IVIM-DWI, and permeability MR imaging were enrolled. We measured signal intensities (SI) ratio of the lesion to the neighborhood muscle on T2WI. TIC patterns were categorized as follows: type A, persistent; type B, washout; and type C, plateau. Apparent diffusion coefficient (ADC), D and f were measured on IVIM-DWI. K_{trans}, K_{ep}, V_e, and V_p were measured from permeability MR imaging. We applied Kruskal-Wallis and Steel-Dwass tests to determine whether any differences among four histopathologic types (pleomorphic adenoma, Warthin's tumor, other benign tumors, and malignant tumors) could be seen. Diagnostic accuracy was compared before and after modification diagnosis referring to permeability MR imaging data.

RESULTS

The 49 benign tumors consisted of 23 pleomorphic adenomas, 16 Warthin's tumors, 10 various benign tumors, and 12 malignant tumors were enrolled. There was no significant difference in SI lesion/muscle, f, and K_{trans}. ADC and D of malignant tumors (1.02 ± 0.23 , 0.86 ± 0.25) were significantly lower than those of pleomorphic adenomas (1.58 ± 0.40 , 1.45 ± 0.41) and other benign tumors (1.25 ± 0.29 , 1.03 ± 0.30), but higher than those of Warthin's tumors (0.90 ± 0.21 , 0.69 ± 0.16). K_{ep} and V_p of Warthin's tumors (0.73 ± 0.11 , 0.044 ± 0.019) were significantly higher than those of malignant tumors (0.45 ± 0.084 , 0.036 ± 0.013). V_e of pleomorphic adenomas (0.57 ± 0.50) was significantly higher than those of Warthin's tumors (0.14 ± 0.093) and malignant tumors (0.26 ± 0.11). In type B and C TIC patterns, positive predictive value improved in addition of K_{ep}, V_p, and V_e compared with ADC and D alone.

CONCLUSION

There is added value of permeability MR imaging data including K_{ep}, V_p, and V_e in the characterization of parotid gland tumors to conventional MR imaging.

CLINICAL RELEVANCE/APPLICATION

Combination of conventional and permeability MR imaging might help to characterize parotid gland tumors more accurately, and patients could avoid unnecessary surgery for benign tumors or the delay of treatment for malignant tumors.

SSA18-06 Localization of Parotid Gland Tumors in Relation to the Intraparotid Facial Nerve on 3D-Double-Echo Steady-State with Water Excitation Sequence

Sunday, Nov. 27 11:35AM - 11:45AM Room: N227B

Participants

Hiroyuki Fujii, MD, Shimotsuke, Japan (*Abstract Co-Author*) Nothing to Disclose
Akifumi Fujita, MD, Shimotsuke, Japan (*Presenter*) Nothing to Disclose
Hidenori Kanazawa, Shimotsuke, Japan (*Abstract Co-Author*) Nothing to Disclose
Edward K. Sung, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Osamu Sakai, MD, PhD, Boston, MA (*Abstract Co-Author*) Consultant, Guerbet SA
Hideharu Sugimoto, MD, Shimotsuke, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to investigate the accuracy of 3D double-echo steady-state with water excitation (3D-DESS-WE)

MR imaging sequence in localizing parotid gland (PG) tumors in relation to direct visualization of the intraparotid facial nerve (FN), in comparison to indirect method of localization.

METHOD AND MATERIALS

We retrospectively reviewed 57 consecutive patients with PG lesions. Two radiologists independently evaluated the detectability of the intraparotid FN on the 3D-DESS-WE sequence in preoperative MR imaging. The location of the PG lesions were categorized into the superficial or deep lobe based on two methods: 1) direct method with visualization of the intraparotid FN on 3D-DESS-WE, and 2) indirect method with approximation of the intraparotid FN using the FN line connecting the lateral surface of the posterior belly of the digastric muscle to the lateral surface of the ascending ramus of the mandible. Locations of PG lesions were confirmed by surgery. The diagnostic accuracy of PG lesion localization using the two methods was compared using the McNemar test.

RESULTS

Of the 114 PGs evaluated using the 3D-DESS-WE, the detectability of the intraparotid FN was 98.2% for the main trunk, 64.9% for the temporofacial branches, and 37.7% for the cervicofacial branches. The interobserver variability between the two radiologists was excellent ($\kappa=0.89$). A total of 58 PG lesions were evaluated for localization. Surgical findings confirmed 45 lesions localized to the superficial lobe, and 13 lesions localized to the deep lobe. The diagnostic accuracy of the 3D-DESS-WE method in lesion localization was 96.6% in total, with 100% accuracy for superficial lobe lesions, and 84.6% accuracy for deep lobe lesions. The diagnostic accuracy of the FN line method in lesion localization was 81.0% in total, with 93.3% accuracy for superficial lobe lesions, and 46.2% accuracy for deep lobe lesions. The difference in accuracy of PG lesion localization between the two methods was statistically significant ($p=0.021$).

CONCLUSION

We can achieve higher diagnostic accuracy in localizing PG tumors by directly visualizing the intraparotid FN using 3D-DESS-WE, compared to approximations using an indirect method.

CLINICAL RELEVANCE/APPLICATION

The spatial relationship of the intraparotid FN relative to a PG tumor is important for preoperative planning, and can optimize the surgical approach to prevent injury to the facial nerve.

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/>

Akifumi Fujita, MD - 2015 Honored Educator
Osamu Sakai, MD, PhD - 2013 Honored Educator
Osamu Sakai, MD, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2015 Honored Educator

SSA18-07 An Active Surveillance Protocol for Low-risk Thyroid Cancer: How Many Patients Would Be Eligible?

Sunday, Nov. 27 11:45AM - 11:55AM Room: N227B

Awards

Student Travel Stipend Award

Participants

Andrew Griffin II, MD, Durham, NC (*Presenter*) Nothing to Disclose
Manisha Bahl, MD, MPH, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Juan Brito Campana, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jenny K. Hoang, MBBS, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The 2015 American Thyroid Association thyroid cancer management guidelines state that an active surveillance management approach can be considered as an alternative to surgery in patients with low risk thyroid tumors. Criteria for selection of patients for active surveillance is important and such a clinical decision making framework has been developed at Memorial Sloan Kettering Cancer Center. The aim of this study is to determine the proportion of thyroid cancers in a large cohort of patients that would meet criteria for active surveillance.

METHOD AND MATERIALS

We retrospectively reviewed 681 patients with thyroid cancer who underwent thyroid surgery between 2003 and 2012. The decision making framework for active surveillance was retrospectively applied to determine how many of these patients would have met criteria for surveillance. Patients with papillary microcarcinomas ($\leq 1\text{cm}$) were categorized as ideal, appropriate and inappropriate based on imaging findings and patient characteristics.

RESULTS

Of 681 patients with thyroid cancer, 419 (62%) were papillary carcinoma and 182 (27%) were papillary microcarcinomas at pathology. 163/182 (90%) were associated with nodules seen on preoperative imaging. The others were incidental papillary microcarcinomas in the pathology specimen. In the patients who had papillary microcarcinoma associated with a thyroid nodule, only 34/163 (21%) were located within nodules measuring $\leq 1\text{cm}$ on preoperative imaging. When the risk stratification clinical decision framework was applied, 15 patients were not low-risk and therefore not appropriate for surveillance: 2 had prior history of thyroid cancer and 13 had suspicious lymph nodes on imaging. For the remaining 19 low-risk cases, one was categorized as "ideal" and 18 were "appropriate" for active surveillance. This represents 3% of all patients with thyroid cancers and 5% of patients with papillary cancers.

CONCLUSION

Although almost one third of cancers in patients undergoing thyroid surgery were papillary microcarcinomas, only a small percentage

Although almost one third of cancers in patients undergoing thyroid surgery were papillary microcarcinomas, only a small percentage of thyroid cancers meet criteria for active surveillance.

CLINICAL RELEVANCE/APPLICATION

A program of active surveillance of thyroid cancers would not place a large burden on endocrinology and radiology departments for imaging follow-up.

SSA18-08 Differentiation of Benign and Malignant Lesions of the Tongue by Using High Resolution Diffusion-Weighted Magnetic Resonance Imaging with Readout-Segmented Echo-Planar Imaging at 3.0 T

Sunday, Nov. 27 11:55AM - 12:05PM Room: N227B

Participants

Shujian Li, Zhengzhou, China (*Presenter*) Nothing to Disclose
Jingliang Cheng, MD, PhD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yong Zhang, DO, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zanxia Zhang, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Readout mosaic segmentation has been suggested as an alternative approach to echo-planar imaging (EPI) for high resolution diffusion-weighted imaging (DWI). The purpose of this study was to assess the role of readout-segmented EPI (RS-EPI) using parallel imaging and a two-dimensional navigator-based reacquisition (RESOLVE) for DWI in differentiating benign and malignant lesions of the tongue at 3.0 T field strength imaging.

METHOD AND MATERIALS

66 patients with 66 solid lingual tumors and tumorlike lesions underwent conventional MRI and RESOLVE DWI with b-values of 0 and 1000 s/mm² before therapy. The apparent diffusion coefficient (ADC) values and the relative apparent diffusion coefficients (rADC) values of the lingual lesions were calculated and compared between benign and malignant lesions of the tongue. The diagnostic performance of the ADC values and the rADC values was calculated using receiver operating characteristic (ROC) curve analysis.

RESULTS

The mean ADC values and rADC values of malignant tumors was significantly lower than that of benign solid lesions ($p < 0.001$, $p < 0.001$). The mean ADC values and rADC values of squamous cell carcinomas were significantly lower than that of adenoid cystic carcinomas ($p = 0.001$, $p = 0.002$), vascular malformation ($p < 0.001$, $p < 0.001$) and inflammatory lesions ($p = 0.001$, $p = 0.002$). The mean ADC values and rADC values of adenoid cystic carcinomas and inflammatory lesions were significantly lower than that of vascular malformation ($p = 0.021$, $p = 0.006$), ($p = 0.021$, $p = 0.026$). No significant differences were seen in the mean ADC values and rADC values of adenoid cystic carcinomas and inflammatory lesions ($p = 0.715$, $p = 0.855$). Receiver operating characteristic analysis showed that when an ADC value $< 1.37 \times 10^{-3}$ mm²/s was used for predicting malignancy, the highest sensitivity of 93.02%, specificity of 86.96% and accuracy of 90.91% were obtained. The optimum threshold for the rADC value was 0.74, resulting in a sensitivity of 90.70%, a specificity of 86.96% and an accuracy of 89.39%.

CONCLUSION

RESOLVE can potentially offer high quality of lingual diffusion-weighted images. ADC mapping may be an effective MR imaging tool for the differentiation of benign and malignant lesions of the tongue.

CLINICAL RELEVANCE/APPLICATION

RESOLVE DWI can be applied as a complementary tool in the differentiation of benign and malignant lesions of the tongue.

SSA18-09 To Evaluate the Differential Role of PET-CT and Post Contrast MRI in Head and Neck Tumours with Local Metastases

Sunday, Nov. 27 12:05PM - 12:15PM Room: N227B

Participants

Sikandar M. Shaikh, DMRD, Hyderabad, India (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate significant differences between the results of 18F-FDG-PET/CT and MRI in their ability to detect primary head-and-neck cancer and local metastatic spread.

METHOD AND MATERIALS

The test results of 21 patients with suspected primary head-and-neck cancer which were examined with dedicated examination of the neck at simultaneous 18-F-FDG-PET/CT and immediately thereafter a simultaneous post contrast MRI were analysed. A nuclear medicine physician and a radiologist evaluated the data of both examinations in consensus in a blinded manner with a 6-week gap between evaluation of the two examinations. Thereafter the results were compared with the gold standard of histopathological report, follow-up imaging or a consensus interpretation of all available data. Sensitivity, specificity, positive (PPV) and negative predictive value (NPV) were calculated for both methods.

RESULTS

Altogether 45 lesions were detected in PET/CT and 63 lesions in MRI. By use of gold standard 25 malignant lesions were found, 8 primary tumours and 30 lymph node metastases. PET/CT presented a sensitivity of 69.6%, a specificity of 97.4%, a PPV of 92.9% and a NPV of 87.0%. PET/MRI presented a sensitivity of 80.4%, a specificity of 90.8%, a PPV of 78.3% and a NPV of 91.8%.

CONCLUSION

MRI shows a higher sensitivity but a lower specificity in detection of primary head-and-neck cancer and local metastases in comparison to 18F-FDG-PET/CT.

CLINICAL RELEVANCE/APPLICATION

MR is superior as it has very Good soft tissue sensitivity compared with PET-CT

SSA19

Neuroradiology (Cerebrovascular Imaging)

Sunday, Nov. 27 10:45AM - 12:15PM Room: N229



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

Participants

Aaron S. Field, MD, PhD, Madison, WI (*Moderator*) Nothing to Disclose

Roland R. Lee, MD, San Diego, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSA19-01 Clinical Impact of Preoperative Brain MR Angiography and MR Imaging in Candidates for Liver Transplantation: A Propensity Score Matching Study in Single Institution

Sunday, Nov. 27 10:45AM - 10:55AM Room: N229

Awards

Student Travel Stipend Award

Participants

Mi Sun Chung, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

Ho Sung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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

Seung Chai Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Choong Gon Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Sang Joon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We investigated the prevalence of cerebrovascular disease and white matter lesions on preoperative MR angiography (MRA) and imaging (MRI) in liver transplantation (LT) candidate and evaluated the association between pre-LT MR findings and perioperative stroke.

METHOD AND MATERIALS

This retrospective study included 1460 consecutive patients with LC who underwent MR for pre-LT evaluation. We matched these patients with 5331 healthy controls based on propensity scores for stroke risk factors and compared prevalence of significant cerebrovascular stenosis and white matter lesions, which were defined as > 50% stenosis in intra/extracranial vessels on MRA and more than moderate degree of Fazekas scale on MRI. The associations between these MR findings and clinical parameters with perioperative cerebral infarction and hemorrhage were evaluated using multivariable analyses.

RESULTS

A matched analysis of 1264 pairs demonstrated that the prevalence of significant cerebrovascular stenosis did not differ between LC and healthy patients (2.2% vs 1.4%; $P=0.143$). LC and LC-related parameters (except hepatitis C infection) had no association with significant stenosis. Significant white matter lesions were more common in LC patients (2.8% vs 1.3%; $P=0.036$). The presence of significant stenosis or white matter lesions was not associated with perioperative stroke or hemorrhage (both $P=1.00$), whereas a preoperative high Model for End-Stage Liver Disease (MELD) score which indicates severity of hepatic dysfunction (OR, 1.11; CI 1.03-1.20; $P=0.008$ for infarction and OR, 1.1; CI 1.04-1.16; $P=0.001$ for hemorrhage) and stroke history (OR, 179.06; CI 45.19-709.45; $P<0.001$ for hemorrhage) were predictors of perioperative stroke.

CONCLUSION

LC and healthy population demonstrated similar prevalence of significant cerebrovascular stenosis on MR, whereas white matter lesions were more common in LC patients. Rather than significant cerebrovascular stenosis or white matter lesions, a high MELD score and stroke history contribute as predictors of perioperative stroke.

CLINICAL RELEVANCE/APPLICATION

The rationale for performing routine MRA with or without MRI as a part of preoperative workup for LT candidate remains inconclusive and may not be necessary.

SSA19-02 Single Versus Double Dose of Gadolinium Comparison on 3D CE-T1 Weighted FSE Black Blood MRI in Vessel Wall Imaging: A Preliminary Study for Gadolinium Dose Optimization for the Evaluation of Atherosclerotic Plaque

Sunday, Nov. 27 10:55AM - 11:05AM Room: N229

Participants

A Leum Lee, MD, Bucheon-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose

Yousun Won, MD, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Hyunji Kim, Bucheon City, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Gihyun Jang, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this prospective preliminary study was to compare the efficacy of a single dose (SD) and double dose (DD) of gadolinium (Gd) for the evaluation of plaque by using high-resolution magnetic resonance vessel wall imaging (HR-MR VWI) and to develop a useful strategy for conducting clinical trials on VWI by establishing the best trade-off in terms of dose.

METHOD AND MATERIALS

We obtained institutional review board approval and written informed consent from all patients before study initiation. From June 2013 to March 2015, we performed 3T HR-MR VWI in 45 consecutive patients (M:F = 29:16) with carotid and intracranial artery stenosis. DD-enhanced scans were obtained 10 min after the injection of an SD of Gd (0.2 mmol/Kg). For SI comparison, reconstructed 0.5-mm-thick isotropic FSE-CUBE images were assessed to determine the SNR_{wall} and CNR_{wall-lumen} of the SD- and DD-enhanced T1 images. Quantitative measurements were performed using the FuncTool II software on a Sun ADW4.3 workstation (GE Healthcare), with 400% zooming. The wall thickness, vessel area (VA), and lumen area (LA) on a cross-sectional image of the target vessel were manually measured by two neuroradiologists. Visual assessment for image quality and additional findings on the DD-scan were recorded. Inter- and intra-observer variabilities were assessed using intraclass correlation coefficients (ICCs). The Mann-Whitney U test and the Wilcoxon two-sample test were used for statistical comparison.

RESULTS

The DD-enhanced images resulted in a 24% and 13% improvement in the SNR_{wall} and CNR_{wall-lumen}, relative to the SD images, although the difference was not statistically significant ($p=0.06$). Inter- (ICC: 0.91, 0.92, and 0.90, respectively) and intra-observer (0.92, 0.88, and 0.93, respectively) reliabilities for the measurements of wall thickness, VA, and LA were good. On visual assessment, the DD-enhanced scans showed better image quality, relative to the SD scans, with statistical significance ($p<0.05$).

CONCLUSION

The results of this study suggest that a DD of Gd might be helpful to delineate plaque enhancement, intramural hematomas, and to measure stenosis.

CLINICAL RELEVANCE/APPLICATION

This study shows that VWI of intracranial atherosclerotic plaque using DD of Gd. can provide better evaluation of plaque enhancement, intramural hematoma, and measurement of stenosis. A larger cohort study would be necessary.

SSA19-03 Correlation of Permeability and Perfusion in Delayed Cerebral Ischemia After Aneurysmal Subarachnoid Hemorrhage

Sunday, Nov. 27 11:05AM - 11:15AM Room: N229

Awards

Trainee Research Prize - Resident

Participants

Elizabeth K. Weidman, MD, New York, NY (*Presenter*) Nothing to Disclose
Omar N. Kallas, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jana Ivanidze, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mary Sun, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose
Amit Kohli, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose
Amber DaPrano, ARRT, RT, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose
Angela Hoang, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose
Gulce Askin, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ajay Gupta, MD, New York, NY (*Abstract Co-Author*) Consultant, Biomedical Systems;
Pina C. Sanelli, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Microvascular dysfunction resulting in alterations in permeability and perfusion is thought to contribute to the development of delayed cerebral ischemia (DCI) after aneurysmal subarachnoid hemorrhage (aSAH). We evaluate the relationship between blood brain barrier (BBB) permeability parameters (K_{trans}, K_{ep}, V_E) and perfusion parameters (CBF, CBV, MTT) in aSAH patients who developed DCI and those who did not.

METHOD AND MATERIALS

Extended-pass CT perfusion (CTP) exams performed at days 0-19 on consecutive aSAH patients were retrospectively reviewed. CTP data was post-processed using standardized methods and contiguous ROI placement sampling the cortex to assess quantitative permeability (K_{trans}, K_{ep}, V_E) and perfusion (CBF, CBV, MTT) parameters. DCI was determined by established criteria using primary outcome measures of infarction on imaging and permanent neurologic deficit distinct from presentation and secondary outcome measure of clinical deterioration. ROI-based analyses were performed to assess the correlation of each pairing of permeability and perfusion parameters in patients with and without DCI using a weighted average correlation coefficient.

RESULTS

71 CTP exams from 36 patients (12 DCI, 24 non-DCI) with aSAH were analyzed. There were no statistically significant differences in the demographic characteristics of the DCI and non-DCI groups, except for the Hunt and Hess (HH) grades on admission. As expected, non-DCI patients had lower HH scores. In DCI patients, a strong to very strong positive correlation was found between CBF:K_{trans}, CBF:V_E, CBV:K_{trans}, and CBV:V_E ($r = 0.82, 0.74, 0.82, 0.77, p < 0.05$). In non-DCI patients, no statistically significant relationship was found between permeability and perfusion parameters.

CONCLUSION

We have demonstrated that changes in CBF and CBV are strongly correlated with changes in permeability in patients who develop DCI that is not present in non-DCI patients. This data indicates that non-DCI patients have an intact BBB since permeability is not affected by CBF changes as would be expected under normal conditions, and furthermore supports the hypothesis that microvascular dysfunction with altered BBB permeability occurs in patients who develop DCI.

CLINICAL RELEVANCE/APPLICATION

Extended-pass CTP may be able to detect DCI earlier by evaluating the correlation between permeability and perfusion in order to prompt immediate treatment, and thus improve outcomes in aSAH patients.

SSA19-04 Impact of Asymptomatic Intracranial Aneurysms Probabilistic Atlas Model on a Computer-aided

Framework for Detecting Small Aneurysms

Sunday, Nov. 27 11:15AM - 11:25AM Room: N229

Participants

Ze Jin, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Hidetaka Arimura, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukunori Korogi, MD, PhD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Shingo Kakeda, MD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Fumio Yamashita, PhD, Morioka, Japan (*Abstract Co-Author*) Nothing to Disclose
Makoto Sasaki, MD, Yahaba, Japan (*Abstract Co-Author*) Research Consultant, Hitachi, Ltd Research Consultant, Olea Medical Research Grant, Hitachi, Ltd Speaker, General Electric Company Speaker, Hitachi, Ltd Speaker, DAIICHI SANKYO Group Speaker, Otsuka Pharmaceutical Co, Ltd Speaker, Mitsubishi Corporation Speaker, Johnson & Johnson Speaker, Boehringer Ingelheim GmbH Speaker, Novartis AG Speaker, FUJIFILM Holdings Corporation

PURPOSE

For early detections of asymptomatic intracranial aneurysms (AIA), computer-aided detection (CADE) frameworks were developed to shorten the reading time while improving diagnostic performance. However, the probabilistic atlas (PA) of AIA with their favorite sites has not been explored and applied for CADE frameworks. Therefore, we developed an AIA-PA model, which was constructed by clinical cases to indicate the favorite sites of AIA, can reduce the number of false positives (FPs) for CADE frameworks at 3.0 magnetic resonance angiography (MRA), and investigated its impact.

METHOD AND MATERIALS

An AIA-PA model was constructed by depicting Gaussian distributions to a modeled brain vessel image according to the relative location between aneurysms and vessels based on 60 patents with 66 aneurysms. AIA-PA model was applied to 22 clinical MRA images with 24 small aneurysms (median: 4.0 mm, range: 1.7-6.4 mm) for detection. Modeled brain vessel image was aligned to clinical MRA vessel images by using a thin plate spline robust point matching (TPS-RPM) method on their skeletonized images. Afterwards, Gaussian distributions in AIA-PA model were registered to the clinical cases by using the same translation vector on its closest deformed skeletonized vessel images. Therefore, the registered AIA-PAs were used to remove FPs for a CADE framework by optimizing the Gaussian threshold to remove outliers. The impact was evaluated by measuring the remaining initial number of FPs and free-response receiver operating characteristic curves between two simple CADE frameworks, which were incorporated with an ellipsoid convex enhancement filter for selectively enhancing aneurysms shape structures.

RESULTS

The average numbers of FPs per case of initial candidates obtained using two CADE frameworks with and without using the AIA-PA model were 26.8 and 45.6 at a sensitivity of 100%, respectively. The final numbers of FPs per case for the two frameworks were 3.1 and 7.8 on average at a sensitivity of 75%, respectively, after further rule-based and support vector machine-based removal of FPs.

CONCLUSION

The AIA-PA model would be effective in reducing the number of FPs for CADE frameworks of AIA at 3.0 MRA.

CLINICAL RELEVANCE/APPLICATION

Although the asymptomatic intracranial aneurysms probabilistic atlas model was constructed by 66 aneurysms, the model can be rebuilt based on many cases in each institution for their own CADE systems.

SSA19-05 High-Resolution Magnetic Resonance Imaging with 3D Parallel Multi-channel Transmission Method for the Evaluation of Intracranial Artery Disease: Noninferiority Study

Sunday, Nov. 27 11:25AM - 11:35AM Room: N229

Participants

Mi Sun Chung, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seung Chai Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seon Ok Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ho Sung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Choong Gon Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Joon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sun Uck Kwon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Dong-Wha Kang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Sung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether high-resolution magnetic resonance imaging (HR-MRI) performed with parallel multi-channel transmission (pTX) methods is noninferior to conventional HR-MRI for the evaluation of intracranial artery disease.

METHOD AND MATERIALS

Institutional review board approval was obtained and informed consent was waived for this retrospective study. From December 2014 to August 2015, 88 consecutive patients who underwent HR-MRI to evaluate intracranial artery disease were included. Two neuroradiologists independently diagnosed intracranial artery disease and assessed diagnostic- and image quality parameters with pTX and conventional HR-MRI. The parameters were maximum outer diameter, length, eccentricity index, eccentricity, signal intensity ratio, vessel wall hemorrhage, total number of lesions, signal-to-noise ratio, and image quality scale. A noninferiority test (noninferiority margin of 85%) for diagnosis, comparison and evaluation of the agreement of parametric measurements using intraclass correlation coefficient (ICC) and kappa value between pTX and conventional HR-MRI were performed.

RESULTS

The agreement between pTX and conventional HR-MRI for the diagnosis was 93.18% (164 of 176 lesions; one-sided 95% confidential interval: $\geq 88.46\%$). The diagnostic parameters were not significantly different between both methods of HR-MRI (all P-

value >.05) with good to excellent agreement (both ICC and kappa value ≥ 0.61). However, conventional HR-MRI had better image quality parameters including precontrast signal-to-noise ratio and image quality scale (both P-value <.05), and detected more intracranial arterial lesions (1.3 ± 1.1 vs. 1.0 ± 0.6 ; P = .001 in both observers), compared with pTX HR-MRI.

CONCLUSION

pTX HR-MRI was noninferior for the diagnosis of intracranial artery disease and showed good to excellent agreement of diagnostic parameters compared to conventional HR-MRI.

CLINICAL RELEVANCE/APPLICATION

pTX HR-MRI achieve similar diagnostic performance to the conventional HR-MRI within approximately half the scan time and could be a considerable technique for HR-MRI for intracranial artery disease, particular in focused evaluation of a target lesion or in longitudinal follow-up imaging.

SSA19-06 Evaluation of Spontaneous Subarachnoid Hemorrhage: A Feasibility Study Using 70-kVp and Low-Iodine-Load CTA

Sunday, Nov. 27 11:35AM - 11:45AM Room: N229

Participants

Min Kyoung Lee, MD, Incheon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Cheolkyu Jung, MD, Chungcheongbuk-do, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chorong Seo, MD, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eung Yeop Kim, MD, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

With the advance of techniques and device, more patients with aneurysmal subarachnoid hemorrhage (SAH) have been treated with embolization, which imposes more radiation with more iodinated contrast medium (CM) on them. We hypothesized that we could reduce both radiation dose and iodine load with 70-kVp CTA and low-iodinated CM (9.45 g I), and achieve diagnostically acceptable imaging by taking advantage iterative reconstruction.

METHOD AND MATERIALS

We enrolled consecutive 99 patients (female, 62; mean age, 54.6) who presented with spontaneous SAH. All patients underwent head CTA (70 kVp, 499 mAs [reference], DLP of 132~147 mGy·cm, SAFIRE strength 3) with administration of 35 mL of iodixanol (270 mg I/mL; 9.45 g I), and were subsequently evaluated with digital subtraction angiography (DSA). Two independent reviewers assessed axial, coronal, and sagittal 5-mm maximum intensity projection CTA first, and reviewed 0.75-mm CTA to confirm their observations. They recorded the presence, maximum size (≤ 3 mm, 3.1~5.0 mm, and > 5 mm), and location of aneurysms. After consensus review, the CTA and DSA were compared in terms of the presence or absence and number of aneurysm per patient, and the size per aneurysm.

RESULTS

On DSA, 84 of 99 patients (84.8%) had 123 aneurysms (≤ 3 mm [n=20], 3.1~5.0 mm [n=30], and > 5 mm [n=73]), and 29 patients (29.3%) had multiple aneurysms (two [n=20], three [n=8], and 7 [n=1] aneurysms). For the presence or absence of aneurysm, there was discrepancy in three patients between the two reviewers (k=0.896). For the 84 patients who showed aneurysm(s) on DSA, the consensus reading of CTA found aneurysm(s) in 81 patients (false positive in one participant), and missed aneurysm (≤ 3 mm) in 4 patients (sensitivity, 95.2%; specificity, 93.3%). All aneurysms greater than 3 mm were detected on CTA, whereas 10 of 20 aneurysms equal to or less than 3 mm were correctly determined (three false positive and 7 false negative readings on CTA; sensitivity of 41.7% and specificity of 62.5%).

CONCLUSION

Low-iodine-load and 70-kVp head CTA is feasible for the assessment of patients with spontaneous SAH, but has low diagnostic accuracy for aneurysms equal to or less than 3 mm.

CLINICAL RELEVANCE/APPLICATION

Low-iodine-load and 70-kVp head CTA, which shows similar diagnostic performance compared to previous reports, can help to reduce both iodine load and radiation in patients with nontraumatic SAH.

SSA19-07 Elevated TGFB1 Protein Levels in Cerebrospinal Fluid Correlate with Vasospasm in Aneurysmal Subarachnoid Hemorrhage

Sunday, Nov. 27 11:45AM - 11:55AM Room: N229

Participants

Richard A. Ferraro, MEd, New York, NY (*Presenter*) Nothing to Disclose
Jana Ivanidze, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ashley E. Giambone, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Moonsoo Jin, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Alan Z. Segal, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ajay Gupta, MD, New York, NY (*Abstract Co-Author*) Consultant, Biomedical Systems;
Pina C. Sanelli, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Vasospasm (VS), a common complication of aneurysmal subarachnoid hemorrhage (SAH), remains clinically challenging due in part to its poorly understood underlying pathophysiology. An inflammatory response following aneurysm rupture has been implicated as a potential etiology. Transforming Growth Factor Beta-1 (TGFB1), an important inflammatory cytokine in many vascular, degenerative and inflammatory CNS conditions, has yet to be associated with complications of SAH. We sought to assess cerebrospinal fluid (CSF) TGFB1 levels as a potential biomarker for persistent VS.

METHOD AND MATERIALS

In this prospective IRB-approved study, patients with SAH underwent serial CT-Angiography (CTA) as part of clinical management within 0-5 and 5-10 days post-aneurysmal rupture to assess for VS. VS was determined by established clinical criteria and categorized based on initial % luminal reduction at first CTA, and followed over the clinical course. Patients were then stratified into "Resolved" versus "Persistent" groups based on improvement of arterial narrowing on follow-up CTA ("Resolved" reflecting either complete resolution or reduction in luminal narrowing greater than 30%). CSF was collected at days 0-7 via ventriculostomy catheter placed for intracranial pressure management. TGFβ1 protein levels were measured in CSF utilizing multiplex microbead immunoassay technology and mean and median values were calculated. Mann-Whitney analysis was performed to determine statistical significance.

RESULTS

A total of 16 patients were enrolled; 12 patients with persistent VS and 4 patients with resolved VS. Significantly higher TGFβ1 protein levels in the CSF of patients with persistent VS (mean: 12039 pg/ml) compared to resolved VS (mean: 3140 pg/ml) were seen ($p < 0.05$) (Figure 1). No significant difference was found in demographic characteristics of VS groups.

CONCLUSION

These preliminary results show a statistically significant increase in CSF TGFβ1 protein levels in patients with persistent VS versus resolved VS following SAH. Our findings suggest a possible pathophysiological link between neuroinflammation and vascular pathology, with potential diagnostic and therapeutic implications.

CLINICAL RELEVANCE/APPLICATION

Our findings suggest a role for increased TGFβ1 levels in clinically significant VS. TGFβ1 is a promising predictive biomarker in SAH, with implications for therapeutic decision-making and patient care.

SSA19-08 Limited Clinical Value in Closely Monitoring Suspected/definite Infundibular Dilatation of Cerebral Arteries: A Review of 432 Cases

Sunday, Nov. 27 11:55AM - 12:05PM Room: N229

Participants

Kanako K. Kumamaru, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Keiken Ri, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukiko Sano, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Michimasa Suzuki, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaaki Hori, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Kamagata, Tyuuouku, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakanishi, MD, PhD, Bunkyo-ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryusuke Irie, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigeki Aoki, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evidence on the natural history of infundibular dilatation (ID) of cerebral arteries has been very limited. Because ID is sometime indistinguishable from true aneurysm, and/or because of the reported risk of progression into aneurysms and rupture, an incidentally found ID is often closely monitored by imaging. The purpose of the study was to evaluate if close follow-up of ID is of clinical value.

METHOD AND MATERIALS

This HIPAA-compliant, IRB-approved retrospective cohort study included consecutive 432 patients (65.9 ± 12.5 years, female 56.5%) who were diagnosed or suspected of ID of cerebral arteries on non-contrast MR angiography (MRA) images during 2/2011-3/2015 at our institution. Composite outcome included subsequent subarachnoid hemorrhage (SAH), >1 mm increase of the diameter of ID, and aneurysmal formation from the known ID. MR images were analyzed to check if any imaging characteristics are related to positive outcome.

RESULTS

The major locations of ID included origins of posterior communication artery (Pcom) (59.7%), middle cerebral artery branches (9.7%), basilar branches (8.8%), and ophthalmic artery (5.1%). In 316 patients (73.1%), suspected ID was not clearly distinguishable from small aneurysm. Multiple IDs were observed in 34 patients (7.9%) and 92 patients (21.3%) had true aneurysm(s) at another location. During a median follow-up of 24 months (Q1-Q3: 13-43 months), positive outcome was observed in only 1 patient (0.23%) who had definite ID at Pcom without any significant morphological change during the imaging follow-up but experienced SAH; catheter angiography did not determine the rupture origin. A total of 160 patients (37.0%) underwent follow-up MRA during the study period (median=twice, max=13 times); none of them showed growth or aneurysmal formation from the known ID.

CONCLUSION

Given the quite low prevalence of possible rupture and significant morphological change, the clinical value of close (< 2 years) MRA monitoring of infundibular dilatation of cerebral arteries may be limited, even if the lesion was indistinguishable from small aneurysm.

CLINICAL RELEVANCE/APPLICATION

The clinical value of close (< 2 years) MRA monitoring of infundibular dilatation of cerebral arteries may be limited, even if the lesion was indistinguishable from small aneurysm.

SSA19-09 Acceleration-selective Arterial Spin Labeling (AccASL) MR Angiography of Brain Arteriovenous Malformation

Sunday, Nov. 27 12:05PM - 12:15PM Room: N229

Participants

Osamu Togao, MD, PhD, Fukuoka, Japan (*Presenter*) Nothing to Disclose

Akio Hiwatashi, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Makoto Obara, Minato-Ku, Japan (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Koji Yamashita, MD, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazufumi Kikuchi, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryo Somehara, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryotaro Kamei, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Time-of-flight (TOF)-MR angiography (MRA) frequently fails to visualize brain arteriovenous malformations (AVMs) because of their complex flow. The purpose of this study was to evaluate the utility of acceleration-selective arterial spin labeling (AccASL)-MRA in the depiction of brain AVMs.

METHOD AND MATERIALS

Fifteen patients with brain AVMs (age 27.8±22.1 year-old; 7 males, 8 females) were examined with both TOF- and AccASL-MRA on a 3T MR scanner. All patients underwent digital subtraction angiography (DSA). The AccASL-MRA consists of control (T2-preparation without motion-sensitized gradient: MSG) and label (with MSG) parts followed by 3D T1-weighted gradient-echo sequence. In the label part, MSG employs a motion compensation design to selectively detect spins with acceleration in arteries. The TOF-MRA was obtained in the same geometry and acquisition time (6min13sec) as AccASL-MRA. In both MRAs, visualization of feeding arteries, nidus and draining veins of AVMs are qualitatively assessed with a 5-points grading scales by using the DSA as a reference standard. In the quantitative assessment, the contrast-to-noise ratio (CNR) was measured in each component of AVM. The visual assessment scores and CNRs were compared between the MRA methods by paired t-test.

RESULTS

The visual assessment grades were not significantly different between TOF-MRA and AccASL-MRA in the feeding arteries (TOF: 4.27±1.28, AccASL:4.87±0.35) but were significantly higher in AccASL-MRA than in TOF-MRA in the nidus (TOF:2.67±1.54, AccASL:4.87±0.51, P<0.0001) as well as in the draining veins (TOF:2.87±1.46, AccASL:4.60±1.06, P=0.0001). The CNRs were not significantly different between TOF-MRA and AccASL-MRA in the feeding arteries (TOF:29.40±20.94, AccASL:23.39±10.03), but were significantly higher in AccASL-MRA than in TOF-MRA in the nidus (TOF:12.84±8.35, AccASL:23.85±8.02, P<0.001) and draining veins (TOF:9.49±8.99, AccASL:18.63±9.09, P<0.001). The AccASL-MRA accurately scored the Spetzler-Martin grade in all patients, while TOF-MRA underestimated the scores in six patients.

CONCLUSION

AccASL-MRA improved the depiction of the nidus and draining veins of AVMs than TOF-MRA.

CLINICAL RELEVANCE/APPLICATION

AccASL-MRA markedly improved the depiction of the nidus and draining veins of AVM than TOF-MRA without the use of contrast agent. AccASL-MRA is useful in the management of brain AVMs.

Physics (CT-Techniques)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S403B



AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.00

Participants

Norbert J. Pelc, ScD, Stanford, CA (*Moderator*) Research support, General Electric Company; Research support, Koninklijke Philips NV; Consultant, Varian Medical Systems, Inc; Consultant, NanoX; Scientific Advisory Board, RefleXion Medical Inc; Scientific Advisory Board, Prismatic Sensors AB; Medical Advisory Board, OurCrowd, LP ;
Mats Danielsson, PhD, Stockholm, Sweden (*Moderator*) Stockholder, Prismatic Sensors AB; President, Prismatic Sensors AB; Stockholder, Innovicum AB; President, Innovicum AB; Stockholder, Biovica International AB; Board Member, Biovica International AB;

Sub-Events**SSA20-01 Development, Implementation, and Initial Experience of a Web-based CT Protocol Management System**

Sunday, Nov. 27 10:45AM - 10:55AM Room: S403B

Participants

Andrea Ferrero, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Emily Sheedy, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Michele A. Powell, RT, CT, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jessica Ballantyne, Toronto, ON (*Abstract Co-Author*) Employee, Bayer AG
Henry Hernaez, Toronto, ON (*Abstract Co-Author*) Employee, Bayer AG
Matthew Hoiko, Toronto, ON (*Abstract Co-Author*) Employee, Bayer AG;
Drew Morris, Toronto, ON (*Abstract Co-Author*) Employee, Bayer AG
Hart Levy, Toronto, ON (*Abstract Co-Author*) Employee, Bayer AG
Sakeena Panju, Toronto, ON (*Abstract Co-Author*) Employee, Bayer AG
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT protocol review is a critical yet manual task that is labor intensive, error prone, and costly. This study aimed to develop and implement a web-based protocol management system and to quantify our initial experience using the system.

METHOD AND MATERIALS

A web-based system was developed and installed at our institute. The software included 4 main modules: 1) Import scanner protocols and automatically identify inconsistencies among master and scanner protocols, 2) Create reviews of specific protocols and track reviewers' decisions, 3) Summarize changes needed to be made on the scanners, 4) View and edit master protocols. An ongoing pilot study was performed for all abdominal protocols on 3 scanners of the same model (Somatom Force, Siemens Healthcare). Master protocols were built from the initial import of scanner protocols, with changes made as needed. Protocols from all 3 scanners were reviewed at the same time by lead techs and medical physicists. Inconsistencies between master and scanner protocols, or among scanner protocols from different scanners, were automatically identified and corrected by the reviewers.

RESULTS

163 protocols (52, 55, 56 per scanner) were imported and monitored. 558 inconsistencies were identified during the first 2 weeks of the pilot, including the initial import to build the master protocols. The inconsistencies covered every aspect of scanning and reconstruction, with series description (342, free text, consequently error-prone) and prep delay (109) the most frequent inconsistencies. Other scan inconsistencies included helical pitch (20), CTDIvol (17), kV (11), mA (11), automatic kV setting (4), automatic exposure control setting (4). Other reconstruction inconsistencies included recon kernel (12), slice increment (11), slice thickness (3), and recon axis (2).

CONCLUSION

The described protocol management system automatically monitored protocol changes and identified inconsistencies between the master protocols and those on the scanner, which is an otherwise tedious manual process. Initial evaluation demonstrated that CT protocol inconsistencies were frequent in our clinical practice, which provided strong motivation for the continued use of this automated system.

CLINICAL RELEVANCE/APPLICATION

The protocol management system greatly increased protocol consistency. It can also be used in lexicon enforcement, e.g. series description, that otherwise is extremely difficult to standardize.

SSA20-02 Super High Temporal Resolution Cardiac CT Imaging using Smart-Recon

Sunday, Nov. 27 10:55AM - 11:05AM Room: S403B

Participants

Yinsheng Li, BEng, Madison, WI (*Presenter*) Nothing to Disclose
Ximiao Cao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhanfeng Xing, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xuguang Sun, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

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

Coronary CT angiography is a challenging task currently limited by the achievable temporal resolution of modern MDCT scanners. In this work, a highly innovative method has been developed and validated to improve temporal resolution of the MDCT by a factor of four with the newly developed Synchronized Multi-Artifact Reduction with Tomographic Reconstruction (SMART-RECON) method. The primary purpose of this work is to validate the feasibility of SMART-RECON using in vivo human subject data.

METHOD AND MATERIALS

Using data acquired from a short scan angular range, the entire cardiac window is divided into 4-5 narrower cardiac windows, each corresponding to a 60-degree angular sector. These 4-5 sub-cardiac phase image volumes can be jointly reconstructed with SMART-RECON to globally improve temporal resolution and noise properties. CT data of twenty human subjects were used to demonstrate that SMART-RECON can significantly improve the quality of CTA using a Discovery CT 750 HD (GE Healthcare, WI, USA) with 350 ms gantry rotation time.

RESULTS

The proposed SMART-RECON cardiac CT imaging method can systematically improve the temporal resolution and noise properties. In contrast, the currently available FBP cardiac reconstruction with Parker weights demonstrates significant motion artifacts. Human subject results also demonstrate the significant improvement of coronary CTA quality cross different heart beats, different vessel branches in all subjects. The noise standard deviations for FBP reconstruction within three selected ROIs are 34 ± 4 HU, and for SMART-RECON with the same ROIs are 15 ± 3 HU respectively.

CONCLUSION

With a single short-scan acquisition, SMART-RECON can be used to systematically improve the temporal resolution for MDCT cardiac CT imaging by a factor of 4 without prior knowledge of cardiac motion.

CLINICAL RELEVANCE/APPLICATION

The proposed new technique can systematically improve the image quality of coronary CTA in clinical practice.

SSA20-03 Automated Coronary Artery Motion Artifact Evaluation and Correction Identification for CT Angiography Images

Sunday, Nov. 27 11:05AM - 11:15AM Room: S403B

Participants

Hongfeng Ma, BEng, MS, Milwaukee, WI (*Presenter*) Nothing to Disclose
Eric Gros, BS, Waukesha, WI (*Abstract Co-Author*) Nothing to Disclose
Darin R. Okerlund, MS, Waukesha, WI (*Abstract Co-Author*) Nothing to Disclose
Taly G. Schmidt, PhD, Milwaukee, WI (*Abstract Co-Author*) Research Grant, General Electric Company

PURPOSE

This study developed and validated an algorithm to automatically evaluate a Coronary CT Angiography (CCTA) dataset for motion artifacts and to determine whether further motion correction is required. CCTA exams are usually reconstructed at low-motion phases, however motion artifacts may be present. Motion correction may require additional computation time. A motion evaluation algorithm is proposed to improve workflow by enabling automatic correction if needed and to save computation time if correction is not needed.

METHOD AND MATERIALS

A novel Motion Artifact Score (MAS) metric was developed and determined to have beneficial properties compared to previous motion artifact metrics. The MAS is the product of a vessel symmetry metric and a low-intensity shading metric. An automated algorithm was developed to calculate the MAS for the Right Coronary Artery (RCA), which included finding through-plane slices, locating the RCA position, segmenting the lumen by k-means clustering, segmenting low intensity regions by threshold transform, and then calculating the motion metrics. Motion correction was determined necessary if 5-mm of consecutive slices had an MAS score below a threshold. The threshold was determined by ROC analysis. The algorithm performance was evaluated on 34 CCTA exams (Revolution CT, GE Healthcare). Image slices were reconstructed at a low-motion phase, selected by an automated method (SmartPhase, GE Healthcare). The reconstructed images were input to the proposed algorithm, which output the decision of "need" or "does not need" motion correction. The algorithm decision was compared to the decision of a trained reader who was blinded to the algorithm results.

RESULTS

Seventeen of the 34 exams were determined as needing correction by readers. The algorithm sensitivity was 71% with 65% specificity. For the five cases missed by the algorithm, the reader decision was based on the left vessels, while the algorithm only evaluated the RCA.

CONCLUSION

When evaluating RCA image quality, the algorithm agreed with the reader in 23 out of 29 cases, with 100% sensitivity in identifying exams that required RCA motion correction. Additional improvements may be possible by evaluating left vessel motion.

CLINICAL RELEVANCE/APPLICATION

By automatically identifying exams for motion correction, the proposed algorithm may improve workflow and vessel image quality.

SSA20-04 Properties of Logarithm Function and Their Effect on Filtered Back Projection (FBP) Reconstruction in Low Dose Computed Tomography (CT)

Sunday, Nov. 27 11:15AM - 11:25AM Room: S403B

Participants

Stanislav Zabic, PhD, Mayfield Village, OH (*Presenter*) Employee, UIH America, Inc

PURPOSE

This report surveys disadvantageous properties of the logarithm function that impact the image quality in volumes reconstructed from the low dose acquisition data in X-ray CT and makes practical system design recommendations to avoid those problems.

METHOD AND MATERIALS

We analyze properties of the logarithm function: strict positivity of the domain and Jensen's inequality. The two properties are disadvantageous because they are causing two types of image domain biases that can shift the Hounsfield units in a CT image at the low dose acquisitions. Biases are illustrated using accurate computer simulations and various dose levels. We explore shifting of the logarithm application from before rebinning to after rebinning and draw conclusions about the bias behavior. In addition to that, we also explore the impact of the projection-based adaptive filtering.

RESULTS

Moving the logarithm application after the rebinning increases the raw data quality and reduces the image based biases by a factor of two on the average, without seriously affecting the noise. Application of the projection-based adaptive filtering eliminates the biases almost entirely and reduces the image noise dramatically. Biases are in practice often confused with beam hardening artifacts, but our monochromatic simulations show that the artifacts are purely caused by a disadvantageous combination of poor statistical quality of x-rays at low dose and logarithm options.

CONCLUSION

Detected non-positive quanta in CT systems is often discarded. Our research shows that the non-positive quanta carries some useful information that can be recovered by careful handling of the logarithm application. This leads to a specific system design recommendation in CT: non-positive quanta should be carried over to the reconstruction engine, where it can be properly treated.

CLINICAL RELEVANCE/APPLICATION

Since the logarithm properties are especially exaggerated at the low dose imaging, clinical benefit is clear since the proposed processing can stretch the limits of the low dose reduction. In addition, this work can explain some of the low dose artifacts seen in practice and raise awareness about the underlying causes to the clinical audience.

SSA20-05 CT Number Accuracy of Virtual Monoenergetic Images from a Whole-Body Research Photon Counting Detector CT

Sunday, Nov. 27 11:25AM - 11:35AM Room: S403B

Participants

Shuai Leng, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

Zhicong Yu, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

Ahmed Halaweish, PhD, Rochester, MN (*Abstract Co-Author*) Employee, Siemens AG

Bernhard Krauss, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG

Bernhard Schmidt, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG

Lifeng Yu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Steffen Kappler, Dipl Phys, Forchheim, Germany (*Abstract Co-Author*) Researcher, Siemens AG

Michael R. Bruesewitz, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

CT numbers depend on the X-ray spectrum; hence CT numbers in conventional CT vary among scanner vendors and models. In virtual monoenergetic images (VMI), however, CT numbers have a predetermined value for a given keV, independent of vendor and scanner. This work evaluated the accuracy of CT numbers in VMIs obtained from a photon-counting-detector (PCD) CT scanner, and compared the performance to that of dual-source (DS), dual-energy (DE) CT scanners with energy integrating detectors (EID).

METHOD AND MATERIALS

Vials containing iodine solutions at 5 concentrations (2, 5, 10, 15, and 20 mgI/cc) were placed in a torso-shaped water phantom (lateral width 30 cm), which was scanned on PCD-CT using 140 kV, energy thresholds of 25 and 65 keV, 0.5 s rotation time, and 0.6 helical pitch. Tube current was set so that the CTDIvol matched that of clinical abdomen scans. The same phantom was also scanned on 2nd and 3rd generation DSDE scanners with the same CTDIvol. VMIs from 40 to 140 keV were generated in 10 keV increments using commercial software. CT numbers were measured for each vial and DE mode. The reference CT numbers were calculated based on the known iodine concentrations and mass attenuation coefficients obtained from NIST. Measured CT numbers were compared with reference values and errors calculated. Variation of VMI CT numbers among the three DE scanners for the same concentration (10mgI/cc) and keV (40) was also calculated.

RESULTS

CT numbers in VMIs from both PCD and EID scanners matched the reference values at each keV and concentration. The mean absolute percentage error (MAPE) was 3.7% for PCD, 8.0% and 9.7% for the two DE modes on the 2nd generation DSDE scanner, and 4.8% to 8.0% for the four DE modes on the 3rd generation DSDE scanner. Error was higher at lower concentrations (8.4% at 2 mgI/cc) than at higher concentrations (1.4% at 20 mgI/cc). VMI CT numbers for 10 mgI/cc at 40 keV ranged from 764.4 to 790.5 HU for the three scanners, with a coefficient of variance of 0.01.

CONCLUSION

Phantom studies demonstrated accurate VMI CT numbers for both PCD- and EID-based CT, with slightly lower errors for PCT-CT.

CLINICAL RELEVANCE/APPLICATION

The spectral performance of a research PCD-CT scanner was comparable to that of EID-CT scanners, each of which provided accurate VMI CT numbers.

SSA20-06 Low-dose CT for the Detection of Liver Lesions: A Grand Challenge to Compare Iterative Reconstruction and Denoising Techniques

Sunday, Nov. 27 11:35AM - 11:45AM Room: S403B

Participants

Cynthia H. McCollough, PhD, Rochester, MN (*Presenter*) Research Grant, Siemens AG
Baiyu Chen, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Gregory J. Michalak, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Alice Huang, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Adam Bartley, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Kyle McMillan, Rochester, MN (*Abstract Co-Author*) Institutional research agreement, Siemens AG Research support, Siemens AG
Tammy A. Drees, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Rickey Carter, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
David R. Holmes Iii, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Joel G. Fletcher, MD, Rochester, MN (*Abstract Co-Author*) Grant, Siemens AG; ;

PURPOSE

To host a low-dose CT Grand Challenge for the task of liver lesion detection and assess the diagnostic performance of iterative reconstruction or denoising techniques using common low dose patient datasets.

METHOD AND MATERIALS

Datasets from contrast-enhanced CT scans of the liver were provided to participants in an NIH- and AAPM-sponsored low-dose CT Grand Challenge. The training data included full-dose and quarter-dose scans of the ACR CT accreditation phantom and 10 patients; both projection and image data were provided. The testing data used to evaluate technique performance were 20 quarter-dose patient datasets, which were provided to each participant as projection or image data, but not both. Pre-processed projection data and a statistical noise map were provided to sites intending to perform iterative reconstruction. Only images were provided to sites intending to perform image domain denoising. Upon return of the denoised or iteratively reconstructed quarter-dose images, randomized and blinded interpretation of the cases was performed by radiologists and the locations of metastatic lesions were identified. The reader markings were scored against clinical or pathologically-demonstrated reference data to determine the percent correct in the test cohort, where cases were scored by lesion and by patient, with a penalty for a false-negative or a false-positive.

RESULTS

103 participants representing 26 countries and 90 unique sites registered during the 1 month enrollment period. 76 sites returned data sharing agreements and 39 sites downloaded the test data. Participants included 27% medical physicists, 23% electrical engineers, 23% computer scientists, 10% physicists, 6% mathematicians, and 11% other. 22% of participants had no experience with medical CT datasets and 60% had not collaborated with a radiologist to optimize image quality. 61% of participants requested projection data and the remainder requested image data.

CONCLUSION

An infrastructure was developed to assess the performance of liver lesion detection for low-dose CT examinations of the liver. The large number of participants indicated a great interest in low-dose CT techniques and in gaining access to medical CT data sets.

CLINICAL RELEVANCE/APPLICATION

An international effort to identify and test novel noise reduction/iterative reconstruction techniques using a common data set and human observers may rapidly accelerate CT dose reduction efforts.

SSA20-07 Improving Readers' Perception of Image Quality at Low keV Virtual Monoenergetic Images using Patient-specific Optimized Display Window Settings

Sunday, Nov. 27 11:45AM - 11:55AM Room: S403B

Participants

Wanyi Fu, BEng, Durham, NC (*Presenter*) Nothing to Disclose
Daniele Marin, MD, Durham, NC (*Abstract Co-Author*) Research support, Siemens AG
Juan Carlos Ramirez-Giraldo, PhD, Malvern, PA (*Abstract Co-Author*) Employee, Siemens AG
Davide Bellini, MD, Latina, Italy (*Abstract Co-Author*) Nothing to Disclose
Mustafa R. Bashir, MD, Cary, NC (*Abstract Co-Author*) Research support, Siemens AG; Research support, Guerbet SA; Research support, General Electric Company; Imaging Core Lab, NGM Biopharmaceuticals; Imaging Core Lab, TaiwanJ Pharma
Ehsan Samei, PhD, Durham, NC (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Siemens AG

PURPOSE

To investigate whether patient-specific optimization of display window settings improves readers' perception of image quality at low keV virtual monoenergetic images (VMI) in patients with hypervascular liver lesions.

METHOD AND MATERIALS

In this HIPAA-compliant, IRB-approved, retrospective study, we enrolled 21 patients with malignant hypervascular liver lesions who underwent a clinically-indicated dual energy CT (DECT) of the liver during the late hepatic arterial phase using a dual-source system (SOMATOM Definition Flash, Siemens Healthcare). Virtual monoenergetic images were reconstructed at energy levels of 40 keV, 70 keV, and linear blended images at 0.3 blending ratio (120 kVp equivalent). Additionally, 40 keV window-adjusted datasets were created for each patient using 3 different methods. Each method attempted to improve readers' perception of image quality at low keV by matching (on a per patient basis) different specific attributes of image quality between 40 and 70 keV datasets. This included matching of (a) the liver histogram distribution of pixel values; (b) the lesion-to-liver contrast; or (c) noise defined as the standard deviation in the background liver. The three metric values were transferred to display space as a function of window level and window width, and further equalized to derive the specific window setting for each patient. All datasets were presented in

random order to 3 readers with different experience in a blinded and independent fashion. Readers' assessment scores for image quality, lesion conspicuity, and observer performance were recorded.

RESULTS

Readers' perception of noise and lesion conspicuity was significantly worse at 40 keV compared to 70 keV and linear blended datasets. Readers' perception of noise and lesion conspicuity improved significantly at 40 keV with all window optimization methods ($P < 0.01$). No significant differences were observed among the three methods, with the exception of contrast that was significantly better for noise-matched method ($P < 0.01$).

CONCLUSION

Patient-specific optimization of display window settings may significantly improve readers' perception of image quality for low keV VMI.

CLINICAL RELEVANCE/APPLICATION

Improved readers' perception of image quality at low keV VMI may improve conspicuity of hypervascular liver lesions, which may translate in earlier lesion detection and improved patient outcomes.

SSA20-08 The Effect of Patient Diameter on the Dual-Energy Attenuation Ratio of Selected Contrast-Producing Elements

Sunday, Nov. 27 11:55AM - 12:05PM Room: S403B

Participants

Jack Lambert, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose
Peter J. Bonitatibus Jr, PhD, Niskayuna, NY (*Abstract Co-Author*) Employee, General Electric Company
Robert E. Colborn, PhD, Niskayuna, NY (*Abstract Co-Author*) Employee, General Electric Company
Peter Edic, Niskayuna, NY (*Abstract Co-Author*) Employee, General Electric Company
Paul Fitzgerald, Niskayuna, NY (*Abstract Co-Author*) Employee, General Electric Company
Yuxin Sun, BS, MSc, 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

The ratio of low- to high-kVp CT numbers (the dual-energy ratio; DER) of different contrast elements determines their separability at Dual-Energy CT (DECT). We assess whether the DER of selected elements is affected by patient diameter.

METHOD AND MATERIALS

Seven contrast-producing elements - calcium, iodine, barium, gadolinium, tantalum, tungsten, and bismuth - were housed sequentially in a vial within an abdomen phantom. Sequential fat ring encasements increased the phantom diameter from 26 to 32 to 38 to 44 cm. For each phantom size and contrast element configuration, the phantom was scanned using single-energy CT (SECT) at x-ray tube voltages of 80 and 140 kVp, and rapid-kVp-switching DECT using the same tube voltages, with virtual monochromatic reconstructions generated at 60 and 80 keV energy levels. For each configuration we measured contrast element CT numbers and calculated the DER for the SECT images (80:140 kVp) and for the DECT images (60:80 keV).

RESULTS

CT numbers decreased with increasing phantom diameter for both SECT and DECT. This decrease was proportional (~20% overall CT number reduction for both low- and high-energy acquisitions), and resulted in consistent DERs for each contrast element across all phantom diameters. The mean range in the DER for each element over the phantom sizes was 6.6%, with a maximum range of 16% for bismuth. The mean difference in DER between pairs of contrast elements within each phantom size was 35%. For 16 of the 21 material pair combinations, the difference in the DER between elements was greater than the range in DER over the phantom sizes, implying that separation should remain possible for these material pairs at all sizes. The exceptions were iodine-barium, iodine-gadolinium, tungsten-tantalum, tungsten-bismuth, and tantalum-bismuth pairs where elements showed highly similar DERs to each other, due to their similar atomic numbers.

CONCLUSION

The dual-energy ratio for different contrast elements is largely unaffected by changes in phantom diameter despite variation in absolute CT numbers. This should allow for robust separation of most contrast material combinations irrespective of patient size.

CLINICAL RELEVANCE/APPLICATION

The consistency of the dual-energy ratios over different phantom sizes increases confidence in current material decomposition methods, and highlights the potential of high-Z contrast agents at DECT.

SSA20-09 A Platform-Independent Method to Reduce CT Truncation Artifacts

Sunday, Nov. 27 12:05PM - 12:15PM Room: S403B

Participants

Ke Li, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Yang Chen, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Yinsheng Li, BEng, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Guang-Hong Chen, PhD, Madison, WI (*Abstract Co-Author*) Research funded, General Electric Company Research funded, Siemens AG

PURPOSE

Large body size or patient offcentering may create truncation artifacts that severely degrade CT image quality and diagnostic performance. Conventional wisdom to reduce truncation artifacts is to extrapolate the truncated projection data based on certain a priori assumptions. The purpose of this work is to develop a novel CT truncation artifact reduction method that directly operates on

DICOM CT images.

METHOD AND MATERIALS

The blooming of pixel values introduced by truncation was found to be trackable using exponential decay functions, based on which a discriminative dictionary with a truncation artifact sub-dictionary and a nonartifact sub-dictionary was created: The truncation artifact sub-dictionary contains 1000 entries with different decay constants, while the nonartifact sub-dictionary contains 1000 entries with different Gaussian white noise realizations to maximize its exclusiveness with the artifact sub-dictionary. By sparsely representing the artifact-contaminated CT images with the discriminative dictionary using the Greedy algorithm, the artifact components of the images were selectively segmented from the nonartifact image features. The proposed method was validated using both an anthropomorphic chest phantom and whole-body CT images of three trauma patients.

RESULTS

The proposed method reduced the relative RMSE from 43% (original images) to 24%, and improved the universal quality index from 0.34 to 0.80. Bloomings at the peripheral region of the scanner field of view were visibly reduced, revealing soft tissue and bony structures once buried in the truncation artifacts. For the whole-body CT images of the trauma patients, the proposed method demonstrated potential benefits in ruling out injuries at extremities and other truncation-prone sites of the body.

CONCLUSION

A discriminative dictionary representation method was developed to mitigate CT truncation artifacts directly in the DICOM image domain. Results of physical phantom experiment and human subject studies demonstrated that the proposed method can effectively suppress truncation artifacts and improve image quality.

CLINICAL RELEVANCE/APPLICATION

The proposed method operates directly on DICOM images, therefore it is vendor- and platform-independent, and it can be applied not only prospectively but also retrospectively upon physician's request.

SSA21

Physics (CT-Dose I)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S404AB



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

Participants

Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Moderator*) Institutional research agreement, Siemens AG Research support, Siemens AG
Bruce R. Whiting, PhD, Pittsburgh, PA (*Moderator*) Nothing to Disclose

Sub-Events

SSA21-01 Diagnostic Reference Levels and Achievable Doses for Ten Commonly Performed US Adult CT Examinations from the ACR CT Dose Index Registry

Sunday, Nov. 27 10:45AM - 10:55AM Room: S404AB

Participants

Kalpana M. Kanal, PhD, Seattle, WA (*Presenter*) Nothing to Disclose
Priscilla F. Butler, MSc, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Debapriya Sengupta, MBBS, MPH, Reston, VA (*Abstract Co-Author*) Nothing to Disclose
Mythreyi Bhargavan-Chatfield, PhD, Reston, VA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Use the ACR CT Dose Index Registry (DIR) to recommend diagnostic reference levels (DRLs) and achievable doses (ADs) for the 10 most common adult CT examinations in the US as a function of patient size.

METHOD AND MATERIALS

Ten most commonly performed adult CT examinations in the United States were analyzed from the DIR - head brain without contrast, cervical spine without contrast, neck with contrast, chest without contrast, chest with contrast, chest with pulmonary embolism protocol, chest abdomen pelvis with contrast, abdomen pelvis with contrast, abdomen pelvis without contrast, and abdomen pelvis nephrolithiasis protocol without contrast. For the head exams, lateral thickness dimension was used as an indicator of patient head size. For neck, c-spine, chest, abdomen and pelvis exams, effective diameter was used. Descriptive statistics were calculated for 4 facility characteristics (facility category, location, census region, and average volume of examinations per month) for all the exams included. Data from over 1.3 million examinations were used to determine median (AD) as well as mean, 25th and 75th (DRL) percentiles of CTDIvol, DLP and SSDE. All analyses were done using SAS 9.3.

RESULTS

The abdomen pelvis exams made up the highest percentage (45%) of exams in the study. Over 46% of the facilities were from community hospitals and 13% from academic facilities. Over 48% were metropolitan followed by 39% suburban and 13% rural facilities. Over 50% of the facilities reported performing less than 500 exams per month. The median CTDIvol did not vary significantly but DLP increased with lateral thickness for head exams. For neck and c-spine, the median CTDIvol and the 75th percentile did not vary significantly but the median DLP did with effective diameter. Similar trends were seen for the median CTDIvol and SSDE for chest, abdomen and chest-abdomen-pelvis exams. Our data agrees well with the data from other resources.

CONCLUSION

This work provides DRLs and ADs for the 10 most common CT adult exams performed in the United States. The enormous volume of patient data, as well as the availability of automatically-determined patient size information, allows for the development of robust, size-specific ADs and DRLs.

CLINICAL RELEVANCE/APPLICATION

This work will enable facilities to compare their patient doses to size-specific national benchmarks and optimize their CT protocols resulting in lower dose at the appropriate image quality.

SSA21-02 Big Data and CT Dose: How a Dose Monitoring System Can Help in Updating and Benchmarking DRLs

Sunday, Nov. 27 10:55AM - 11:05AM Room: S404AB

Participants

Donat Thery, Buc, France (*Presenter*) Employee, General Electric Company
Lyamine Bouhafs, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Nicolas Alexandre, Buc, France (*Abstract Co-Author*) Nothing to Disclose
Claire Steinvill, Buc, France (*Abstract Co-Author*) Nothing to Disclose
Federica Zanca, PhD, Leuven, Belgium (*Abstract Co-Author*) Employee, General Electric Company

PURPOSE

The new European Directive on Basic Safety Standard requires that Member States shall ensure the establishment, regular review and use of diagnostic reference levels (DRLs) for radiodiagnostic examinations, having regard to the recommended European DRLs where available. The process to set and update DRLs should be both flexible and dynamic. The aim of this study was to assess the value of a dose monitoring system and access to big data in benchmarking and updating EU DRLs.

METHOD AND MATERIALS

Dose data were collected using the same dose management software (DoseWatch and DoseWatch Explore-cloud-based. GE

Healthcare) from 11 countries (Finland, Spain, Italy, Luxembourg, France, Belgium, UK, Germany, Sweden, Hungary and Switzerland), 61 CT (7 GE, 3 Siemens, 3 Toshiba and 2 Philips models) for a total of 12817 CT exams (19100 series). For each systems protocol Radlex mapping for the following anatomical region occurred: head (axial and spiral), sinus, chest, abdomen-pelvis and lumbar spine. The estimated European and national DRLs based on collected data (median CTDIvol and DLP) for the investigated RPIDs were compared to European (DataMed II) and national DRLs. The one-sample Wilcoxon signed rank test was used to assess statistical significant differences.

RESULTS

The overall median CTDIvol and DLP for all 11 countries per anatomical region compared to European DRLs were respectively: head -7.95% and -2.41 %, chest -17.30% and -29.48%, abdomen -56.56% and -43.25%, lumbar spine -29.63% and +8.67%. When comparing to national DRLs, CTDIvol and DLP were above in 14.3% and 0% of the countries for head CT (n = 3044), in 0% and 0 % for abdominal CT (n = 4761) and in 50% and 33% for chest CT (n = 2965), respectively. Preliminary analyses between CT protocols of the same body region show that radiation exposure varied up to 50 % of the DRLs across countries.

CONCLUSION

The implemented dose monitoring on several European sites enables large-scale CT automated benchmarking, in regard to national and international DRLs. The cloud-based approach offers great potential for a dynamic and flexible update of European and national DRL

CLINICAL RELEVANCE/APPLICATION

Using a large-scale and cloud-based dose monitoring system would allow for an easy update and use of DRLs as recommended by the new European directive, making them more representative of clinical practice and eventually update them linked to clinical indication.

SSA21-04 Dynamic Contrast-Enhanced CT Dose Optimization Using a Perfusion Phantom

Sunday, Nov. 27 11:15AM - 11:25AM Room: S404AB

Participants

Hanif Gabrani-Juma, Ottawa, ON (*Presenter*) Nothing to Disclose

Eric Zakher, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

Tyler Holmwood, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

Robert Dekemp, PhD, Ottawa, ON (*Abstract Co-Author*) Royalties, FlowQuant; Royalties, Jubilant Life Sciences Ltd; Consultant, Jubilant Life Sciences Ltd

Ran Klein, PhD, Ottawa, ON (*Abstract Co-Author*) Consultant, Jubilant Life Sciences Ltd; Shareholder, Jubilant Life Sciences Ltd

PURPOSE

Dynamic contrast enhanced (DCE) CT can add functional information such as absolute blood flow to a wide range of clinical exams, but can result in high radiation exposure, which limits its clinical use. While much effort has been devoted to reduce radiation exposure, validation is hampered by a lack of a gold standard to which accuracy can be compared. Therefore we developed a DCE perfusion phantom and demonstrate its usability for optimizing radiation exposure.

METHOD AND MATERIALS

The DCE phantom (Shelley Medical) was imaged on a 320 slice Toshiba Aquillion One CT at a single bed position. Wash-in and wash-out flow to the phantom was set to 100 mL/min. 100 CT volumes were acquired over 360 seconds immediately after contrast (Omnipaque 300) injection at varying temporal sampling frequency between frames ($45 \times 1.5s$, $35 \times 3.5s$, and $20 \times 5s$). Imaging was repeated at 80, 100 and 120 kVp with constant 300 mA tube current. Dynamic scans were retrospectively modified by excluding frames to simulate reduced temporal sampling (1/2, 1/4, 1/5, 1/10, 1/20 of frames). Dynamic images were processed using custom developed software to derive input and output time-attenuation-curves to which a modified 1-tissue-compartment kinetic model with wash-in (K1) and wash-out (k2) parameters were fitted along with transport time delay. Image derived flow estimates were compared to flow meter measured flow rates (ground truth) to determine flow accuracy.

RESULTS

Flow values agreed within 2% with varying tube voltage. The overall fit of the kinetic-model was excellent and did not suffer as the number of frames in the dynamic sequence was reduced ($r^2 > 0.82$). The number of frames in the dynamic sequence was reduced by 75% (1/4 of frames) before the image derived flow estimates exceeds our error tolerance of $\pm 5\%$. The estimated wash-in flow remained within tolerance up to a 80% dose reduction (1/5 of frames), with overestimation of wash-in increasing exponentially thereafter. All wash-out errors remained below 20%.

CONCLUSION

Dynamic CT can accurately quantify contrast kinetic parameters. Wash-in rate parameters are more susceptible to temporal under-sampling error than wash-out rate.

CLINICAL RELEVANCE/APPLICATION

The proposed phantom and image analysis software are useful for validating and optimizing DCE-CT imaging equipment and protocols. Furthermore, the phantom can be used to calibrate between alternative imaging modalities such as nuclear medicine and MRI.

SSA21-05 Automatic Anatomical Landmarks Recognition for Organ Dose Estimation with a Dose Monitoring System

Sunday, Nov. 27 11:25AM - 11:35AM Room: S404AB

Participants

Pierre Guntzer, MSc, Strasbourg, France (*Presenter*) Nothing to Disclose

Xiaoyu Tian, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

Joshua Wilson, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

David E. Miller, PhD, Kirkland, WA (*Abstract Co-Author*) Employee, General Electric Company

Donald P. Frush, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Ehsan Samei, PhD, Durham, NC (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Siemens AG
Federica Zanca, PhD, Leuven, Belgium (*Abstract Co-Author*) Employee, General Electric Company

PURPOSE

Software estimation of organ doses is often based on standardized models that do not accurately represent the individual patient. The aim of this work is to develop a method for automatic anatomical landmarks recognition, to be used for matching a specific individual to voxelized phantom models for patient-specific organ dosimetry.

METHOD AND MATERIALS

Using the topograms collected through a dose tracking system (DoseWatch, GE Healthcare) an algorithm was developed to detect the following anatomical regions: head, shoulders, chest, abdomen, pelvis, lower limbs. Using a patient's anterior-posterior localizer we estimated patient contours, gray-scale intensity profile and bone symmetries, and edges. For each identified anatomical region, the percent of region detected was estimated and the percentage of region irradiated, through comparison with the scanned area. Extracted patient-specific landmarks from DoseWatch, along with exposure parameters, were used to estimate patient-specific organ doses for a sample of patients, to assess the workflow.

RESULTS

We analyzed landmark recognition in 30 prospectively selected patients who underwent a CT exam during a 7-month period. Of the 30 patients, 6 (16.7%) were chest exams, and an equal number of abdomen, pelvic abdominopelvic, kidney-to-bladder and chest-abdomen-pelvic exams were selected. The software correctly identified the percent of irradiated organ in 100% of chest exams, 80% of abdomen exams, 20% of pelvic exams, 40% of abdominopelvic exams, 80% of kidney-to-bladder exams, and 40% of chest-abdomen-pelvic exams. Failings were related to detection of lower limbs or when the patient was not fully in the field of view. Organ-doses were estimated for all patients.

CONCLUSION

The implementation of automatic detection of anatomical landmarks in a dose tracking system has high potential when combined with an MC framework. It accounts for the variation in patient size and improves the accuracy of the estimates.

CLINICAL RELEVANCE/APPLICATION

By improving the accuracy of organ dose estimation, dose monitoring can offer more accurate and representative indices of patient safety.

SSA21-06 Effective and Organ Dose Estimations from Low-Dose Lung Cancer Screening Chest CT Exams using Tube Current Modulation

Sunday, Nov. 27 11:35AM - 11:45AM Room: S404AB

Participants

Anthony Hardy, BS, Los Angeles, CA (*Presenter*) Nothing to Disclose
Maryam Bostani, PhD, Los Angeles, CA (*Abstract Co-Author*) Research support, Siemens AG
Kyle McMillan, Rochester, MN (*Abstract Co-Author*) Institutional research agreement, Siemens AG Research support, Siemens AG
Maria Zankl, PhD, Neuherberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG
Christopher H. Cagnon, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Abstract Co-Author*) Institutional research agreement, Siemens AG Research support, Siemens AG

PURPOSE

The purpose of this work was to estimate effective and organ doses from a low-dose lung cancer screening protocol using tube current modulation (TCM) and patient models of various sizes.

METHOD AND MATERIALS

Monte Carlo simulation methods were used to estimate effective and organ doses from a low-dose lung cancer screening protocol for a 64-slice CT (Sensation 64, Siemens Healthcare) that used TCM. Scanning parameters were from the AAPM's Alliance for Quality CT on-line protocols. Ten GSF voxelized patient models that had all radiosensitive organs identified were used to facilitate estimating both organ and effective doses. Predicted TCM schemes for each patient model were generated using a validated method wherein tissue attenuation and scanner limitations were used to determine the TCM output as a function of table position and source angle. The water equivalent diameter (WED) was determined by estimating the attenuation at the center of the scan volume for each patient model. Monte Carlo simulations were performed using the unique TCM scheme for each patient model. All organ doses were tallied and effective doses were estimated using ICRP 103 tissue weighting factors. All dose values were normalized by scan-specific dose-length product (DLP) from 32 cm CTDIvol values that used the average tube current across the entire length of the simulated scan. Absolute and normalized doses were reported as a function of WED for each patient model.

RESULTS

For all ten patient models, the effective dose using TCM protocols was below 1.5 mSv. Smaller sized patient models experienced lower absolute doses compared to larger sized patients. DLP-normalized effective, lung, thyroid, and breast doses possessed an exponential relationship with respect to patient size with coefficients of determination of 0.73, 0.72, 0.24, and 0.73, respectively.

CONCLUSION

Effective doses for a low-dose lung screening protocol using TCM were below 1.5 mSv for all patient models used in this study. Strong correlations existed between DLP-normalized effective, lung, and breast doses, while thyroid doses showed some dependence on patient size.

CLINICAL RELEVANCE/APPLICATION

These results, along with the scanner-reported DLP and WED, can be used to estimate effective, lung, thyroid, and breast doses from lung screening CT exams that use TCM.

SSA21-07 Automated Dose Tracking Software in a Clinical Setting: Radiation Dose Evolution Over Three CT Generations

Sunday, Nov. 27 11:45AM - 11:55AM Room: S404AB

Participants

Roy Marcus, MD, Rochester, MN (*Presenter*) Institutional research agreement, Siemens AG; Research support, Siemens AG
Elise Koerner, DDS, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Roland C. Aydin, MD,MS, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Dominik Zinsser, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Fabian Bamberg, MD, MPH, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Research Grant, Siemens AG;
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
Mike Notohamiprodjo, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate and compare the radiation dose and image quality of whole-body-CT (WBCT) performed on three CT generations using an automated CT dose tracking software.

METHOD AND MATERIALS

Patients undergoing a single post-venous phase WBCT exam on the 3rd and 2nd generation dual-source-CT (DSCT) (Siemens Somatom Force and Flash, Siemens Healthcare, Forchheim, Germany), as well as on the 64-slice single-source-CT (SSCT) (Siemens Sensation 64, Siemens Healthcare, Forchheim, Germany) were included into the retrospective study. Acquisitions on both DSCT-systems were performed with automated tube voltage selection and automated tube current selection, whereas SSCT protocol included solely the automatic tube current modulation. All images were reconstructed with a 3 mm slice thickness and an increment of 1.5 mm, using the iterative method on both DSCT-systems and filter-back-projection on the SSCT. Commercially available automated dose tracking software (Radimetrics, Bayer Healthcare, Whippany, NJ) was used to calculate the size-specific-dose-estimate. Subjective image quality of axillary and mediastinal lymph nodes, and adrenal glands was rated by two experienced radiologists in a blinded fashion: 5= Excellent image quality with excellent delineation, no blurriness; 4= Good image quality with good delineation, slight blurriness, diagnostically usable; 3= Acceptable image quality with acceptable delineation or blurriness, diagnostically still usable; 2= Insufficient image quality with non-definable delineation or blurriness and not recommended for diagnostic usage. 1= Non-usable image quality.

RESULTS

43 patients having the identical CT exam on all three modalities were included into the study. Subjective image quality was excellent throughout all three CT-generations ($p = 0.38-0.98$). Calculated patient dose in the 3rd generation DSCT was lower by 29% and 43%, when compared to the radiation dose on the 2nd generation DSCT and SSCT, respectively.

CONCLUSION

Modern CT-equipment substantially reduce radiation dose without affecting the image quality. Dose properties can be easily monitored by automated dose tracking software in daily routine.

CLINICAL RELEVANCE/APPLICATION

Automated dose tracking is an objective approach in monitoring patient radiation dose.

SSA21-08 CT Dose Comparison Between Two Academic Institutions: Complexities in Achieving an Apples to Apples Dose Comparisons

Sunday, Nov. 27 11:55AM - 12:05PM Room: S404AB

Participants

Timothy P. Szczykutowicz, PhD, Madison, WI (*Presenter*) Equipment support, General Electric Company; License agreement, General Electric Company
Joshua Wilson, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Robert K. Bour, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Frank N. Ranallo, PhD, Madison, WI (*Abstract Co-Author*) Grant, General Electric Company
Annelise Malkus, PhD, Madison, WI (*Abstract Co-Author*) Licensing agreement, General Electric Company
David E. Miller, PhD, Kirkland, WA (*Abstract Co-Author*) Employee, General Electric Company
Mike Farrell, Waukesha, WI (*Abstract Co-Author*) Employee, General Electric Company
Ken Denison, Waukesha, WI (*Abstract Co-Author*) Employee, General Electric Company
Ehsan Samei, PhD, Durham, NC (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Siemens AG
Myron A. Pozniak, MD, Madison, WI (*Abstract Co-Author*) Stockholder, Celectar Biosciences, Inc; Support, General Electric Company

CONCLUSION

Our efforts at multi-institutional comparative dose mapping encountered serious impediments early in the process. Specifically having to do with: (1) size based protocols and (2) protocols that are used for multiple indications.

Background

The aggregation of CT dose data on an institutional level has now become common place using 3rd party dose monitoring products or the ACR DIR. This work describes an attempt to use such a system to compare 13 single phase, adult and pediatric, chest, abdomen, and neuro CT protocols between two academic hospitals. We also explore challenges with dose comparison related to issues with naming conventions and differences in data aggregation. We hope that other sites can learn from this exercise and use our experience to better evaluate their own CT dose.

Evaluation

Doses were compared using the CTDIvol, DLP, and SSDE metrics for the mean and 25/50/75th percentiles. With the exception of

CTA for pulmonary embolism whose mean dose metrics varied by over 100% between the two institutions, all other indications differed by less than 75%. One institution tended to have higher neuro but lower abdomen and chest doses than the other. Cases in which the workflow for choosing protocols between the two institutions for the same indication will be presented. For example, institution A uses the same protocol for scans of the abdomen with and without contrast, while institution B uses two different protocols. For an accurate comparison, such differences must be taken into account. Additionally, institution A uses separate size based protocols (small/medium/large); institution B uses one protocol for non-bariatric adults (which are modified at scan time for patient size) plus a dedicated bariatric protocol.

Discussion

In this study, we focused on single phase exams to avoid dealing with series level dose mapping. Variability in technologist's workflow and the protocol disparity regarding anatomic coverage and patient body habitus add complexity to mapping protocols for dose comparison.

SSA21-09 Comparison of Standard Formulaic Calculations of Effective Dose Against Monte Carlo-Simulated Software Calculations for Various CT Exams on 64-Slice and 16-Slice CT Scanners

Sunday, Nov. 27 12:05PM - 12:15PM Room: S404AB

Awards

Student Travel Stipend Award

Participants

Amy L. Ellenbogen, MD, Washington, DC (*Presenter*) Nothing to Disclose

James P. Earls, MD, Clifton, VA (*Abstract Co-Author*) Nothing to Disclose

Myles T. Taffel, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

Robert K. Zeman, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

Shahriar Haji-Momenian, MD, Arlington, VA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the effective dose of various CT studies using standard formulas against Monte Carlo-simulated software calculations on 64-slice and 16-slice CT scanners.

METHOD AND MATERIALS

This is an IRB-approved retrospective study. Fifty non-contrast head CT's (NCHCT), non-contrast chest CT's (ChCT), non-contrast abdominopelvic CT's (ncCTAP), and contrast-enhanced abdominopelvic CT's (c+CTAP) performed on GE LightSpeed 64-slice and GE BrightSpeed 16-slice scanners from April 2015 to December 2015 were enrolled. Fifty CT pulmonary angiography (CTPA) studies from the 64-slice scanner and the 12 CTPA studies from the 16-slice scanner during the study period were enrolled. Radiation dose monitoring software, Radimetrics (Bayer, Whippany, NJ), was used to extract the exam dose length product (DLP). The effective dose (ED) was calculated using the standard formula ($ED = DLP * k$). Radimetrics software provided Monte Carlo-simulated calculations of ED for each exam using a library of phantoms with pre-run Monte Carlo simulations for various scan parameters best matched to the patient exam. The standard formulaic calculation of ED for each exam on each scanner was compared with the Monte Carlo calculation. Bland-Altman plots and paired t-test analysis were performed.

RESULTS

There were statistically significant differences ($p < 0.05$) between the standard formulaic and Monte Carlo-simulated calculations of ED for NCHCT's, ChCT's, CTPA's, and c+CTAP's on the 64-slice and 16-slice CT scanners. There was no significant difference between ED calculations for the ncCTAP on both scanners. The standard deviation of the difference between the Monte Carlo and formulaic calculations were 0.45 mSv for NCHCT, 2.2 mSv for ChCT, 3.1 mSv for CTPA, 1.9 mSv for ncCTAP, and 2.8 mSv for c+CTAP. With chest CT's, most of the formulaic calculations were less than the Monte Carlo calculations. With abdominopelvic CT's, most of the formulaic calculations were less than the Monte Carlo values in lower dose exams and greater than the Monte Carlo values in higher dose exams.

CONCLUSION

Standard formulaic calculations of ED differ significantly from Monte Carlo-simulated software calculations for most exams on GE 64- and 16-slice scanners.

CLINICAL RELEVANCE/APPLICATION

The difference between these methods should be considered when estimating patient dose.

SSA22

Physics (MR-Techniques)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S405AB

BQ **MR** **PH**

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: .50

FDA Discussions may include off-label uses.

Participants

Chen Lin, PhD, Indianapolis, IN (*Moderator*) Nothing to Disclose
Edward F. Jackson, PhD, Madison, WI (*Moderator*) Nothing to Disclose

Sub-Events

SSA22-01 Dual-Echo Dixon Imaging in the Presence of Large Field Inhomogeneities

Sunday, Nov. 27 10:45AM - 10:55AM Room: S405AB

Awards

Trainee Research Prize - Fellow

Participants

Eric Stinson, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Phillip M. Young, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Joel G. Fletcher, MD, Rochester, MN (*Abstract Co-Author*) Grant, Siemens AG; ;
Joshua D. Trzasko, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Stephen J. Riederer, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this work is to demonstrate dual-echo Dixon imaging with a novel cost-based, graph-cuts-guided optimization that allows for successful separation of fat and water images in regions of high B0 inhomogeneity.

METHOD AND MATERIALS

Dual-echo Dixon imaging under a linear signal model is an inherently underdetermined problem with two complex knowns (the two images at different echo times) and five real-valued unknowns (magnitude and initial phase of both water and fat and the inhomogeneity in the main magnetic field, ΔB_0). By constraining the initial phase, ϕ_0 , of the water and fat images to be equal, the now nonlinear problem has only four real-valued unknowns (magnitude of water and fat, ϕ_0 , and ΔB_0). Therefore, to find the maximum likelihood solution, the minimum of a four-dimensional cost function must be found. Additionally, to avoid signal swaps, the solutions for ΔB_0 and ϕ_0 must be unwrapped before reconstructing the water and fat images. In this work, we utilize nested variable projection to reduce the four-dimensional cost function to that of one dimension (solved for ΔB_0). When the maximum likelihood solutions have been found, ΔB_0 and ϕ_0 are unwrapped via minimization of a regularized cost function that promotes smoothness. The greedy binary optimization is guided by graph cuts, and allows for large B0 inhomogeneities to be resolved. This reconstruction algorithm was used to reconstruct dual-echo CE-MRA images for the thighs and pelvic images depicting perianal fistulas.

RESULTS

Images from a dual-echo CE-MRA study in the thighs depict a successful water/fat separation despite absolute ΔB_0 values greater than 2500 Hz near the edge of the field-of-view. The largest ΔB_0 values in this thigh study represent field inhomogeneities of ~20 parts per million. Similar separation results are seen in the pelvis, demonstrating successful separation in a smaller field-of-view within which the field is more homogenous.

CONCLUSION

Dual-echo Dixon imaging with a constrained phase signal model and a regularized graph-cuts-guided optimization is able to successfully separate images of fat and water signals in the presence of large inhomogeneities in the main magnetic field.

CLINICAL RELEVANCE/APPLICATION

Fat suppression allows visualization of pathologies obscured by fat signal, but is confounded by large B0 inhomogeneities. The method described here performs well even with large B0 inhomogeneities.

SSA22-02 Magnetic Resonance Fingerprinting: Mitigating the Bias in the Quantification of T1 and T2 Caused by Macromolecules

Sunday, Nov. 27 10:55AM - 11:05AM Room: S405AB

Participants

Tom Hilbert, Lausanne, Switzerland (*Abstract Co-Author*) Employee, Siemens AG
Florian Knoll, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Tiejun Zhao, PhD, Pittsburgh, PA (*Abstract Co-Author*) Employee, Siemens AG
Kai Tobias Block, PhD, New York, NY (*Abstract Co-Author*) Royalties, Siemens AG
Jean-Philippe Thiran, PhD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Gunnar Krueger, DPHIL, Lausanne, Switzerland (*Abstract Co-Author*) Employee, Siemens AG
Tobias Kober, Lausanne, Switzerland (*Abstract Co-Author*) Employee, Siemens AG
Daniel Sodickson, MD, PhD, New York, NY (*Abstract Co-Author*) Royalties, General Electric Company License agreement, General Electric Company Royalties, Bruker Corporation License agreement, Bruker Corporation Research collaboration, Siemens AG
Martijn A. Cloos, PhD, New York, NY (*Presenter*) Nothing to Disclose

PURPOSE

In this work we aim to mitigate the bias in the quantification of T1 and T2 caused by macromolecules when using magnetic resonance fingerprinting (MRF).

METHOD AND MATERIALS

Magnetization transfer (MT) effects can bias the estimation of T1 and T2 in MR and are caused by dipolar effects and chemical exchange between free water and macromolecules. We used a radial MRF sequence to measure the T1 and T2 in the brain of a healthy volunteer at 3T. The same measurement was performed with three different RF pulse durations (5 ms, 2 ms, and an interleaved mix of both). The first two measurements were reconstructed using the traditional method, whereas the last scan was reconstructed using a new prototype algorithm which includes a specialized MT model.

RESULTS

In the conventional fingerprinting sequence, the white-matter T2 values show a dependence on the RF pulse duration (48 ms for the long and 35 ms the short pulses). Moreover, compared to the values reported in the literature (~60 ms), both configurations significantly underestimate the true T2. Using a mix of different RF pulse durations in combination with the proposed algorithm, an MT bias map can be extracted which enables a more accurate measurement of T2 (~60ms).

CONCLUSION

Here we demonstrate that the quantification of relaxation parameters using fingerprinting is sensitive to MT effects and show that this bias can be mitigated by varying the RF pulse duration in the sequence and incorporating a MT model into the reconstruction process.

CLINICAL RELEVANCE/APPLICATION

Unlike weighted images, quantitative imaging enables intra- and inter-subject comparison. Unbiased quantitative measures promise benefits to diagnosis, staging and monitoring of pathology and therapy.

SSA22-03 Motion Imaging in Thoracic and Abdominal MRI using a Self-Navigated Cartesian Compressed Sensing Acquisition and Reconstruction Scheme

Sunday, Nov. 27 11:05AM - 11:15AM Room: S405AB

Participants

Thomas Kuestner, DIPLING, Stuttgart, Germany (*Presenter*) Nothing to Disclose
Sergios Gatidis, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Wuerslin, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
Petros Martirosian, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Fritz Schick, MD, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Bin Yang, PhD, DIPLING, Stuttgart, Germany (*Abstract Co-Author*) Nothing to Disclose
Nina Schwenzler, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Holger Schmidt, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Respiratory motion is a main source of image artifacts in thoracic and abdominal MRI that can strongly deteriorate image quality. The purpose of this study was to implement and evaluate a Compressed Sensing-based acquisition and reconstruction scheme for motion imaging in thoracic and abdominal MRI under free-movement (respiration, cardiac motion).

METHOD AND MATERIALS

The proposed method consists of an acquisition and a reconstruction step. A 3D T1-weighted gradient echo (GRE) sequence is acquired using a sparse variable-density Poisson-Disc k-space sampling in a short scan time of 90s under free-movement. The acquired k-space data is retrospectively gated according to an extracted self-navigation signal which captures the periodic respiratory motion. An additionally acquired ECG signal allows performing a cardiac motion-correction simultaneously. The gates are subsequently jointly reconstructed using Compressed Sensing techniques yielding a respiratory and cardiac motion-resolved 4D (3D+time) image. A single 3D motion-corrected image can be derived by image registration. The method is evaluated for 20 healthy volunteers on a 3T PET/MR scanner. Image quality of MR images acquired using the proposed method is compared to a standard GRE sequence without motion correction and to a breath-hold image using statistical features. In addition, subjective image quality is rated by five radiologists on a 3-point score (3:best).

RESULTS

The proposed method achieves significant quantitative and qualitative improvement in image quality with perceptible reduction of motion artifacts (respiration and heart). Motion-corrected images are of similar image quality as breath-hold/triggered acquisitions with an average score of 2.6 and good motion resolvability (liver-lung boundary slope steepness improvement over free-movement images of 288%±150%).

CONCLUSION

MR motion imaging using a Cartesian Compressed Sensing acquisition and reconstruction scheme with self-navigation is feasible and achieves a marked reduction of motion artifacts in free-movement acquisitions in a short scan time.

CLINICAL RELEVANCE/APPLICATION

The proposed method may contribute to more robust motion imaging and correction, yielding a better diagnostic image quality in anatomic areas with repetitive motion.

SSA22-04 Automated Quantification of Intermuscular Adipose Tissue on Thigh MRI of Varying Severities of Muscle Disease

Participants

William Kovacs, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Chia-Ying Liu, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Nuria Carrillo, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Summers, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Royalties, iCAD, Inc ;
Jianhua Yao, PhD, Bethesda, MD (*Abstract Co-Author*) Royalties, iCAD, Inc
Isabella Nogues, BA, Bethesda, MD (*Presenter*) Nothing to Disclose

PURPOSE

Our goal is to develop a system capable of quantifying the amount of muscle, subcutaneous (SAT) and intermuscular (IMAT) adipose tissue on thigh MRI in cases of severe muscle disease.

METHOD AND MATERIALS

A sequence of advanced image processing algorithms is developed to classify tissues and identify fascia lata in the thighs. Our program first separates left and right thighs and applies the N4ITK algorithm to correct intensity inhomogeneities inherent in T1 weighted MRI. Fuzzy c-means is then used to separate muscle and adipose tissues. The bone is identified via histogram analysis and region growing. A thin-line gradient filter is passed over the image, and potential fascia lata points are identified as the max response along rays from the thigh's center to its boundary. A contour to separate the SAT and IMAT is constructed by checking each ray and connecting the potential fascia points. Outliers are removed in this contour based on neighborhood information, and a piecewise smooth Bernstein polynomial is fitted to obtain the fascia lata boundary. We tested our method on the T1 sequence of the thighs of 38 patients (aged 41±11, and 17 male and 21 female) with GNE myopathy at varying degrees of thigh muscle involvement (9 Mild, 23 Moderate, 6 Severe). Of these, 12 patients (4 of each group) had 3 slices manually segmented as reference.

RESULTS

Based on our automatic segmentation, we found that the IMAT percentage of the thigh was 13±3%, 24±7%, and 36±8% in mild, moderate, and severe groups, respectively. Comparisons between manual and automated segmentation reveal a varying amount of agreement depending on the level of severity of the muscle involvement. We achieved Dice coefficients of 0.95±0.01, 0.91±0.03, and 0.68±0.07 for muscle, SAT, and IMAT, respectively, in mild group, of 0.94±0.01, 0.92±0.05, and 0.83±0.03 in moderate group, and 0.76±0.23, 0.90±0.02, and 0.87±0.03 in severe group. The R2 value between manual and automated measurements for the percentage of muscle, SAT, and IMAT in the thigh were 0.99, 0.97, and 0.96, respectively for the validation set.

CONCLUSION

We have demonstrated an automated and robust method to distinguish between the SAT and IMAT of the thigh, thus making it capable of quantifying the different tissue types regardless of disease severity.

CLINICAL RELEVANCE/APPLICATION

The proposed system provides consistent quantification of thigh tissue composition and can be used to effectively study and track muscle disease.

SSA22-05 Automated Image Quality Assessment in Whole-Body MRI

Sunday, Nov. 27 11:25AM - 11:35AM Room: S405AB

Participants

Sergios Gatidis, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose
Annika Liebgott, MSc, Stuttgart, Germany (*Abstract Co-Author*) Nothing to Disclose
Holger Schmidt, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nina Schwenzer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Petros Martirosian, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
Fritz Schick, MD, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Bin Yang, PhD, DIPL ENG, Stuttgart, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Kuestner, DIPL ENG, Stuttgart, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MR image quality is highly variable due to numerous influencing factors and possible artifacts. Automated assessment of image quality may enable efficient optimization of MRI acquisition. The purpose of this study was to implement and evaluate a machine learning framework for automated analysis of whole-body MRI data.

METHOD AND MATERIALS

The proposed algorithm consists of a training phase with feature extraction, feature reduction and training of a classifier. Image foreground and background were segmented prior to feature extraction using level set segmentation. A variety of image features (intensity-based, gradient-based and texture-based features) were obtained from each MR data set describing an image in a high-dimensional space. After feature reduction using principal component analysis, a Support Vector Machine was trained to categorize image quality into one of five classes (1: very high quality, 5: very poor quality). Subjective quality ratings given independently by 5 radiologists were used as ground truth labels in the training phase. This method was applied on 2911 randomly selected MR images from different acquisition protocols of head/neck, thoracic and abdominal regions. 70% of these images were randomly used as a training set and 30% as test set. Classification accuracy was measured as the percentage of correctly classified samples in the test set.

RESULTS

Ground truth image quality was classified by the radiologists with the following distribution: 1:10%; 2:21%; 3:29%; 4:28%; 5:12%. We observed varying classification accuracy depending on the amount and selection of features used. Optimal classification

accuracy of 92% was observed using a total of 3039 features and 36 principal components. Most classification errors occurred between classes 1 (very good quality) and 2 (good quality).

CONCLUSION

Automated assessment of MR image quality is feasible using a machine learning approach and yields a high classification accuracy.

CLINICAL RELEVANCE/APPLICATION

The presented method can contribute to automated optimization of MR image quality in clinical practice or assisted image acquisition and reading and thus possibly improve diagnostic efficacy.

SSA22-06 Changing Temporal Resolution of DCE-MRI Radial VIBE Data by ICTGV Reconstruction

Sunday, Nov. 27 11:35AM - 11:45AM Room: S405AB

Participants

Matthias Schloegl, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose

Martin Holler, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose

Kristian Bredies, Graz, Austria (*Abstract Co-Author*) Nothing to Disclose

Rudolf Stollberger, PhD, Graz, Austria (*Presenter*) Nothing to Disclose

PURPOSE

To explore the adjustment of the temporal resolution of DCE-MRI after data acquisition by a new iterative reconstruction technique.

METHOD AND MATERIALS

This fully HIPAA-compliant study uses raw data of already acquired golden angle radial DCE-MRI scans and reconstructs dynamic image series with different temporal resolution with a new reconstruction technique based on infimal convolution total generalized variation (ICTGV). Data acquisition was performed for DCE liver scan at 3Tesla with a 12 element body array coil. A 3D radial VIBE sequence (stack of stars) was performed with 30 slice encodings and 600 spokes per slice. With a standard compressed sensing GRASP algorithm a spatial resolution of 1x1x3 mm (matrix = 384x384x30) and a temporal resolution of 2.6s would be obtained. ICTGV was used to retrospectively reconstruct a dynamic series with a higher temporal resolution by grouping number of consecutive spokes. This approach was compared for the same undersampled number of projections with low-rank sparse (L+S) reconstruction and the GRASP technique.

RESULTS

DCE-series were reconstructed by using 8, 14, and 21 spokes- per-frame (spf) resulting in a temporal resolution of 0.94, 1.7 and 2.6 s. For 8 and 14 spokes, the standard GRASP reconstruction delivered a noisy image quality suffering from aliasing artifacts. L+S and ICTGV suppressed the aliasing artifacts much better and preserved also tiny image details (see Fig. for 8 spokes). The analysis of the arterial input function shows a marked temporal blurring for the L+S reconstruction. The AIF determined from ICTGV reconstruction shows the best SNR, the highest peak value and a pronounced second pass (see Fig.).

CONCLUSION

ICTGV outperformed both alternative algorithms in spatial and temporal SNR and allows calculating dynamic 3D data with high temporal resolution to better characterize the contrast-agent related functional signal changes. Therefore ICTGV reconstruction is able to improve the data basis for subsequent quantitative analysis.

CLINICAL RELEVANCE/APPLICATION

The investigated method allows combining high spatial and high temporal resolution and a retrospective adjustment depending on specific patho-morphological requirements.

SSA22-07 Assessment of the Accuracy, Repeatability, and Efficiency of Accelerated Variable Flip Angle T1 Mapping Techniques Using a NIST-traceable MR System Phantom

Sunday, Nov. 27 11:45AM - 11:55AM Room: S405AB

Participants

Alexander Antolak, Madison, WI (*Presenter*) Nothing to Disclose

Edward F. Jackson, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Assess the accuracy and repeatability of a variable flip angle (VFA) 3D-FSPGR T1 mapping method using a recently commercialized NIST/ISMRM MR System Phantom with and without parallel imaging and with 2 to 7 flip angles.

METHOD AND MATERIALS

The NIST/ISMRM MR System Phantom, produced by High Precision Devices, Inc (Boulder, CO), contains, among other inserts, an array of 14 spheres with T1 values ranging from 23 to 2033 ms at 1.5 T. The NiCl₂ solutions used to fill the spheres are prepared and maintained by NIST to ensure stability and accuracy. The phantom was imaged 3 times over 4 days on a GE HDxt 1.5 T MR scanner using a 3D-FSPGR sequence with 7 flip angles from 2 to 30 degrees and 4 averages. In addition, parallel imaging was applied with no averaging, and subsets of the 7 flip angle data, with and without parallel imaging, were used to investigate the impact of decreased acquisition times on T1 measurement accuracy and repeatability. T1 calculations were performed in Matlab using a nonlinear least squares fit. The mean T1 value, standard deviation, and percent deviation from nominal T1 values were computed for each T1 sphere in the phantom.

RESULTS

For all cases, the minimum deviation from nominal T1 values was 14%. The deviation increased for larger T1 values, up to a maximum of 30%. Total scan time for the 4 average T1 mapping protocol using 7 flip angles was approximately 18 minutes. Parallel imaging with an acceleration factor of 2 and no averaging provided similar results to the 7 flip angle, 4 average protocol while decreasing the imaging time by a factor of 8. T1 mapping accuracy was also maintained using only 3 flip angles instead of 7 (with

and without parallel imaging). Using 3 flip angles and parallel imaging together decreased the imaging time from approximately 18 minutes to 1 minute. The maximum coefficient of variation across all 3 acquisitions for any T1 sphere and acquisition strategy was 5%.

CONCLUSION

Highly repeatable estimates of T1 relaxation times can be obtained when using parallel imaging and as few as 3 flip angles, significantly improving the efficiency of T1 measurements. Parallel imaging, with acceleration factors of 2, have minimal impact on repeatability and accuracy.

CLINICAL RELEVANCE/APPLICATION

To be clinically relevant, T1 measurements should be acquired efficiently and with known accuracy and repeatability. Parallel imaging had no significant impact on the quality of such measures.

SSA22-08 fMRI in All Plane Orientations with Decreased Image Distortion Using A 2D RF Pulse for Field-of-View Reduction

Sunday, Nov. 27 11:55AM - 12:05PM Room: S405AB

Awards

Student Travel Stipend Award

Participants

Muge Karaman, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

Yi Sui, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Ying Xiong, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Xiaohong J. Zhou, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To demonstrate the use of a 2D excitation radio-frequency (RF) pulse for fMRI over a reduced field-of-view (rFOV) to reduce image distortion in a focused region in not only an axial, but also sagittal and coronal planes that are conventionally prohibitive due to excessive image distortion.

METHOD AND MATERIALS

A 2D RF pulse was designed and incorporated into a single-shot echo planar imaging (ssEPI) sequence. The pulse features a tilted excitation profile to enable multi-slice imaging and simultaneous lipid suppression. With IRB approval, fMRI experiments were carried out on five healthy human subjects at 3T with a 32-channel head coil using a flashing checkerboard visual activation or a finger tapping task (5 epochs of 30s on and 30s off). For comparison, both a commercial full FOV (fFOV) and the proposed rFOV sequences were used. The visual cortex experiments (VCEs) were performed in the axial and sagittal planes with the same in-plane resolutions of $1.875 \times 1.875 \text{mm}^2$. The motor cortex experiments (MCEs) were performed in the axial and coronal planes with in-plane resolutions of $1.875 \times 1.875 \text{mm}^2$ and $1.875 \times 1.5 \text{mm}^2$, respectively. The activation t -maps were calculated using SPM12 and superimposed on 3D T1-weighted anatomical or EPI images.

RESULTS

The activated voxels from the axial, sagittal, or coronal VCEs and MCEs in the rFOV images were substantially better registered to the T1-weighted images than those in the fFOV images due to the reduced image distortion. In the coronal-MCEs, the false positive activations on the skull decreased noticeably in the rFOV compared to the fFOV acquisition. The close resemblance between the rFOV coronal-MCE activation and the reformatted coronal view of the fFOV axial-MCE activation provides further evidence demonstrating the benefit of using the proposed rFOV technique over the fFOV sequence in the coronal plane without suffering from intensity discontinuity imposed by slice reformatting.

CONCLUSION

The proposed rFOV ssEPI sequence outperformed the conventional ssEPI sequence particularly in non-axial planes where the excessive distortion often makes EPI-based fMRI prohibitive.

CLINICAL RELEVANCE/APPLICATION

This rFOV technique provides flexibility in selecting acquisition planes without suffering from excessive image distortion, allowing fMRI to be performed in a plane that best matches the activation regions.

SSA22-09 Volumetric Respiratory-Resolved and Cardiac--Resolved MR Flow Imaging

Sunday, Nov. 27 12:05PM - 12:15PM Room: S405AB

Participants

Joseph Y. Cheng, PhD, Stanford, CA (*Presenter*) Research support, General Electric Company

Marcus T. Alley, PhD, Stanford, CA (*Abstract Co-Author*) Research funded, General Electric Company; Research Consultant, Arterys Inc

John Pauly, Stanford, CA (*Abstract Co-Author*) Research support, General Electric Company

Michael Lustig, PhD, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose

Shreyas S. Vasanawala, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research collaboration, General Electric Company; Consultant, Arterys Inc; Research Grant, Bayer AG;

PURPOSE

Volumetric cardiac-resolved MR flow imaging (4D flow) enables the assessment of flow, function, and anatomy from a single sequence. This technique simplifies and shortens congenital heart disease (CHD) MRI exams. Modern accelerated imaging techniques enable the acquisition to be performed in a practical 5–15 min scan. With patients freely breathing, the impact of respiration on cardiac flow quantification is typically ignored. The purpose of this work is to develop an ultra-high-dimensional flow imaging technique (ND flow) to evaluate the impact of respiration on cardiac flow quantification.

METHOD AND MATERIALS

With IRB approval and informed consent, pediatric patients were imaged with MRI, ferumoxytol administration, and general anesthesia. A Cartesian 4D flow sequence is modified to include intrinsic navigators and pseudo-random variable-density k-t sampling. The EKG and navigation signals are used to retrospectively sort the data into respiratory and cardiac phases. A compressed-sensing-based parallel imaging method is used to reconstruct this highly-subsampled dataset. The proposed technique is compared to conventional 4D flow with and without respiratory motion compensation through soft-gating (SG). Velocity images are corrected for background phase errors, and flow is quantified in the superior and inferior vena cava (SVC and IVC).

RESULTS

Using the proposed ND flow in a 3-yr-old female, 0.75–0.84 L/min (mean 0.74 L/min) for the SVC and 0.15–0.69 L/min (mean 0.44 L/min) for the IVC were observed for total blood flow as a function of respiration. For conventional 4D flow, a flow of 0.40 L/min (with and without SG) in the IVC and a flow of 0.72 (no SG) and 0.75 L/min (with SG) in the SVC were measured. Respiratory-dependent flows were also measured in a 10-yr-old male: 0.72–2.0 L/min (mean 1.4 L/min) for SVC and 0.48–1.1 L/min (mean 0.9 L/min) for IVC. For conventional 4D flow, 1.33 and 1.49 L/min (without and with SG) in the SVC and 0.98 and 1.0 L/min (without and with SG) in the IVC were measured.

CONCLUSION

Respiratory-induced blood flow variations has been demonstrated using ND flow. This technique will provide a tool to investigate specific CHDs, how anesthesia impacts flow measurements, and the relationship between respiratory and cardiac systems.

CLINICAL RELEVANCE/APPLICATION

Respiration may impact cardiac flow quantification, and we present a tool to evaluate and study this effect for potentially more accurate blood flow measurements.

Radiation Oncology (Lymphoma/Biology/Non-Malignant Disease)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S104A



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

Participants

Martin Colman, MD, Houston, TX (*Moderator*) Nothing to Disclose
Jerry J. Jaboin, MD, PhD, St. Louis, MO (*Moderator*) Nothing to Disclose

Sub-Events**SSA23-02 Outcomes with R-CHOP and Consolidative Radiation in Advanced Diffuse Large B-Cell Lymphoma**

Sunday, Nov. 27 10:55AM - 11:05AM Room: S104A

Participants

Matthew Mills, BS, Tampa, FL (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The role of consolidative radiation (RT) after R-CHOP in advanced stage Diffuse Large B-Cell Lymphoma (DLBCL) is typically given for bulky disease, but remains a clinical question. In particular the role of RT in double-hit DLBCL has not been well defined. Therefore, we evaluated the outcome of patients treated with R-CHOP followed by consolidative RT with a particular focus on double-hit DLBCL. **Materials/Methods:** The records of 63 advanced stage (3-4) DLBCL patients treated with R-CHOP and consolidative RT between 1999 and 2014 were retrospectively analyzed. A total of 78 lesions treated in 63 patients were identified for analysis. Patient demographics, tumor/treatment details, and outcomes were abstracted from the electronic medical record. Outcomes including freedom from progression (FFP) following RT and overall survival (OS) were estimated with Kaplan-Meier univariate analysis (UVA). Cox proportional hazard ratio (HR) model was used to assess the effect of patient, tumor, and other predictive factors. **Results:** Median follow-up following completion of RT was 21.9 months (range: 0.23-168 months). Median age of diagnosis was 57 years (range: 20-99), the majority were male (63%) and white (90%). The cohort consisted of stages 3A (29%), 3B (14%), 4A (35%), and 4B (22%). The majority of patients had a poor International Prognostic Index (IPI) (51%), B symptoms (52%) and extra-nodal involvement (78%). Median LDH at diagnosis was 591 (range: 161-20680). Regarding treatment, the median number of chemotherapy (CT) cycles received before and after RT was 6 (range: 0-16) and 0 (range: 0-15), respectively. The median number of cycles of Rituximab before and after RT was 6 (range: 0-14) and 0 (range: 0-14), respectively. Four (6%) patients received bone marrow transplant prior to RT and 9 (14%) after RT. Median RT dose was 35 Gy (range: 5.4-40.4 Gy). At the time of analysis 44 patients were alive and the median OS was not reached. Survival at 6, 12, 24, 36, and 60 months was 93%, 83%, 71%, 71%, and 71%, respectively. 6, 12, 24, 36, and 60 month FFP was 75%, 74%, 74%, 74%, 70%. No significant difference in OS was noted between stage ($p=0.58$), IPI ($p=0.77$), B symptoms ($p=0.35$), extra-nodal/BM involvement ($p=0.64$). On UVA, bulky disease ($>5\text{cm}$) predicted worse OS with a HR of 3.42 (95% CI 1.1-14.9, $p=0.03$). Double/triple hit positivity was determined in 19 patients; 4 had a double-hit and 2 had triple hit. Double/triple hit DLBCL was associated with worse FFP with HR 4.9 (95% CI: 1.02-21.7, $p=0.05$) and a trend for worse OS with HR 2.9 (95% CI 0.77-13.9 $p=0.12$). Bulky disease ($p=0.48$) and radiation dose ($p=0.48$) were not significant for FFP ($p=0.48$). **Conclusion:** Consolidative RT after R-CHOP provides good local control benefit in advanced DLBCL patients, comparable to previous studies. Also, double/triple hit positivity may aid in stratifying responders.

SSA23-05 Evaluation of Radiotherapy Techniques for Gastric Mucosa-Associated Lymphoid Tissue (MALT) Lymphoma

Sunday, Nov. 27 11:25AM - 11:35AM Room: S104A

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

Grace Kusumawidjaja, MD, Oak Brook, IL (*Presenter*) Nothing to Disclose
Syazana Mohamed Rashid, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose
Kevin Lee Min Chua, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose
thamizhisai swaminathan, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose
zubin master, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose
Kheng Wei Yeoh, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Refractory primary gastric MALT lymphoma patients, primarily treated with radiotherapy (RT), achieve excellent long-term outcomes. Modern RT such as intensity-modulated radiation therapy (IMRT) and helical tomotherapy (HT) aims to minimize doses to normal tissues, potentially reducing long-term toxicities. We hypothesize that the incremental benefits of modern techniques may not be significant in all instances and resource limitation globally highlight the need for a screening criteria which will identify patients most likely to benefit from complex RT delivery. **Materials/Methods:** Retrospective analysis of 15 patients who had previously received RT was performed. Prescription dose was 30Gy in 1.5 Gy fractions. 5 different plans were generated - Anterior-posterior (APPA), 3D conformal with field in field (FIF) and without (3D) techniques, IMRT and HT. A dosimetric comparison was performed, focusing primarily on coverage of planning target volume (PTV) by 95% of the prescription dose (V95) and heart and kidney doses. Based on the CT simulation images, patients were also grouped into categories based on the amount of overlap between PTV and kidneys - Category A (Non-overlapping) and Category B (Overlapping). **Results:** The difference between V95 for HT and IMRT compared to 3D was not statistically significant (HT v 3D, $p=0.07$; IMRT v 3D, $p=0.07$). QUANTEC dose constraints for mean dose to both kidneys (mean dose 0.05); this was not seen in category A patients. QUANTEC dose constraints for mean heart doses of Conclusion: We demonstrate the dosimetric benefits with complex RT techniques were primarily seen in reducing V25 heart. For other dose constraints, differences between the techniques were marginal. Patients with kidneys not overlapping with

the stomach at screening CT simulation did not benefit from complex techniques. Table. Dosimetric parameters of RT techniques (all patients) V95 (%)Both Kidneys Mean (Gy)Heart Mean (Gy)Heart V25 (%)APPA87.57 +/- 7.0110.28 +/-7.1610.20 +/- 3.6225.66 +/- 12.073DCRT96.71 +/- 2.348.17 +/- 5.0211.79 +/- 2.3423.37 +/- 6.84FIF98.57 +/- 1.805.39 +/- 3.8911.38 +/- 3.3127.28 +/- 11.41IMRT99.99 +/- 0.056.94 +/- 4.539.62 +/- 2.3415.64 +/- 5.27HT99.94 +/- 0.075.11 +/- 2.4110.16 +/- 1.8815.35 +/- 4.81

SSA23-06 MRI is Useful in Planning for and Following Response to Definitive Electron Beam Therapy of Superficial Fibromas in the Hands (Dupuytren's Disease) and Feet (Ledderhose Disease)

Sunday, Nov. 27 11:35AM - 11:45AM Room: S104A

Participants

Aaron H. Wolfson, MD, Miami, FL (*Presenter*) Nothing to Disclose
Ty K. Subhawong, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
James Banks, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The use of electron beam therapy (EBT) for benign superficial fibromas of the hands (Dupuytren's Disease [DD]) and feet (Ledderhose Disease [LD]) is becoming more prevalent as a definitive treatment modality. However, there exists a paucity of information on optimal planning methods and gaging treatment response. Our hypothesis is that magnetic resonance imaging (MRI) can provide additional information over physical exams in the planning and follow-up of patients undergoing EBT for DD and LD.
Materials/Methods: : Our single institutional retrospective review (eProst protocol #20150048) included 8 patients with a total of 23 superficial fibromas measuring at least 3 mm of the hands (DD) and/or feet (LD) who had pre-and post-EBT MRI scans with and without contrast. There were six females and two males with median age of 55.8 years. EBT delivered approximately 30 Gy at 3 Gy per daily fraction with a planned 12 week hiatus between fraction #5 and #6. All patients had the disease sites clinically marked with radio-opaque wiring by the radiation oncologist (RO) at time of CT-simulation. MRI fusion of the T2-weighted contrast-enhanced images with the planning CT images was performed to determine the appropriate beam energy, thickness of bolus, and prescription isodose line. Pre- and post-EBT MRIs were evaluated to determine disease volume (mL) signal intensity (SI) on T-2 weighted images (1-4 ordinal scale), and post-contrast enhancement pattern (i-4 ordinal scale) by a fellowship- trained musculoskeletal radiologist. MRI findings were correlated with the physical exam findings of the RO.
Results: On MRI, the 23 superficial fibromas had a pre-EBT mean size of 0.63 +/- 1.1 mL, mean T2 hyperintensity score = 2.13 +/- 0.87, and mean enhancement score = 2.12 +/- 0.83. Post-EBT at about 3 months were available for 10 lesions of which all 10 showed a grade 1 T2 intensity (p=0.005); however, volume of the 10 were not significantly reduced (mean difference = -0.06 mL (p=0.61).
Conclusion: This small study suggests that MRI may be more useful than physical palpation in the planning pf patients receiving definitive EBT for DD and LD. T2 hypointensity more than volume changes may be a better indicator of EBT response. An international prospectively randomized trial should be considered to provide the opportunity to further evaluate the role of MRI as a planning and follow-up tool for these uncommon benign diseases.

SSA23-09 A Novel Pre-Clinical Model of Cognitive and Neuro-Inflammatory Consequences of Precision Radiation and Immunotherapy

Sunday, Nov. 27 12:05PM - 12:15PM Room: S104A

Awards

Student Travel Stipend Award

Participants

Gwendolyn J. McGinnis, BS, Portland, OR (*Presenter*) Nothing to Disclose
David Friedman, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Kristina Young, MD, PhD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Charles R. Thomas JR, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Michael Gough, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Jacob Raber, MD, PhD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Following treatment, up to one-third of cancer patients report cognitive and behavioral changes, which may in part be mediated by neuroinflammation. Therefore, neuroinflammation is of particular concern given novel treatments combining peripheral radiotherapy with immune activation, such as checkpoint inhibitor immunotherapy.

METHOD AND MATERIALS

Here we test the hypothesis that immunotherapy combined with peripheral radiotherapy causes behavioral alterations and has detrimental cognitive effects as a result of an enhanced proinflammatory environment in the brain. Our project utilizes anti-CTLA-4 immunotherapy preceding CT-guided radiotherapy to the tumor site to model clinical treatment. C57BL/6J mice injected with 3LL carcinoma cells or vehicle in the hind flank were used. Mice received sham, radiotherapy-only, immunotherapy-only, or radiotherapy+immunotherapy treatment (10 mice per group, 80 mice total). To assess cognitive function, mice were exposed to two identical objects and 24 hours later reintroduced to one familiar object and one novel object. The percent time exploring the novel object out of the total time exploring both objects is calculated to determine object recognition. Brain tissue was harvested for immunoassay of inflammatory cytokine and chemokine levels or processed for immunohistochemistry for CD-68, a marker of activated microglia.

RESULTS

In mice that did not receive tumors, object recognition was seen in every group except those receiving combined radiotherapy and immunotherapy. In mice with tumors, object recognition was only observed in mice treated with radiotherapy alone. Increased hippocampal levels of IFN- γ , IL-2, and FGF-Basic were seen in mice without tumors receiving immunotherapy. Increased CD-68 immunoreactivity was observed in all mice receiving either immunotherapy or combined radiotherapy and immunotherapy.

CONCLUSION

While combining immunotherapy and radiotherapy optimizes tumor control, it is associated with cognitive impairments and neuroinflammation.

CLINICAL RELEVANCE/APPLICATION

Neuroinflammation and subsequent cognitive and behavioral alterations should be considered in treatment planning and utilization of combination immunotherapy and radiotherapy in the context of cancer-related neurological dysfunction.

SSA24

Vascular Interventional (Portal Vein Imaging and Intervention)

Sunday, Nov. 27 10:45AM - 12:15PM Room: E350



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

FDA Discussions may include off-label uses.

Participants

Albert A. Nemcek JR, MD, Chicago, IL (*Moderator*) Consultant, B. Braun Melsungen AG
Wael E. Saad, MBBCh, Ann Arbor, MI (*Moderator*) Research Consultant, Siemens AG; Research Consultant, Boston Scientific Corporation; Research Consultant, Medtronic, Inc; Research Consultant, Getinge AB; Research Consultant, Merit Medical Systems, Inc;

Sub-Events

SSA24-01 An Irradiation Stent for Portal Vein Tumor Thrombosis in Hepatocellular Carcinoma-Initial Results

Sunday, Nov. 27 10:45AM - 10:55AM Room: E350

Awards

Trainee Research Prize - Medical Student

Participants

Jian Lu, Nanjing, China (*Presenter*) Nothing to Disclose
Gao-Jun Teng, MD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Jin-He Guo, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Hai-Dong Zhu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Guang-Yu Zhu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We aim to assess the safety and preliminary efficacy of an irradiation portal vein stent for PVTT in patients with HCC.

METHOD AND MATERIALS

Participants with PVTT caused by HCC were evaluated for the treatment with an irradiation portal vein stent (self-expandable stent loaded with 125I seeds). Transarterial chemoembolization (TACE) was conducted after stenting. The outcomes were measured in terms of technical success, recanalization success, stent patency, overall survival, and complications.

RESULTS

From a group of 40 candidates, 25 were recruited. The median follow-up was 13.4 months (range 0.2-32.5). The technical success rate was 92% (23/25). The recanalization success rate was 100% (23/23) immediately after stenting. The median stent patency period was 10.1 months (95% CI: 6.5, 13.7). The 3-, 6-, 9-, and 12-month cumulative stent patency rates were 89.7%, 66.1%, 54.1%, and 27.8%, respectively. The median survival was 12.5 months (95% CI: 8.8, 16.1). The 3-, 6-, 9-, and 12-month cumulative survival rates were 86.4%, 81.6%, 76.1%, and 54.5%, respectively. No Grade 3 or higher stenting or radiation-related complications were observed.

CONCLUSION

Placement of the irradiation portal vein stent appears feasible and safe. This is a promising technique for combining recanalization of an occluded portal vein and brachytherapy for PVTT, which allows TACE to be performed following stenting. Therefore, this irradiation stent placement may benefit to prolong the overall survival of these patients.

CLINICAL RELEVANCE/APPLICATION

Irradiation stent placement is a promising technique for combining recanalization of an occluded portal vein and brachytherapy for PVTT, which provides a longer patency period and allows TACE or other treatments to be performed safely following stenting

SSA24-02 Inpatient Mortality is Higher in Hospitals with Low Annual TIPS Volume

Sunday, Nov. 27 10:55AM - 11:05AM Room: E350

Participants

Lujia Zhou, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ammar Sarwar, MD, Boston, MA (*Presenter*) Stockholder, Agile Devices
Elliot Tapper, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Raza Malik, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Muneeb Ahmed, MD, Wellesley, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine patient and hospital characteristics associated with inpatient mortality in patients undergoing transjugular intra-hepatic portosystemic shunt (TIPS).

METHOD AND MATERIALS

An all-payer database containing discharge information from all hospitalizations in 21 states between 1/1/13 and 12/31/13 (~14 million hospitalizations) was analyzed. All patients >18 years old with an ICD-9 procedure code of 39.1 (intra-abdominal venous shunt) during index admission but without liver transplantation prior to or during the index admission were included (n=2731).

Hospitals were divided into equal quintiles based on annual TIPS volume; very low (1-4/yr), low (5-9/yr), medium (10-19/yr), high (20-29/yr) and very high (≥ 30 /yr). Inpatient mortality during hospitalizations with TIPS was calculated. Multivariate regression analysis was performed to assess the association of annual procedure volume with inpatient mortality using the following co-variables: patient demographics, route of admission (emergent vs. elective), etiology of liver disease (alcoholic, viral, non-alcoholic, and other), insurance status, AHRQ co-morbidity measures and hospital characteristics (ownership, bed size, teaching status, location).

RESULTS

In 2013, 2731 patients underwent TIPS (57.2 \pm 10.95 age; 37.24% female). Inpatient mortality for the index admission was 10% (286/2731). Inpatient mortality decreased across quintiles of annual procedure volume (13% for very low to 6.6% for very high volume hospitals; $p=0.005$). Elective admissions for TIPS procedures increased across quintiles of annual procedure volume (19.4% for very low to 33.3% for very high volume hospitals; $p<0.0001$). On multivariate analysis, compared to hospitals performing ≥ 30 TIPS/yr, hospitals performing 1-4/yr (OR:2.05, 95%CI:1.32-3.23; $p=0.0015$) and 5-9/yr (OR:1.67 95%CI:1.07-2.63; $p=0.02$) had a higher rate of inpatient mortality.

CONCLUSION

Inpatient mortality during admissions with TIPS is higher in hospitals performing less than 10 TIPS per year.

CLINICAL RELEVANCE/APPLICATION

Similar to association of surgical volume and mortality, annual TIPS volume is inversely associated with inpatient mortality. Further validation could result in TIPS placement at high volume centers only.

SSA24-03 Ablative Liver Partition and Portal Vein Embolization (ALP-PVE): Proof of Concept Testing in a Rabbit Model

Sunday, Nov. 27 11:05AM - 11:15AM Room: E350

Awards

Student Travel Stipend Award

Participants

Janesh Lakhoo, BS, Chicago, IL (*Presenter*) Nothing to Disclose

James T. Bui, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Ron C. Gaba, MD, Chicago, IL (*Abstract Co-Author*) Research Grant, Guerbet SA; Research Grant, NeuWave Medical, Inc

PURPOSE

Portal vein embolization (PVE) is used for future liver remnant (FLR) growth induction prior to hepatectomy. Associated liver partition and portal vein ligation (ALPPS) is an alternative 2-step surgery involving PV ligation and hepatic transection followed by resection at a later date. ALPPS may result in more rapid/robust FLR growth vs. PVE, allowing more patients to be resection eligible, but has high morbidity/mortality. Theoretically, combining these two procedures to retain the minimal invasiveness and safety of PVE and exploit the regenerative capacity of ALPPS may allow high FLR growth rates with low adverse events. This study examined the feasibility and efficacy of a modified combined approach—termed Ablative Liver Partition and Portal Vein Embolization (ALP-PVE)—in an animal model.

METHOD AND MATERIALS

In this proof-of-concept study, 16 rabbits (mean weight 2.6 kg) underwent PVE ($n=8$) or ALP-PVE ($n=8$). All rabbits underwent laparotomy for PVE to 3 cranial liver lobes using 100-300 micron microspheres and metallic coils; the PV to the caudal lobe FLR was spared. In the ALP-PVE cohort, the parenchymal bridge connecting cranial and caudal lobes was ablated with a commercially available microwave ablation device. Animals were sacrificed and livers were harvested on post-procedure day 7. Caudal/cranial liver lobes were weighed after oven drying for 4 weeks. Liver masses were standardized to rabbit weight, and compared using the 1-tailed Student's t-test.

RESULTS

The final cohort included 15 rabbits; 1 ALP-PVE rabbit died on post-procedure day 2 and was excluded. The caudal lobe to whole liver mass ratio was higher for ALP-PVE vs. PVE (0.313 vs. 0.267, $P=0.058$). This difference became statistically significant when the first 2 rabbits in each group (constituting the procedure learning curve) were excluded (0.323 vs. 0.266, $P=0.029$), with ALP-PVE caudal lobes showing a 6% greater degree of hypertrophy. Immunohistochemical analysis of Ki-67 activity to quantify and compare cellular proliferation in FLRs between groups is currently pending.

CONCLUSION

This study suggests that ALP-PVE spurs faster and more robust FLR growth vs. PVE, due to ablative destruction of PV collateral networks between embolized and non-embolized liver. This study provides evidence favoring use of ALP-PVE for FLR hypertrophy that mandates further preclinical/clinical testing.

CLINICAL RELEVANCE/APPLICATION

ALP-PVE may enhance FLR growth vs. standard PVE.

SSA24-04 Changes in Platelet Count after Transjugular Intrahepatic Portosystemic Shunt: Correlation with Portosystemic Pressure Gradient

Sunday, Nov. 27 11:15AM - 11:25AM Room: E350

Participants

Sanghun Kim, Birmingham, AL (*Presenter*) Nothing to Disclose

Sherwin Chiu, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

Mohamad Babi, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (*Abstract Co-Author*) Consultant, St. Jude Medical, Inc; Consultant, Baxter

International Inc; Consultant, C. R. Bard, Inc; Consultant, Boston Scientific Corporation; Consultant, W. L. Gore & Associates, Inc;

Moustafa Massoud, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Sherif M. Moawad, MBBCh, MSc, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Amr S. Moustafa, MBBCh, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Bradford Jackson, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Souheil Saddekni, MD, Birmingham, AL (*Abstract Co-Author*) Consultant, St. Jude Medical, Inc
Mohamed G. Shoreibah, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Omar Massoud, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Platelet count is an important laboratory metric that reflects the change in portal pressure after transjugular intrahepatic portosystemic shunt (TIPS) placement. However, the increase in platelet count after TIPS placement is variable between patients. The purpose of this study is to demonstrate if there is a correlation between the changes in platelet count after TIPS with the change in portosystemic pressure gradient.

METHOD AND MATERIALS

We retrospectively reviewed the medical records of 306 patients who had TIPS placed between January 2004 and December 2015. We stratified the patients into 4 groups according to the pre-TIPS platelet count: group 1 (0-20), group 2 (20-50), group 3 (50-100), group 4 (100-150). We calculated the percent change in platelet count before and after TIPS as well as the percent change in PSG for each group.

RESULTS

The study included 193 (63%) males and 113 (37%) females, 208 Caucasians (68%), with a mean age of 56.6 years. There was an overall increase in the platelet count after TIPS (mean=17%, SD=62%). When the patients were stratified according to their pre-TIPS platelet counts, the percent change in the platelet count was statistically significantly different by pair wise comparison between the groups ($p < 0.05$), with patients in groups 1,2,3 and 4 showing a mean of 243%, 59%, 25% and 0.26% increase in platelet counts respectively. There was a negative correlation between the change in the platelet count and the change in PSG which decreased after TIPS (mean=67%, SD=17%). This negative correlation was maintained when the patients were stratified into groups, despite the fact that the change in the PSG was not statistically significantly different between the groups.

CONCLUSION

Pre-TIPS platelet count is an important indicator for the improvement in platelet count after TIPS. The change in the platelet count correlates with the change in PSG, and can be used as an indicator for improvement of PSG after TIPS.

CLINICAL RELEVANCE/APPLICATION

Pre-TIPS platelet count is an important indicator for the improvement in platelet count after TIPS. The change in the platelet count correlates with the change in PSG, and can be used as an indicator for improvement of PSG after TIPS.

SSA24-05 MR-iGuide TIPS: MRI-Angio Fusion Image Guided TIPS (Pre-Clinical Study)

Sunday, Nov. 27 11:25AM - 11:35AM Room: E350

Participants

Edward W. Lee, MD, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Jonathan K. Park, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Bashir A. Tafti, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Justin P. McWilliams, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Stephen T. Kee, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the feasibility, safety and reproducibility of performing MRI-Angio fusion image guided TIPS

METHOD AND MATERIALS

Upon ARC approval, twelve Yorkshire swine underwent TIPS procedure using an iGuide software (Siemens) and Rosch-Uchida TIPS set. 3D images were prepared using non-contrast MRI images fused with cone-beam CT images. The following data were evaluated: a time to create 3D images, a total procedure time, a total fluoro time and the number of punctures needed to cannulate portal vein. Any procedure related complications were also noted.

RESULTS

A technical success rate of creating TIPS was 100% in all 12 animals. Of 12, 11 animals had a "single puncture" TIPS with a mean fluoro time of 7 minutes. A mean time of creating 3D image map was 10 minutes. MRI-Angio fusion images were successfully created in all 12 animals. A mean total procedure time for the entire TIPS procedure was 25 minutes. No immediate complications were noted.

CONCLUSION

Using MR-iGuide, a safe, "single puncture" TIPS is possible. MR-iGuide TIPS is feasible and reproducible with a minimal radiation exposure.

CLINICAL RELEVANCE/APPLICATION

One of the most challenging part of performing TIPS procedure is to identifying intrahepatic portal vein blindly. With our results, we may be able to improve and change the way we perform TIPS currently by providing a direct guidance to the portal vein safely and effectively.

SSA24-06 Long-term Outcomes of Endovascular Intervention for Portal Venous Inflow Disturbance after Liver Transplantation

Sunday, Nov. 27 11:35AM - 11:45AM Room: E350

Participants

Lyo Min Kwon, Anyang-si, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hye Doo Jung, Anyang, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jinyoung Chang, MD, Anyang, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong Eun Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kwanseop Lee, Anyang, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We retrospectively evaluated long-term outcomes of percutaneous transhepatic balloon angioplasty with or without stent placement for portal vein stenosis or thrombosis after liver transplantation (LT).

METHOD AND MATERIALS

Between January 2004 and December 2014, 1294 patients underwent LT (living donor: 889, deceased donor: 405); 54 (43 men, 11 women; mean age, 57.7 years) were confirmed to have portal vein stenosis or thrombosis on follow-up computed tomography or ultrasonography. All patients with portal vein stenosis underwent percutaneous transhepatic interventions, including direct portography with manometry and balloon angioplasty with or without stent placement. Technical and clinical success, laboratory and manometry findings, patency, and major complications were evaluated. Follow-up after the initial balloon angioplasty ranged from 14 days to 110.6 months (mean, 38.2 months).

RESULTS

The technical success rate was 98.1%, and clinical success was achieved in 90.7% of cases. Forty-eight patients experienced a significantly improved pressure gradient across the stenosis after percutaneous transhepatic balloon angioplasty with or without stent placement; the mean pressure gradient decreased from 11.2 mmHg to 2.04 mmHg. At 1, 3, 6, and 12 months and at the last follow-up after balloon angioplasty with or without stent placement, clinical success rates were 98.1%, 96.2%, 94.3%, 94.3%, and 92.5%, respectively. One major complication following balloon angioplasty with stent placement was noted, namely abrupt removal of the vascular sheath with tract bleeding.

CONCLUSION

Percutaneous transhepatic balloon angioplasty with or without stent placement is a safe and effective treatment with long-term patency for portal vein stenosis after LT.

CLINICAL RELEVANCE/APPLICATION

Percutaneous transhepatic balloon angioplasty with portal vein stent placement is a useful and safe treatment for portal vein stenosis after liver transplantation.

SSA24-07 Analyzing Factors Affecting the Hepatic Vein Pressure Gradient in Patients with Chronic Liver Disease

Sunday, Nov. 27 11:45AM - 11:55AM Room: E350

Participants

Yasutaka Baba, MD, Hiroshima, Japan (*Presenter*) Nothing to Disclose
Tomoyo Fuji, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Minoru Ishifuro, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Kenji Kajiwara, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaki Ishikawa, MD, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, Eisai Co, Ltd; Medical Advisor, General Electric Company; ; ; ;
Wataru Fukumoto, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate factors affecting the hepatic vein pressure gradient (HVPG) in patients with chronic liver disease.

METHOD AND MATERIALS

From September 2011 to September 2015, 134 patients (91 males, 43 females, average age 65) with chronic liver disease underwent HVPG to check their portal vein pressure. Chronic liver disease was due to hepatitis B virus (HBV) (n=26), hepatitis C virus (HCV) (n=47), non-B non-C hepatitis (NBNC) (n=19), nonalcoholic steatohepatitis (NASH) (n=4), alcoholism (n=27), and other factors (n=11). The HVPG was correlated with prognostic factors including patient the background, blood test results, the Child-Pugh (CP)- and the MELD score, and CT splenic volumetry. Correlations were assessed with the Spearman correlation coefficient for continuous- and the Mann-Whitney test for categorical variables. The predictive power of HVPG > 10 mmHg was evaluated with receiver operating characteristic (ROC) curves. Multivariate analysis was with the logistic regression method.

RESULTS

There was a statistically significant correlation with albumin (p=0.0097), choline esterase (ChE, p=0.0001), the CP score (p=0.0009), hemoglobin (p=0.0195), ICG15 (p<0.0001), the international normalized ratio of prothrombin time (PT-INR, (p=0.0301), the platelet count (p=0.009), prothrombin time (p=0.0102), red blood cell count (RBC, p=0.0006), T-bilirubin (p=0.0001), white blood cell count (WBC, p=0.0112), NH3 (p=0.007), and splenic volume (p=0.0017). By ROC analysis for predicting a HVPG > 10 mmHg, relevant values were albumin (AUC: 0.636, p=0.004), ChE (AUC: 0.659, p=0.0007), the CP score (AUC: 0.633, p=0.0046), albumin (AUC: 0.636, p=0.004), ICG15 (AUC: 0.680, p=0.001), the platelet count (AUC: 0.614, p=0.0242), RBC (AUC: 0.657, p=0.001), and splenic volume (AUC: 0.675, p=0.0018). By multivariate analysis, albumin (OR: 0.32, 95% CI: 0.12-0.83) and the platelet count (OR: 0.99, 95% CI: 0.98-0.99) were the best factors for predicting HVPG > 10 mmHg.

CONCLUSION

Our results indicate that albumin and the platelet count are the factors best correlated with HVPG. They can be used to predict

Our results indicate that albumin and the platelet count are the factors best correlated with HVPG. They can be used to predict HVPG > 10 mmHg.

CLINICAL RELEVANCE/APPLICATION

An HVPG > 10 mmHg is a poor prognostic marker in patients with chronic liver disease; it is correlated with albumin and the platelet count.

SSA24-08 Do Cirrhotic Patients Have a Higher Rate of Development of HCC after Placement of TIPS?

Sunday, Nov. 27 11:55AM - 12:05PM Room: E350

Awards

Student Travel Stipend Award

Participants

Shanchita Ghosh, MD, Miami, FL (*Presenter*) Nothing to Disclose

Beatrice L. Madrazo, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose

Dania Cioni, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose

Riccardo A. Lencioni, MD, Pisa, Italy (*Abstract Co-Author*) Research Consultant, BTG International Ltd; Research Consultant, Guerbet SA; Research Consultant, Bayer AG

Patricia D. Jones, Miami, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Several studies suggest surgically created portosystemic shunts predispose to greater risk of HCC development (Bañares et al, Hepatology 2005), thought to be secondary to altered venous drainage. Our study seeks to determine if there is an increased risk of developing HCC in cirrhotic patients with intrahepatic porto-systemic shunting, the lag period between TIPS placement and HCC development, and contribution of HCC to mortality in patients who underwent TIPS procedure if any.

METHOD AND MATERIALS

Patients who underwent a TIPS procedure at multiple medical centers from 2010–2016 were retrospectively identified and reviewed for development of HCC and mortality. Exclusion criteria included an existing diagnosis of HCC. Patients were followed until death, development of HCC, or to liver transplant. Primary outcome included incidence of HCC, with secondary outcomes being time to diagnosis of malignancy, all-cause mortality rate, and disease specific mortality. Patients were further characterized by MELD score and etiology of cirrhosis for comparison.

RESULTS

A total of 115 patients with TIPS were followed for 234 person-years with 3 incident cases of HCC. Two cases were identified within two months after placement of TIPS and likely existed prior to the procedure. One case of HCC developed four years after initial TIPS placement. Additionally, of the total 12 observed deaths, the majority were attributable to complications of the underlying liver disease and severe life threatening infection/sepsis, rather than HCC.

CONCLUSION

Despite literature suggesting that portosystemic shunts predispose to greater risk of HCC development, our study indicates that TIPS procedures are not associated with an increased risk for developing HCC. Furthermore, malignancy did not contribute to all-cause mortality in our patient population, whereas mortality related to underlying liver disease was much higher. Thus, a more rigorous HCC surveillance program for this specific patient population as previously argued may be of limited benefit to patient care.

CLINICAL RELEVANCE/APPLICATION

Alteration in venous drainage due to portosystemic stent shunting does not predispose to greater risk of HCC development or contribute significantly to mortality in this patient population.

SSA24-09 Outcomes of TIPS Reduction: Do Symptoms Related to The Original Indication for TIPS Return?

Sunday, Nov. 27 12:05PM - 12:15PM Room: E350

Awards

Student Travel Stipend Award

Participants

Anthony M. Esparaz, MD, Boston, MA (*Presenter*) Nothing to Disclose

Ammar Sarwar, MD, Boston, MA (*Abstract Co-Author*) Stockholder, Agile Devices

Nihara Chakrala, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Raza Malik, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Muneeb Ahmed, MD, Wellesley, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine effect of TIPS reduction (TIPS-R) on reducing side effects of increased shunting and original symptoms requiring TIPS (volume overload [VO] or variceal bleeding [VB]).

METHOD AND MATERIALS

After IRB approval, we retrospectively reviewed all TIPS reductions at a single institution from 01/08-01/16. Indication for TIPS and pre-TIPS, pre-TIPS-R, and post-TIPS-R clinical parameters were collected. Outcomes of patients undergoing TIPS for VO (ascites/hydrothorax) and VB were analyzed separately.

RESULTS

Twenty patients (61±9 years; 80% males) with cirrhosis (MELD: Median 17 [IQR: 10.5-21]) underwent TIPS-R after TIPS placement (time between TIPS-R: Median 64 days [IQR: 22.25-110]; TIPS for VO 10/20, VB 10/20). TIPS-R was deemed technically

successful by an immediate increase in portosystemic gradient ([PSG] pre: 7.6 ± 4.3 mmHg, post: 14.6 ± 5.2 mmHg; $p < .0001$) in 19/20 patients. Concurrent variceal embolization was performed in 4/19 patients, all with VB. TIPS-R was indicated due to hepatic encephalopathy (HE; 13/19), new liver failure (LF; 3/19), or new right heart failure (RHF; 3/19). In patients with successful TIPS-R, at median 30 days, MELD was unchanged (16.1 ± 4.8 to 18.5 ± 9.1 ; $p = 0.15$). TIPS-R improved hepatic encephalopathy in 12/13 patients (West Haven score decreased from 3.4 ± 0.5 to 1.8 ± 0.9 , $p < .0001$), improved pulmonary arterial hypertension in 2/3 patients with RHF, and improved total bilirubin for 2/3 patients with LF (11.7 to 3.4 mg/dL and 27.0 to 6.1 mg/dL). No variceal bleeding recurred in VB patients after TIPS-R, but 1/10 (10%) patient had hematemesis due to a band-related ulcer. In patients with TIPS for VO, 3/10 had reduced frequency of paracentesis after TIPS-R, while 7/10 had either no change in frequency or increased frequency compared to pre-TIPS state.

CONCLUSION

TIPS-R with concurrent variceal embolization in VB patients can improve side-effects of increased shunting with low risk of re-bleeding. However, TIPS-R results in recurrence of volume overload in a majority of patients with VO.

CLINICAL RELEVANCE/APPLICATION

TIPS reduction (TIPS-R) to treat shunt-induced hepatic encephalopathy (HE), hepatic decompensation, and right heart failure is successful without rebleeding, but can result in recurrence of ascites.

Vascular Interventional (Percutaneous Ablation of the Liver)

Sunday, Nov. 27 10:45AM - 12:15PM Room: E352



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

FDA Discussions may include off-label uses.

Participants

James T. Bui, MD, Chicago, IL (*Moderator*) Nothing to Disclose

Nael E. Saad, MBBCh, Saint Louis, MO (*Moderator*) Research Consultant, Veran Medical Technologies, Inc; Proctor, Sirtex Medical Ltd

Sub-Events

SSA25-01 Effectiveness of Contrast-Enhanced Ultrasonography as a Planning Modality for Radiofrequency Ablation of Isoechoic Hepatocellular Carcinoma

Sunday, Nov. 27 10:45AM - 10:55AM Room: E352

Participants

Jae Woong Choi, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

Yang Shin Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Jong Mee Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Chang Hee Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Kyeong Ah Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Cheol Min Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To demonstrate the added value of contrast-enhanced ultrasonography (CEUS) as a radiofrequency ablation (RFA) planning modality for hepatocellular carcinoma (HCC) compared with conventional gray-scale ultrasonography (GSUS)

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board and the requirement for informed consent was waived. Total sixty-four HCCs from 57 patients (men:women=41:16; mean age, 62.6) who have undergone GSUS & CEUS for RFA planning were retrospectively reviewed. Sonographic contrast agent was used for CEUS after conventional GSUS. Two radiologists reviewed the recorded images of GSUS and CEUS in consensus. On GSUS, the size, location, & echogenicity of each HCC were reviewed. Also the definition of HCC on GSUS was categorized to clearly-visible, equivocal, and invisible.

RESULTS

The mean size of HCCs was 1.8 cm (range, 0.9-4.8 cm). Among 64 HCCs, hyperechoic nodules were 11; isoechoic, 24; hypoechoic, 22; and mixed echogenicity, 7 on GSUS. Among the 24 isoechoic nodules, three nodules were clearly visible due to hypoechoic rim on GSUS, two were equivocal, and 19 were invisible. One hypoechoic nodule and two mixed nodule were equivocal on GSUS. Total 40 nodules were clearly visible, 5 were equivocal, and 19 were invisible. By performing CEUS, 11 out of 19 invisible, isoechoic nodules and 5 out of 5 equivocal nodules were identified. Forty out of 64 nodules were identified on GSUS, however 56 out of 64 nodules were identified by performing GSUS and CEUS (detection rate: 62.5% vs 87.5%, p-value < 0.001).

CONCLUSION

Total 48 HCCs were enrolled in RFA by using CEUS, compared to 40 HCCs on GSUS only (40% increase). CEUS is a useful RFA planning modality when a target HCC is poorly defined or invisible on GSUS.

CLINICAL RELEVANCE/APPLICATION

Small HCC invisible on GSUS can not be a candidate for US-guided RFA, however CEUS can help detect isoechoic HCC more clearly thus expands candidates for US-guided RFA.

SSA25-02 No Touch Multibipolar Radiofrequency Ablation Improves Sustained Local Response of HCC≤5cm Compared to Monopolar Techniques: A Multicentric Study

Sunday, Nov. 27 10:55AM - 11:05AM Room: E352

Participants

Arnaud Hocquet, Pessac, France (*Presenter*) Nothing to Disclose

Christophe Aube, MD, PhD, Angers, France (*Abstract Co-Author*) Speaker, Bayer AG Support, General Electric Company

Agnes Rode, MD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose

Victoire Cartier, Angers, France (*Abstract Co-Author*) Nothing to Disclose

Olivier Sutter, Ezanville, France (*Abstract Co-Author*) Nothing to Disclose

Herve Trillaud, MD, Bordeaux, France (*Abstract Co-Author*) Nothing to Disclose

Olivier Seror, Bondy, France (*Abstract Co-Author*) Consultant, Angiodynamics, Inc Consultant, Olympus Corporation Consultant, Bayer AG

PURPOSE

The aim of this study was to compare global radiofrequency ablation failure between monopolar RFA (MonoRFA) versus NoTouch Multibipolar RFA (NTmbpRFA) for HCC≤5cm in cirrhotic patients.

METHOD AND MATERIALS

The study involved 362 cirrhotic patients (181 per groups) observed in 4 French centers. Global RFA failure (primary RFA failure or local tumor progression) was analysed using the Kaplan Meier method after coarsened exact matching. Cox regression models were used to identify factors associated with global RF failure and overall survival.

RESULTS

Patients were well-matched according tumor size (≤ 30 / >30 mm); Tumor number (one/several); Tumor location (subcapsular and near large vessel); Serum AFP (<10 ; 10-100; >100 ng/ml); Child-Pugh score (A/B) and platelet count (30mm and HCC near large vessel) were independent factors associated with global RFA failure. The 5-years overall survival were 37.2% following MonoRFA versus 46.4% following NTmbpRFA $P=0.378$.

CONCLUSION

This large multicentric matched study showed that NTmbpRF provided better primary RF success and sustained local tumor response without increasing severe complications rates, for HCC ≤ 5 cm. Consequently, NTmbpRF should be proposed as the standard RF Ablative technique for treatment of HCC ≤ 5 cm.

CLINICAL RELEVANCE/APPLICATION

NoTouch MultiBipolar RFA should be proposed as the standard RF Ablative technique for treatment of HCC ≤ 5 cm.

SSA25-03 Multimodality Imaging to Assess Immediate Response following Irreversible Electroporation in Patients with Malignant Hepatic Tumors

Sunday, Nov. 27 11:05AM - 11:15AM Room: E352

Participants

Katsutoshi Sugimoto, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Kazuhiro Saito, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Fuminori Moriyasu, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Takao Itoi, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the diagnostic accuracy in identifying residual tumor of contrast-enhanced ultrasound (CEUS), contrast-enhanced multiphase CT (CECT), and gadoxetic acid-enhanced MRI (EOB-MRI) in the subacute follow-up of patients with malignant hepatic tumors treated by irreversible electroporation (IRE).

METHOD AND MATERIALS

From February 2014 to January 2016, we enrolled 16 patients with 21 hepatic lesions (primary/secondary hepatic tumors, 16/5; tumor size range, 9-36 mm; mean tumor size, 19.8 mm) treated by IRE and examined by CEUS, CECT, and EOB-MRI at 1, 1, and 7 days after IRE, respectively. Follow-up examinations by EOB-MRI or CECT and CEUS were performed at 3-month intervals. Two experienced radiologists independently reviewed the images and assessed the probability of residual tumor using a five-point scale with receiver operating characteristic (ROC) curve analysis. The sensitivity and specificity were also evaluated. Verifiable local recurrence was also assessed using follow-up imaging as the reference standard.

RESULTS

The mean area under the ROC curve was significantly higher for CEUS (0.980) than for CECT (0.742: $P=0.001$) and EOB-MRI (0.806: $P=0.002$), as were the sensitivity and specificity (mean 85.7% and 85.7% for CEUS, respectively, vs 64.3% and 46.4% for CECT and 78.6% and 64.3% for EOB-MRI). The interobserver agreement rate for CEUS (0.781) was higher than for CECT (0.734) and EOB-MRI (0.577).

CONCLUSION

CEUS was found to be superior to CECT and EOB-MRI for the diagnosis of residual tumor in the subacute phase following IRE.

CLINICAL RELEVANCE/APPLICATION

Checking the ablation results in an early phase of treatment using CEUS should help to increase the likelihood of complete ablation.

SSA25-04 High-Powered Microwaves (MWS) Ablation of Intermediate Hepatocellular Carcinoma (HCC) in Cirrhosis: A Multicenter, Prospective Study

Sunday, Nov. 27 11:15AM - 11:25AM Room: E352

Participants

Maria Gabriella Merola, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonio Giorgio, MD, Salerno, Italy (*Abstract Co-Author*) Nothing to Disclose
Pietro Gatti, MD, Ostuni, Italy (*Presenter*) Nothing to Disclose
Carmine Coppola, MD, NAPLES, Italy (*Abstract Co-Author*) Nothing to Disclose
Bruno Santoro, Caserta, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesca Merola, Salerno, Italy (*Abstract Co-Author*) Nothing to Disclose
Valentina Giorgio, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

AASLD and EASLD guidelines recommend TACE in treatment of intermediate HCC in cirrhosis. The aim of our study was to report the results in treatment of intermediate HCC in cirrhotic patients using new high-powered microwaves for percutaneous ablation under US guidance.

METHOD AND MATERIALS

From 2010 to 2014, 277 cirrhotics with intermediate HCC were asked to undergo MWS percutaneous ablation instead of TACE. 215

patients (149 Child A, 66 Child B) accepted MWS ablation forming the study group. 109 patients had a single nodule (\varnothing 5.3-8.2 cm, mean 6.4 cm) [group A]; 70 patients had 2 nodules (\varnothing 3-6 cm, with at least one nodule >5 cm) [group B] and 36 patients had 3-5 nodules (\varnothing 1.5-6.7 cm with at least one nodule >5 cm) [group C]. No patient had ascites or portal venous thrombosis or extrahepatic spread of HCC. In patients with one nodule, 1-2 sessions were scheduled; for group B from 2 to 3 sessions were scheduled and for group C patients up to 4 session were scheduled. Percutaneous ablation was performed using high powered MWS device (100-180 W) at 2450MHZ, under US guidance. 10 possible factors affecting survival were analyzed.

RESULTS

All patients but one were treated according to the scheduled protocol. The complete ablation rates were 83% for the 1st ablation and 100% for the 2nd ablation for 3-5 cm lesions, while 64% and 86% respectively for 5-8.2 cm lesions. 1 patient (Child A; 80 years; HCC \varnothing 6cm; 1 session) died for haemoperitoneum. No other major bleeding, liver rupture, or liver abscesses occurred. The 1, 3 and 5-year survival rates were 89, 81, 60, 40 and 21% respectively. At univariate analysis, age, number of nodules, \varnothing of HCC, number of insertions and pre-ablation bilirubin were independent factors for survival. At multivariate analysis bilirubin and number of insertions were independent factors in predicting survival.

CONCLUSION

High powered percutaneous US guided MWS ablation of intermediate HCC in cirrhotic patients is safe and effective in this stage of cancer disease. Our data, although obtained in a non-randomized trial, indicate that percutaneous ablation using new high-powered MWS should have long term survival similar to TACE in treatment of intermediate HCC in cirrhosis. Pre-ablation bilirubin and number of antenna insertions seem independent predictors for long-term survival.

CLINICAL RELEVANCE/APPLICATION

High powered percutaneous MWS ablation of intermediate HCC in cirrhotic patients is safe and effective in this stage of cancer disease.

SSA25-05 Microwave versus Radiofrequency Ablation of Hepatocellular Carcinoma: A Randomized Trial

Sunday, Nov. 27 11:25AM - 11:35AM Room: E352

Participants

Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Presenter*) Nothing to Disclose
Lena-Maria Klothmann, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Tatjana Gruber-Rouh, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Renate M. Hammerstingl, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively determine and compare therapy response and safety of microwave (MWA) and radiofrequency ablation (RFA) of hepatocellular carcinoma (HCC) in a randomized trial.

METHOD AND MATERIALS

In this prospective study 36 patients underwent CT-guided thermal ablation: 18 received RFA and 18 MWA (31 males, 5 females; mean 64 years; range 42 to 82; SD of 9.98). Using magnetic resonance imaging (MRI) the location of the HCC and changes in size, volume, necrotic area, diffusion and ADC-value in the malignant tissue were evaluated. First MRI control was performed before thermal ablation. The follow-up contained MRI controls 24 hours after ablation and then within 12 months in three monthly intervals.

RESULTS

36 HCC lesions with a mean diameter of 2.4cm (range 0.9-5cm; MWA 2.5cm, RFA 2.2cm) were treated with thermal ablation. The mean volume 24 hours after ablation was 47.3cm³: 62cm³ for MWA and 32.7cm³ for RFA. Complete ablation was recorded in 88.9% (32/36): 83.3% (15/18) in the MWA group and 94.4% (17/18) in the RFA group. The recurrence rate within one year for both groups was 11.1% (4/36): 16.7% (3/18) for MWA and 5.6% (1/18) for RFA. The rate for new malignant formations in another location than the ablated lesion is 22.2% (4/18) for both groups. The mortality rate for this trial is 0% and no major complications were noticed.

CONCLUSION

No significant differences in mortality or complication rates between RFA and MWA were documented. The study shows that the thermal treatment with MWA generates greater ablation volumes and the 1-year follow-up of the MWA group shows a slightly higher rate of local recurrences.

CLINICAL RELEVANCE/APPLICATION

MWA and RFA present similar results with greater ablation volumes and a slightly higher recurrence rate for MWA.

SSA25-06 Increased Risk of Needle Tract Seeding after Irreversible Electroporation (IRE) of Malignant Liver Tumors

Sunday, Nov. 27 11:35AM - 11:45AM Room: E352

Participants

Martina Distelmaier, Aachen, Germany (*Presenter*) Nothing to Disclose
Alexandra Barabasch, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heil, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils A. Kraemer, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Bruners, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

IRE has been proposed as a non-thermal ablation technique for the treatment of unresectable tumors because it offers specific

advantages, notably absence of heat-sink effect or of thermal damage to adjacent vessels or bile ducts. A possible disadvantage of this method is that no ablation of the needle tract is possible. Our aim was to investigate the local efficacy and the rate of needle tract seeding after CT-guided IRE for liver metastases located adjacent to major portal and hepatic veins.

METHOD AND MATERIALS

29 patients with 43 liver malignancies, underwent percutaneous CT-guided IRE. All lesions were located immediately adjacent to major hepatic veins (20), portal vein branches (15), or both (8), and therefore not eligible for RFA or MWA. 2 - 5 IRE probes (median of 3) were placed strictly parallel under CT-guidance. All patients underwent hepatic ce-MRI according to a standardized protocol before treatment and at standardized intervals after IRE in order to systematically search for local recurrence and/or evidence of needle tract seeding.

RESULTS

Based on the immediate post-interventional CT and post-interventional MRI, complete ablation was achieved in 40/43 (93%) lesions, with a safety margin of at least 5-10 mm. All adjacent vessels remained perfused at mean follow-up time of 24 ± 7 months. In 13 of the 40 lesions (33%) where complete ablation had been achieved, local recurrence was observed between 2 and 18 months after treatment. Of these 13, only 2 cases (15%) were observed within or immediately adjacent to the ablation zone. In the remaining 11 cases (85%), metastatic growth was observed along the needle tract. Accordingly, needle tract seeding was observed in 11 of 43 lesions (26%). None of the two "true" local recurrences occurred at the side of the vessel.

CONCLUSION

None of the 40 lesions with complete ablation exhibited a local recurrence at the site of the vessel triggering the decision to use IRE rather than RFA or MWA. This suggests that IRE is indeed useful to avoid incomplete ablation of lesions due to heat sink effects. However, needle tract seeding was observed in as many as 26% of lesions treated. Therefore, improved IRE methods are urgently needed that address this issue.

CLINICAL RELEVANCE/APPLICATION

IRE is an effective method to treat liver tumors located in areas where thermal ablation is not an option. However, the high rate of needle tract seeding is a concern that deserves immediate attention.

SSA25-07 Ablation Treatment of Primary and Secondary Liver Tumors Under Contrast-Enhanced Ultrasound (CEUS) Guidance: A Multicenter Study

Sunday, Nov. 27 11:45AM - 11:55AM Room: E352

Participants

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

PURPOSE

Aim of this study was to quantify the use of CEUS as guidance technique for percutaneous ablation treatment of primary and secondary liver tumors in field practice of five centers with high-volume ablation activity

METHOD AND MATERIALS

The five participating centers retrospectively selected all patients in whom therapeutic needles for Percutaneous Ethanol Injection (PEI), Radiofrequency (RF), Microwave (MW) had been positioned into the target during CEUS with a Low Mechanical Index Ultrasound Contrast Agent. The rate of CEUS-guided ablation was calculated on the whole liver ablation activity of each center between 2005 and 2015. In addition, contrast media consumption, procedure indications, therapeutic effectiveness and complications were assessed.

RESULTS

CEUS-guided ablation was carried out 101 patients (70M/ 31F; mean age 71.5 yrs) with 94 Hepatocellular Carcinoma nodules (mean size 17.3 mm) and 13 metastases (mean size 17.3 mm) by using PEI in 50 cases (46.7%), RF in 41 cases (38.3%) and MW in 16 cases (15%). CEUS-guided ablation represented 6.2% (range 1.8%-13.5%) of 1728 liver ablations performed at the participating centers. Indications to CEUS-guided ablation were: a target lesion not visible on non-enhanced ultrasound (19.6%), improvement of conspicuity of the target (29%), detection of vital area/s in nodules with either incomplete ablation after a previous treatment without CEUS guidance or local tumor progression (51.4%). A single standard dose (2,4 ml) of medium contrast was used in 73 of the treated nodules (68.2%). No complications ensued infusion of contrast medium. Minor complications (pleural effusion) were observed in 2 cases (1.8%) after ablation. Complete ablation was obtained in 73 of the treated tumors (68.2%). Altogether hyperthermic techniques (RF and MW) performed better than PEI (complete ablation rate 86% vs. 48%).

CONCLUSION

To the best of our knowledge, it is the first time that the use of CEUS as guidance technique for liver ablation has been quantified. In experienced hands such a procedure seems to have limited indications (6.2% of 1728 ablative sessions), but is deemed necessary to reach both small, ill-defined focal lesions and vital area/s in nodules with previous incomplete ablation or local tumor progression.

CLINICAL RELEVANCE/APPLICATION

Quantification of the use of CEUS-guided ablation of liver malignancies in field practice of high-volume ablative centers

SSA25-08 High Frequency versus Low Frequency Microwave Ablation in Malignant Liver Tumors: Evaluation of Local Tumor Control and Survival

Sunday, Nov. 27 11:55AM - 12:05PM Room: E352

Participants

Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Presenter*) Nothing to Disclose
Ahmad Hagar, 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
Tatjana Gruber-Rouh, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Katrin Eichler, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Hanns Ackermann, Frankfurt On Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Wolf-Otto Bechstein, 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

PURPOSE

To compare local tumor control and survival rates in patients with liver metastases treated with microwave ablation (MWA) with either a low frequency (LF) (915 MHz) or high frequency (HF) system (2.45 GHz).

METHOD AND MATERIALS

The retrospective study included 221 patients (mean age: 61.7 years) with 356 malignant hepatic lesions. 94 patients with 133 lesions underwent LF-MWA, 127 patients with 223 lesions were treated with HF-MWA. MRI was performed 24 hours after each procedure and at 3, 6, 12, 18, and 24 months post-ablation. Both groups were compared with the Fisher's exact test. Survival rates were calculated using the Kaplan-Meier test.

RESULTS

The mean initial ablation volume of LF-MWA was nearly half of HF-MWA (19.1mL vs. 39.9mL). The difference in volume between both systems was significant ($p < 0.0001$). At follow-up, 39/133 lesions (29.32%) treated using LF-MWA progressed while in HF-MWA 32/223 (14.35%) progressed. The mean time to progression was 5.03 and 5.31 months for lesions treated with LF-MWA and HF-MWA systems respectively. The difference between both systems was significant ($p = 0.00059$). The 1-year, 2-year and 4-year overall survival rates were 98.9%, 95.7% and 83% for LF-MWA and 100%, 97.6% and 92.9% for HF-MWA. The difference in survival rates was not significant ($p > 0.05$).

CONCLUSION

Both LF- and HF-MWA generator systems are effective treatment options for malignant oligonodular liver lesions, but significantly higher ablation volumes, longer time to progression and lower progression rates were observed in HF-MWA.

CLINICAL RELEVANCE/APPLICATION

HF-MWA is superior to LF-MWA regarding ablation volumes and results in lower progression rate.

SSA25-09 Long-term Therapeutic Outcomes of Radiofrequency Ablation (RFA) for Small to Intermediate Perivascular Hepatocellular Carcinomas: RFA Only Versus Combined Transarterial Chemoembolization and RFA

Sunday, Nov. 27 12:05PM - 12:15PM Room: E352

Participants

So Yeon Park, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jae Woong Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyeong Ah Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chang Hee Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Mee Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yang Shin Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Cheol Min Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myung Gyu Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Tae Seok Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the therapeutic outcomes of perivascular hepatocellular carcinoma (HCC) between radiofrequency ablation (RFA) only and combined transarterial chemoembolization (TACE) and RFA.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board and the requirement for informed consent was waived. Between March 2000 and May 2014, 185 perivascular HCCs were selected among 635 HCCs treated by RFA. The perivascular HCC is defined HCC located less than 3 mm away from large vessels which diameter measuring ≥ 3 mm in axial CT/MR images. 185 perivascular HCCs were from 183 patients consisting of 130 men and 53 women; mean age 60.3, range, 29-83 years. The HCCs were classified into two groups according to the absence or presence of combined TACE: A group underwent RFA only ($n=79$) and the other group underwent combined TACE and RFA ($n=106$). Technical success, overall adverse event rates, recurrence rates and local tumor progression within 24 months were compared between the two groups.

RESULTS

The technical success of RFA was achieved in 178 out of 185 cases (96.2%). The median follow-up time was 46.7 months (range, 3.2 - 165). RFA only group included 79 HCCs (mean size = 1.63 cm) from 78 patients and combined TACE & RFA group, 106 HCCs (mean size = 1.91 cm) from 105 patients. The local tumor progression rates between two groups were not statistically different: RFA only group 8.9% (7/79) vs. combined TACE and RFA group 11.2% (12/106) ($P > .05$). The overall recurrence rates within 24 months between two groups were not statistically different: RFA only group 33.8% vs. combined TACE and RFA group 32.9% ($P > .95$). The adverse event rates within 24 months between two groups were not statistically different: RFA only group 28.3% vs.

combined TACE and RFA group 36.5% (P > .83).

CONCLUSION

RFA only is similar to combined TACE and RFA for the treatment of perivascular HCC in terms of local tumor progress, overall recurrence, and disease free survival.

CLINICAL RELEVANCE/APPLICATION

In the treatment of perivascular HCC, RFA only seems to be as effective as combined TACE and RFA therapy; thus TACE prior to RFA is not mandatory.

VSPD11

Pediatric Series: Neuro

Sunday, Nov. 27 10:45AM - 12:15PM Room: S100AB



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

Participants

Daniela Prayer, MD, Vienna, Austria (*Moderator*) Nothing to Disclose
Manohar M. Shroff, MD, Toronto, ON (*Moderator*) Consultant, Guerbet SA;

Sub-Events

VSPD11-01 MRI of the Preterm Brain Injury

Sunday, Nov. 27 10:45AM - 11:05AM Room: S100AB

Participants

A. James Barkovich, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

At the conclusion of this lecture, the attendee should know the following:
A. Types of brain injury that occur in prematurely born babies
B. What imaging modalities are appropriate and inappropriate for neonatal imaging
C. Which modalities and (when appropriate) imaging sequences should be obtained for the necessary results
D. Imaging manifestations of each type of injury
E. Clinical consequences of the different types of injury

ABSTRACT

LEARNING OBJECTIVES

1) To understand the types of brain injury and dysfunction that can be associated with premature birth. 2) To determine when cerebral sonography is sufficient and when MRI is indicated. 3) How to optimally image the brains of prematurely born infants.

ABSTRACT

Premature birth is a major cause of infant death and childhood morbidity throughout the world, occurring in 11.1% of all births worldwide in 2010 and in 11.4% of births in the United States in 2013. Of babies born prematurely, the 5% born before 28 weeks (extremely premature) and the ~10% born from 28-32 weeks are at highest risk; many die in the first few postnatal months, close to 10% of survivors have significant neurologic impairments, and 40% have neurodevelopmental disability. Those with neurodevelopmental disability have a very high incidence of neuroimaging abnormalities, which will be the subject of this lecture. Sonography via the anterior fontanelle and the posterolateral fontanelle is the primary neuroimaging study, as it can be performed in the Intensive Care Nursery and is sensitive to moderate and large hemorrhages, significant white matter lesions and can be used (with Doppler) to assess flow in the major cerebral arteries. Although MRI requires transportation of these (often unstable) neonates, it is more sensitive and specific than sonography: it allows differentiation of echogenic germinal matrix from small hemorrhages, detection of subtle white matter injuries, small cerebellar hemorrhages, and more sensitive assessment of the cerebral vasculature. In this lecture, the various types of cerebral injury associated with premature birth will be discussed, along with the optimal way to image the child, when MRI is indicated, and how to safely perform and interpret these images.

VSPD11-03 Whole-body Cooling and MRI Findings to Predict Neurodevelopment Injury in the Hypoxic-Ischemic Encephalopathy Perinatal

Sunday, Nov. 27 11:15AM - 11:25AM Room: S100AB

Awards

Student Travel Stipend Award

Participants

Maria Gabriela Longo, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose
Andrea Corso, Porto Alegre, Brazil (*Abstract Co-Author*) Nothing to Disclose
Gabriela Filipouski, Porto Alegre, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rita Silveira, Porto Alegre, Brazil (*Abstract Co-Author*) Nothing to Disclose
Renato Procianny, Porto Alegre, Brazil (*Abstract Co-Author*) Nothing to Disclose
Leonardo Vedolin, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study aims to evaluate the findings of Magnetic Resonance Imaging (MRI) performed in the neonatal period and compared with the 12-months clinical outcome of patients with hypoxic-ischemic encephalopathy after perinatal asphyxia submitted to whole-body cooling.

METHOD AND MATERIALS

It is a prospective cohort study, nestled in a whole-body cooling project of a tertiary hospital of the South of Brazil. Infants born after 35 or more completed weeks' gestation who showed signs of moderate to severe encephalopathy were assigned to whole-body cooling and went through MRI until two weeks after born. Two radiologists studied the images, and the divergences were solved by consensus. The MRI findings were compared with 12-months neurodevelopment, evaluated by the Bayley scored performed by a neuropsychologist blinded for the MRI.

RESULTS

20 subjects concluded the MRI and neurodevelopment evaluation. The mean of cognitive, language and motor Bayley score were 88

(95% CI 83 to 93), 88 (95% CI 83 to 93) and 86 (95% CI 80 to 92), respectively. The MRI signs that had an impact in the 12-months neurodevelopment were the absence of PLIC sign for all three domains, presence of cortical lesion for language and basal ganglions lesion for the motor domain. The mean of cognitive Bayley in patients without PLIC sign was 80 (95% CI 71 to 88) and 93 (95% CI 87 to 99) for the patients with the PLIC sign, $p=0.01$, of language was 79 (95% CI 71 to 86) and 93 (95% CI 88 to 98), $p=0.006$, and of motor was 78 (95% CI 71 to 86) and 91 (95% CI 71 to 86), $p=0.05$, respectively. The mean of language Bayley for patients with cortical lesions were 79 (95% CI 68 to 90) and 91 (95% CI 86 to 97) for patients without the lesion, $p=0.04$. The mean of motor Bayley for patients with basal ganglions lesion were 81 (95% CI 71 to 89) and 92 (95% CI 84 to 101) for patients without the lesion, $p=0.05$.

CONCLUSION

The absence of PLIC sign seems to be the most important predictor in the neurodevelopment impairment, even in a cohort of patients assignment to whole-body cooling.

CLINICAL RELEVANCE/APPLICATION

Hypoxic-ischemic encephalopathy after perinatal asphyxia is an important cause of mortality and morbidity in newborns. The whole-body cooling would be associated with a reduction in cerebral lesions

VSPD11-04 Ultrasound Elastography of Neonate Brain; Preliminary Study

Sunday, Nov. 27 11:25AM - 11:35AM Room: S100AB

Participants

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

Moonyoung Park, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Taeun Chang, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

Ultrasound elastography can show tissue elasticity. Our aim was to determine the US elasticity of brain in neonates.

METHOD AND MATERIALS

Strain elastography was obtained in 21 neonates without brain abnormality (10 males, 11 females; mean gestational age: 34 weeks, range: 28 - 40 weeks). By two radiologists, elastography scores were assigned to each following brain structure using five-point color scale (1-5; most soft to most hard); ventricle, periventricular white matter (WM), caudate, subcortical WM, cortical gray matter (GM), and subdural space. Elastography score of each structure was compared and correlation analysis with gestational age (GA) and birth weight was done. Inter-observer variability between the radiologists was calculated.

RESULTS

Ventricle and subdural space showed elastography score of 1 in all patients. Elastography score of other regions were as follows (median, 1st quartile-3rd quartile); periventricular WM (4.0, 3.0-4.0), caudate (4.3, 3.7-4.7); subcortical WM (4.0, 4.0-4.0), and cortical GM (3.0, 2.3-3.3). Caudate was significantly harder than periventricular WM ($P = 0.004$) and cortical GM ($P < 0.001$). Cortical GM was significantly softer than periventricular WM ($P < 0.001$) and subcortical WM ($P < 0.001$). Periventricular WM was significantly softer than subcortical WM ($P = 0.009$). Elastography score of caudate showed negative relationship between GA ($\gamma = -0.433$, $P = 0.050$) and birth weight ($\gamma = -0.472$, $P = 0.031$). Inter-observer variability was moderate to almost perfect ($k = 0.53-0.89$).

CONCLUSION

Ultrasound elastography allowed elasticity assessment in neonate intracranial structures. In normal neonates, caudate was significantly harder than most of the other brain regions. Cortical GM and periventricular WM were significantly softer than subcortical WM. Caudate became softer with increasing GA and birth weight.

CLINICAL RELEVANCE/APPLICATION

Normal elasticity of neonate brain can be evaluated with US elastography. Knowing the normal elasticity of neonate brain with US can be applied to future studies of hypoxic ischemic injury.

VSPD11-05 Cerebral Perfusion is Perturbed by Preterm Birth and Brain Injury

Sunday, Nov. 27 11:35AM - 11:45AM Room: S100AB

Awards

Trainee Research Prize - Fellow

Participants

Eman S. Mahdi, MD, MBChB, Washington, DC (*Presenter*) Nothing to Disclose

Marine Bouyssi-Kobar, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

Jonathan G. Murnick, MD, PhD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

Caitlyn Loucas, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

Taeun Chang, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

Catherine Limperopoulos, PhD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Premature birth is a major public health concern, in large part because of its risk for brain injury and associated neurodevelopmental consequences. Early disturbances in systemic and cerebral hemodynamics are thought to mediate prematurity-related brain injury. However, the extent to which cerebral blood flow (CBF) is perturbed by preterm birth is unknown. Our objective was to compare global and regional CBF in preterm (PT) infants with and without brain injury on conventional MRI over the third trimester of pregnancy.

METHOD AND MATERIALS

We prospectively enrolled PT infants < 32 weeks gestational age (GA) and < 1500 grams using conventional MRI and Arterial spin

labelling (ASL). Global and regional CBF (dorsolateral prefrontal, primary motor, mid-temporal, thalamus, pons, anterior and posterior vermis, and cerebellar hemispheres) were quantified using GE Functool software. Preterm infants were stratified into those with and without structural brain injury. We further categorized PT infants by injury severity: moderate-severe injury (Grade III intraventricular hemorrhage (IVH), periventricular hemorrhagic infarction and/or extensive cerebellar hemorrhage) and mild injury (Grade I/II IVH, punctate cerebellar hemorrhage).

RESULTS

We studied 78 PT infants [31 without brain injury; 47 with brain injury: 29 mild/19 moderate-severe] with a mean GA of 27.2±2.7 weeks at birth, and 0.96±0.3kg birthweight. Mean postconceptional age (PCA) in days was 44.75±18.75. Global CBF decreased as a function of increasing PCA ($p<0.04$) and was significantly reduced in PT infants with brain injury ($p<0.04$). Similarly, regional CBF was significantly lower in the thalamus and pons ($p<0.006$) in those with vs without injury, controlling for GA at MRI. Regional CBF in PT infants with moderate/severe injury was significantly lower in the primary motor, mid-temporal, thalamus, pons and anterior vermis regions compared to PT infants that were brain injury free ($p<0.01$, for all).

CONCLUSION

We report for the first time early disturbances in global and regional CBF in PT infants following brain injury. Regional cerebral perfusion alterations were evident in the thalamus and pons suggesting regional vulnerability of the developing cerebro-cerebellar circuitry.

CLINICAL RELEVANCE/APPLICATION

ASL may provide a useful non-invasive tool for identifying early cerebral perfusion abnormalities in preterm infants and assist in identifying future targets for therapeutic interventions.

VSPD11-06 Age-associated Hippocampal Volume Changes in Pediatric Arterial Ischemic Stroke

Sunday, Nov. 27 11:45AM - 11:55AM Room: S100AB

Awards

Trainee Research Prize - Medical Student

Participants

Zak Ritchey, Aurora, CO (*Presenter*) Nothing to Disclose
Nicholas V. Stence, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
David M. Mirsky, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sean Deoni, PhD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Timothy Bernard, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
David Weitzenkamp, PhD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Paco Herson, PhD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Using a middle cerebral artery (MCA) occlusion model, researchers at our institution have yielded preliminary data that suggest juvenile mice have mechanisms of post-stroke recovery in the hippocampus that are not found in adult mice. We examined the clinical significance of these findings by measuring hippocampal volume (HCV) changes in a cohort of children with unilateral arterial ischemic stroke (AIS) in the MCA territory, hypothesizing that children with AIS occurring before age 9 will lose less HCV than children with comparable stroke at age 9 or older.

METHOD AND MATERIALS

The medical records of 149 children treated for AIS at a children's hospital were retrospectively reviewed to identify a subset of patients with unilateral MCA-territory stroke ($n=60$). Cases without 3D T1-weighted, high-resolution (1 mm voxel size) MRI scans at both acute (<72 hours since diagnosis) and chronic (>90 days since diagnosis) time periods were excluded ($n=41$). Manual segmentation was performed on each scan to measure bilateral HCV, total brain volume (TBV), and infarct volume (IV). HCV measurements were converted into hippocampal volume ratios (HCVR, stroke-side HCV/contralateral HCV) to adjust for individual brain size differences. Patients were divided into two age-at-stroke groups: younger (<9 years old) and older (9-18 years old). The difference between acute and chronic HCVR was calculated, and then compared between groups via t-test.

RESULTS

The MRI scans of 19 children (9 younger, 10 older) were analyzed. The younger patient group experienced a 5.58% increase in HCVR; in comparison, the older group sustained a 6.31% decrease in HCVR ($P=0.002$). The mean time between scans was 2.1 years in younger children, and 0.8 years in older ($P=0.0001$). The mean acute TBV-adjusted IV was 7.08% in younger children, and 7.83% in older ($P=0.891$).

CONCLUSION

In our cohort of children with AIS, the significant increase of HCVR in the younger patient group compared to the older group suggests relative preservation of stroke-side HCV, which could reflect differences in age-related plasticity. We intend to identify more study participants and investigate the neuropsychological implications of post-stroke HCV changes over time.

CLINICAL RELEVANCE/APPLICATION

In children with AIS, younger age is associated with preservation of hippocampal volume. This could indicate an age-dependent mechanism of plasticity analogous to that seen in a juvenile mouse model.

VSPD11-07 Arterial Ischemic Stroke in Children

Sunday, Nov. 27 11:55AM - 12:15PM Room: S100AB

Participants

Manohar M. Shroff, MD, Toronto, ON, (manohar.shroff@sickkids.ca) (*Presenter*) Consultant, Guerbet SA;

LEARNING OBJECTIVES

1) To discuss differences compared to adult stroke and illustrate etiologies of childhood Arterial Ischemic Stroke (AIS). 2) To discuss acute stroke protocol and role of various imaging techniques in childhood AIS. 3) To illustrate cases showing the value of vessel wall imaging in childhood AIS. 4) To discuss emerging treatment pathways for childhood AIS.

ABSTRACT

Stroke is traditionally classified into ischemic and hemorrhagic subtypes and is among the top 10 causes of death in children and a significant cause of long-term morbidity. This presentation focuses on pediatric arterial ischemic stroke (AIS) only. AIS occurs with a frequency of 2 to 3/100,000 children per year. The incidence is higher in neonates, approximately 1 in 4000 live births. Pediatric AIS differs from adult AIS in that it is uncommon, has a subtler clinical presentation, and is caused by a wide number of causes including genetic, cardiac, thrombotic and vasculopathies. The risk factors are often age-dependent across childhood. Imaging appearances of the young brain are very different from an adult and imaging often requires sedation. This presentation will review the various imaging features and appearances of pediatric AIS. Strokes recur in one-fifth of later childhood AIS and recurrence is rare after perinatal stroke. In later childhood AIS recurrence occurs within five years in two-thirds of children whose vascular imaging studies identified abnormalities. It is hence important to image suspect vessels with as much detail as possible. This presentation will review vessel wall imaging and its importance in the diagnosis of vasculitis and dissection. Imaging findings can contribute further to the understanding of outcomes in children and can provide evidence supporting specific treatments. A brief discussion of relatively new treatment possibilities will also be discussed.

RCA11

Creating Vector-based Drawings for Presentations and Publications with Adobe Illustrator (Hands on)

Sunday, Nov. 27 11:00AM - 12:30PM Room: S401AB



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

Participants

Sarah C. Abate, BS, Ann Arbor, MI, (sabate@med.umich.edu) (*Presenter*) Nothing to Disclose

Elise Van Holsbeeck, DO, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss why we use vector based programs. 2) Explain how to use the tools in Illustrator. 3) Demonstrate how to import and label an image. 4) Demonstrate how to make one's own line drawing. 5) Demonstrate how to color and shade drawing. 6) Demonstrate how to export an image for print, PowerPoint, and Internet.

Active Handout: Sarah C. Abate

[http://abstract.rsna.org/uploads/2016/16005083/ACTIVE RCA11 Illustrator_FINAL.pdf](http://abstract.rsna.org/uploads/2016/16005083/ACTIVE_RCA11_Illustrator_FINAL.pdf)

RCB11

Using Keynote: An Alternative to Power Point (Hands-on)

Sunday, Nov. 27 11:00AM - 12:30PM Room: S401CD



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

Participants

Shawn D. Teague, MD, Denver, CO, (sdteague@gmail.com) (*Presenter*) Stockholder, Apple Inc

LEARNING OBJECTIVES

1) Modify the master slides used in a template. 2) Change the aspect ratio for a presentation from 4:3 to 16:9. 3) Utilize movies in a presentation.

Principles and Practice of 3D Printing

Sunday, Nov. 27 11:00AM - 12:30PM Room: S501ABC

IN

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

Participants

Frank J. Rybicki III, MD, PhD, Ottawa, ON, (frybicki@toh.ca) (*Moderator*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

This course will introduce medical 3D printing to the RSNA community. The technologies will be described, and creation of medical models from volumetric radiology data will be introduced. The session will also highlight clinical scenarios that have been positively impacted by 3D printing.

ABSTRACT

3D printing/additive manufacturing is a growing industry. Within the medical field there is growing interest in this technology and its impact on patients lives. In this talk we will discuss the basics of 3D printing and how they can be incorporated into medical uses from surgical design of implants to anatomic modeling of complex surgery.

Sub-Events

RCC11A 3D Printing for the Radiologist: A Primer and Introduction to Sessions

Participants

Frank J. Rybicki III, MD, PhD, Ottawa, ON, (frybicki@toh.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with 3D printing technologies. 2) To have an introduction of materials used to create 3D-printed anatomical models and how they can be used in medical applications. 3) To be exposed to the process of 3D printing and those realized and potential clinical benefits in radiology, stratified by organ section.

ABSTRACT

While advanced visualization in radiology is instrumental for diagnoses and communication with referring clinicians, there is an unmet need to render DICOM images as three-dimensional (3D) printed models capable of providing both tactile feedback and tangible depth information of both anatomic and pathologic states. 3D printed models, already entrenched in the non-medical sciences, are being rapidly embraced in medicine as well as in the lay community. Incorporating 3D printing from images generated and interpreted by radiologists presents particular challenges including training, materials and equipment, and guidelines. The overall costs of a 3D printing lab must be balanced by clinical benefits. The RSNA 2016 program includes 6 hours of didactic lectures that review and summarize numerous studies that support such benefits from 3D printing, as it is expected that the number of 3D printed models generated from DICOM images for planning intervention and fabricating implants will grow exponentially. The program also includes multiple hands-on courses that will enable radiologists, at a minimum, to become familiar with 3D printing software and hardware as it relates to our field. Readers are strongly encouraged to review two articles published in *RadioGraphics*. Familiarity with these two educational resources will provide background information and enable conference participants to optimize their experience at the annual meeting: 1. Mitsouras D et al, *Radiographics*. 2015 Nov-Dec;35(7):1965-88. doi: 10.1148/rg.20151403202. Matsumoto JS et al, *Radiographics*. 2015 Nov-Dec;35(7):1989-2006. doi: 10.1148/rg.2015140260. Readers slated to participate in the Hands-on Training are strongly encouraged to review the training manual for the 2015 Hands-on session at the following link: <http://threedmedprint.springeropen.com/articles/10.1186/s41205-015-0002-4>. In addition, the 2014 Hands-on session can be found in the Appendix of Reference 1 (Mitsouras et al) above.

Honored Educators

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

Frank J. Rybicki III, MD, PhD - 2016 Honored Educator

RCC11B Implementing 3D Printing into a Clinical Practice

Participants

Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the basics of 3D printing technologies. 2) Discuss how these can be used clinically. 3) Discuss the current limitations of this technology as it relates to health care. 4) Use case examples to define current uses of this technology in surgical and medical specialties.

ABSTRACT

3D printing/additive manufacturing is a growing industry. Within the medical field there is growing interest in this technology and its impact on patients lives. In this talk we will discuss how we incorporated this technology into a quaternary referral center as a real

time clinical service. We will specifically discuss the advantages as well as limitations of this technology as it relates to the medical/surgical field. We will discuss "How we do it" and what resources are needed to develop a service. As the impact of this technology is growing we will also discuss what evidence will we need to have global acceptance as a clinical service and why it should be housed in radiology.

RCC11C 3D Printing Technologies

Participants

Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the basic principle of Additive Manufacturing (3D Printing) and how it differs from subtractive technology. 2) Understand the principles of the software needed to convert Medical Images into three-dimensional printed models and what factors contribute to the quality of each model. 3) Become familiar with the different types of Additive Manufacturing (3D Printing) technologies.

ABSTRACT

This presentation will provide a novice to Additive Manufacturing the general knowledge applicable to the medical field. The basic principles of Additive manufacturing (3D Printing) will be discussed along with the different technologies which encompass the field. The steps of converting radiographic images into three-dimensional printable files and the differences between the multitude of additive manufacturing techniques will be the primary focuses.

RCC11D Techniques for Current 3D Printing

Participants

Gerald T. Grant, MD, MS, Louisville, KY, (gerald.grant@louisville.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the development of the use of Additive manufacturing in Customized reconstruction and rehabilitation. 2) Be familiar with type of additive manufacturing used in healthcare. 3) Be familiar with new materials and current advances in 3D print technology for patient care. 4) Exposure to practical workflow in the use of Additive manufacturing in patient care.

ABSTRACT

The application of digital imaging, design, and manufacturing of medical devices has proven to be a valuable tool in custom patient care, especially in reconstruction and rehabilitation. These applications have extended past the early adoption of the technology in Craniofacial reconstruction and Orthopedics, to cardiology, neurology, pediatrics and a host of other disciplines, contributing to custom. A brief history on the development of the use of AM technologies, a discussion on the technology, the materials, and the application of Advanced Digital Technologies in healthcare will be presented.

VSIO11

Interventional Oncology Series: Renal and GU Tumors

Sunday, Nov. 27 1:30PM - 6:00PM Room: S405AB



AMA PRA Category 1 Credits™: 4.50
ARRT Category A+ Credits: 2.00

Discussions may include off-label uses.

Participants

Debra A. Gervais, MD, Boston, MA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To appraise the benefits of partial nephrectomy, active surveillance, and tumor ablation (including multiple technology platforms) for RCC. 2) To assess results of renal tumor ablation including published literature and early registry findings. 3) To appraise the role of imaging and biopsy in clinical management decisions in patients considered for tumor ablation. 4) To describe the role of tumor ablation in GU tumors outside the kidney such as prostate tumors, adrenal masses, gynecologic tumors, and RCC metastases.

ABSTRACT

Sub-Events

VSIO11-01 Tumor Ablation and the Renal Mass-Changing Management Paradigms Beyond Guidelines

Sunday, Nov. 27 1:30PM - 1:45PM Room: S405AB

Participants

Debra A. Gervais, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

Honored Educators

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

Debra A. Gervais, MD - 2012 Honored Educator

VSIO11-02 T1b- Tumor Ablation

Sunday, Nov. 27 1:45PM - 2:00PM Room: S405AB

Participants

Thomas D. Atwell, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

VSIO11-03 New versus Old Technology for Renal Tumor Ablation: Are Outcomes Impacted?

Sunday, Nov. 27 2:00PM - 2:15PM Room: S405AB

Participants

Stephen B. Solomon, MD, New York, NY (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

View learning objectives under the main course title.

VSIO11-04 Trajectory of Recovery Following Renal Tumor Ablation Based on Patient Reported Outcomes

Sunday, Nov. 27 2:15PM - 2:25PM Room: S405AB

Participants

Georgianna Schultz, RN, Rochester, MN (*Presenter*) Nothing to Disclose
Thomas D. Atwell, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Lavonne Speer, RN, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Kristin Saari, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Grant D. Schmit, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Kathleen Yost, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Anil N. Kurup, MD, Rochester, MN (*Abstract Co-Author*) Research Grant, Galil Medical Ltd; Royalties, UpToDate, Inc
Robert Thompson, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine characteristics of patient recovery following renal tumor ablation based on patient reported outcomes (PROs).

METHOD AND MATERIALS

We derived a battery of questions felt to best measure outcomes following renal tumor ablation using the National Institute of Health's Patient Reported Outcome Measurement Information System (PROMIS) short forms, Brief Pain Inventory (BPI) and 0-10 numerical rating scales (NRS). Outcomes included patient reported pain, physical function (PF), and social activity (SA). Baseline measurements were obtained the day prior to ablation. Subsequent outcomes were then measured at days 1-7 following treatment and 30 days following treatment.

RESULTS

From 2/10/2016 to 3/29/2016, 25 patients had agreed to participate. On day 1 (T1) following ablation, 11/23 (48%) of patients felt that they had completely recovered from the ablation procedure, and average pain NRS question mean score (range 0-10) was 1.52, compared to 0.08 at baseline. 20 patients completed the assessment 7 days (T7) following ablation, with average pain, overall PWB, and overall SA NRS questions improved compared to the T1 assessment, but not quite returned to baseline levels. However, the differences between T7 and pre-procedure scores were much lower than the clinical meaningful difference for a 0-10 scale of 2 points. Seven patients have completed the 30 day assessment at the time this interim dataset was created. Average pain had a mean score of 0.00 which means all 7 patients rated their pain as 0=no pain. PROMIS PWB and SA short forms showed meaningful improvement from T7 to T30 and were essentially consistent with baseline scores.

CONCLUSION

Based on patient reported outcome measurements, pain following renal tumor ablation is minimal. Patients report very little impact on PF and SA, and any such impact resolves quickly following treatment. Continued assessment of PROs will provide evidence to direct quality patient care and assist in patient education.

CLINICAL RELEVANCE/APPLICATION

Patient reported outcomes may allow a procedural practice to track impact of treatment on different aspects of patient well-being. Specific impacts may then be addressed to improve the quality of one's practice.

VSI011-05 Renal Tumor Ablation Registries and Early ARMOR Findings

Sunday, Nov. 27 2:25PM - 2:40PM Room: S405AB

Participants

Jeremy C. Durack, MD, New York, NY (*Presenter*) Scientific Advisory Board, Adient Medical Inc; Investor, Adient Medical Inc;

LEARNING OBJECTIVES

1. Understand the patient registry landscape and role that registries can play in the management of renal masses. 2. Understand the goals, methodology and early findings from the Ablation of Renal Masses Outcomes Registry (ARMOR).

ABSTRACT

LEARNING OBJECTIVES

1) Understand the benefits and drawbacks of registry studies and how registries contribute to our knowledge of renal ablation outcomes.

ABSTRACT

VSI011-06 Partial Nephrectomy and Tumor Ablation: The Urologist Perspective

Sunday, Nov. 27 2:40PM - 2:55PM Room: S405AB

Participants

Sarah P. Psutka, MD, MSc, Chicago, IL, (spsutka@cookcountyhhs.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the indications for partial nephrectomy and tumor ablation for small renal masses. 2) Describe partial nephrectomy techniques, risks, and benefits. 3) Compare and contrast the potential risks and complications of partial nephrectomy vs. tumor ablation. 4) Discuss the comparative oncologic outcomes following both partial nephrectomy and tumor ablation. 5) Describe decision-making strategies and decision-aids that may be utilized to optimize the individualized selection of treatment for a small renal mass, taking into account patient-specific factors and competing risks of comorbidities.

ABSTRACT

VSI011-07 Decision Making: Active Surveillance - When to Follow & When to Intervene

Sunday, Nov. 27 2:55PM - 3:10PM Room: S405AB

Participants

Stuart G. Silverman, MD, Brookline, MA, (sgsilverman@partners.org) (*Presenter*) Author, Wolters Kluwer nv

LEARNING OBJECTIVES

View learning objectives under the main course title.

VSI011-08 Decision Making: Nephrometry Revisited - The Truth about Nephrometry and Ablation

Sunday, Nov. 27 3:10PM - 3:25PM Room: S405AB

Participants

Grant D. Schmit, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

VSI011-09 Maximum tumor diameter is superior to the R.E.N.A.L. nephrometry and P.A.D.U.A. scores for prediction of local recurrence following renal cell carcinoma ablation

Sunday, Nov. 27 3:25PM - 3:35PM Room: S405AB

Awards

Student Travel Stipend Award

Participants

Aaron W. Maxwell, MD, Providence, RI (*Presenter*) Nothing to Disclose

Grayson L. Baird, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

Damian E. Dupuy, MD, Providence, RI (*Abstract Co-Author*) Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

PURPOSE

To evaluate the performance of the R.E.N.A.L. nephrometry and P.A.D.U.A. scoring systems and other tumor biometrics with respect to prediction of local tumor recurrence following thermal ablation for renal cell carcinoma.

METHOD AND MATERIALS

This HIPAA-compliant study was performed with a waiver for informed consent following institutional review board approval. A retrospective evaluation of 207 consecutive patients (131 male, 76 female; mean age 71.9 ± 10.9 years) with 217 biopsy-proven renal cell carcinoma tumors treated with thermal ablation was conducted. Serial post-ablation CT or MR imaging was used to evaluate for local tumor recurrence. For each tumor, R.E.N.A.L. nephrometry and P.A.D.U.A. scores were calculated using imaging-derived tumor morphology data. Several additional tumor biometrics and combinations thereof were also measured, including maximum tumor diameter. Harrell's C index and hazard regression techniques were used to quantify associations with local tumor recurrence.

RESULTS

The R.E.N.A.L. (H.R.=1.43, $p=0.003$) and P.A.D.U.A. (H.R.=1.80, $p<0.0001$) scores were significantly associated with recurrence by regression techniques but demonstrated only poor to fair discrimination by Harrell's C index (C=0.68 and 0.75, respectively). Maximum tumor diameter showed the highest discriminatory strength of any individual variable evaluated (C=0.81) and was also significantly predictive by regression techniques (H.R.=2.98, $p<0.0001$). For every 1 cm increase in diameter, the estimated rate of recurrence risk increased by 198%.

CONCLUSION

Maximum tumor diameter demonstrates superior performance relative to existing tumor scoring systems and other evaluated biometrics for prediction of local tumor recurrence following renal cell carcinoma ablation.

CLINICAL RELEVANCE/APPLICATION

Maximum tumor diameter alone should be considered for use in place of existing scoring systems when stratifying patients according to predicted local tumor recurrence risk prior to thermal ablation for renal cell carcinoma.

Honored Educators

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

Damian E. Dupuy, MD - 2012 Honored Educator

VSI011-10 Ablation of Renal Cancer Metastases

Sunday, Nov. 27 3:40PM - 3:55PM Room: S405AB

Participants

Matthew R. Callstrom, MD, PhD, Rochester, MN, (Callstrom.matthew@mayo.edu) (*Presenter*) Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd

LEARNING OBJECTIVES

1) Describe patients that are appropriate for ablation for renal cell metastases. 2) Describe the relative role of ablation with other treatments for renal cell metastases. 3) Describe outcome of the use of ablation for the treatment of renal cell metastases.

VSI011-11 Ablation of Cystic Renal Masses: Special Considerations and Outcomes

Sunday, Nov. 27 3:55PM - 4:10PM Room: S405AB

Participants

Steven S. Raman, MD, Santa Monica, CA, (sraman@mednet.ucla.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1. Background on Cystic Renal Masses 2. Imaging of Cystic Renal Masses 3. Reasons for intervention and ablation 4. Tips and Tricks for Optimal Ablation 5. Outcomes

ABSTRACT

Cystic renal masses account for less than 10% of renal malignancies and are generally indolent. In this talk, I will discuss

treatment of cystic renal masses in the context of their demographics and clinical behavior.

VSI011-12 Renal Mass Ablation Imaging Follow Up: Challenging Cases

Sunday, Nov. 27 4:10PM - 4:25PM Room: S405AB

Participants

Anil N. Kurup, MD, Rochester, MN, (kurup.anil@mayo.edu) (*Presenter*) Research Grant, Galil Medical Ltd; Royalties, UpToDate, Inc

LEARNING OBJECTIVES

1) Protocol CT and MRI scans for post renal mass ablation follow up. 2) Recognize residual/recurrent renal cell carcinoma and its mimics following renal mass ablation. 3) Detect common and uncommon complications related to renal mass ablation.

ABSTRACT

VSI011-13 Advances in Renal Mass Biopsy: Implications for Decision Making

Sunday, Nov. 27 4:25PM - 4:40PM Room: S405AB

Participants

William W. Mayo-Smith, MD, Boston, MA (*Presenter*) Author with royalties, Reed Elsevier; Author with royalties, Cambridge University Press

LEARNING OBJECTIVES

View learning objectives under the main course title.

VSI011-14 Embolization of Renal Masses and Metastases: Update

Sunday, Nov. 27 4:40PM - 4:55PM Room: S405AB

Participants

Kamran Ahrar, MD, MBA, Houston, TX, (kahrar@mdanderson.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Outline current clinical indications for embolotherapy in patients with renal cell carcinoma and its metastases. 2) Describe the use of different embolic agents for embolization of renal tumors and its metastases. 3) List potential complications of embolotherapy in patients with renal cell carcinoma and its metastases.

LEARNING OBJECTIVES

View learning objectives under the main course title.

VSI011-15 MRI Guided Ablation of Localized and Recurrent Prostate Cancer

Sunday, Nov. 27 4:55PM - 5:10PM Room: S405AB

Participants

David A. Woodrum, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

VSI011-16 Biophysics, Mechanics and Technique of Irreversible Electroporation (IRE) of Prostate Cancer - Why and How We Do It Differently from (Almost) Everybody Else

Sunday, Nov. 27 5:10PM - 5:20PM Room: S405AB

Participants

Michael K. Stehling, MD, PhD, Offenbach, Germany (*Presenter*) Investor, InterScience GmbH
Eric Guenther, Dipl Phys, Frankfurt, Germany (*Abstract Co-Author*) Investor, InterScience GmbH
Stephan Zapf, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Rachid El-Idrissi, Offenbach, Germany (*Abstract Co-Author*) Nothing to Disclose
Nina Klein, MSc, Offenbach am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Boris Rubinsky, PhD, Berkeley, CA (*Abstract Co-Author*) Consultant, InterScience GmbH

PURPOSE

We have employed Irreversible Electroporation (IRE) to treat prostate cancer (PCa) in over 380 patients within 5.5 years. Our technique, based on the biophysics of IRE and our practical experience, differs from that employed others, who emulate brachytherapy. We demonstrate the rationale and technical details of our approach and explain, why we consider it superior.

METHOD AND MATERIALS

Computer simulations, in-vitro and in-vivo studies: Based on mass collected impedance data we carried out theoretical, gel-phantom and animal studies to understand the E-field geometry under non-standard electrode geometries (non-parallel, unequal exposure length, etc.), and the effects of the electric current, e.g. electrolysis with gas formation, changes in pH and thermal effects. Mechanics and geometry of electrode placement: Contrary to others, we do not use a brachytherapy grid. This affords higher accuracy electrode positions adjusted to the prostate's shape. Also, grid and prostate move relative to each other during IRE, due to muscle contractions. Diagnostic work-up and follow-up: We employ multi-parametric MRI for treatment planning and follow-up. In most patients, we employ additional 3D-mapping biopsy to determine tumour and Gleason score distribution.

RESULTS

During IRE electric currents induce electrolysis, causing gas formation, pH changes, generation of cytotoxic chemicals and

During IRE electric currents induce electrolysis, causing gas formation, pH changes, generation of cytotoxic chemicals and temperature rises. These effects can be minimized by adjusting the IRE pulse parameters. Placement of the IRE electrodes without a grid affords higher accuracy (1-2 vs. 5-9 mm) of the electrode positions. It allows non-parallel, shifted and angled electrode geometries better adjusted to the shape of the prostate without affecting the ablation reliability. It also avoids electrode displacement during IRE. Optimal ablation field planning requires MRI and 3D-biopsy which provide complementary information in most cases.

CONCLUSION

Based on biophysics, mechanics and experience we have developed an optimized IRE technique for the treatment of prostate cancer. Techniques following the brachytherapy approach are suboptimal and potentially harmful to the patient.

CLINICAL RELEVANCE/APPLICATION

Irreversible Electroporation (IRE) is a powerful but complex technology. Understanding of the biophysics and mechanics is required to optimize the interventional technique to minimize toxicity and achieve optimal clinical results in the treatment of prostate cancer.

VSIO11-17 Ablation for Benign and Malignant Gynecologic Tumors

Sunday, Nov. 27 5:20PM - 5:35PM Room: S405AB

Participants

Peter J. Littrup, MD, Providence, RI (*Presenter*) Founder, CryoMedix, LLC; Research Grant, Galil Medical Ltd; Research Grant, Endo International plc; Consultant, Delphinus Medical Technologies, Inc

LEARNING OBJECTIVES

View learning objectives under the main course title.

VSIO11-18 Effect of Radiofrequency Ablation (RFA) Heating Parameters and the Suppression of Resultant Heat Shock Proteins on Induced Systemic Tumor Growth in a Small Animal Tumor Model

Sunday, Nov. 27 5:35PM - 5:45PM Room: S405AB

Participants

Gaurav Kumar, PhD, Boston, MA (*Presenter*) Nothing to Disclose

S. Nahum Goldberg, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, AngioDynamics, Inc; Research support, Cosman Medical, Inc; Consultant, Cosman Medical, Inc;

Tatyana Levchenko, Pharm D, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Marwan Moussa, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Svetlana Gourovich, BSc, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

Muneeb Ahmed, MD, Wellesley, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study variable hepatic RFA heating parameters on activation of heat shock proteins (HSPs) and their effect on modulating distant tumor growth.

METHOD AND MATERIALS

First, effect of RFA parameters on local HSP70 expression and cellular infiltration was studied. 24 F344 rats received hepatic RFA (21g electrode, 1 cm tip) at one of three RFA doses that induced the same-sized ablation: 60°Cx10min, 70°Cx5min, or 90°Cx2min, or sham electrode placement without RFA (4 arms, n=6/group). Immunohistochemistry (IHC) of HSP70 at 24h and α -SMA (myofibroblasts), CD68 (macrophages), and CDC47 (cell proliferation) at 7d was performed (n=3/group). Next, to study RFA dose effects on distant tumor growth, animals with subcutaneous R3230 adenocarcinoma (10±1mm) were assigned to 3 different RF doses or sham (n=6/arm). Post-RFA tumor growth rates, cellular proliferation (Ki-67), and microvascular density (MVD) were compared at 7d. Finally, each RF dose was combined with an adjuvant HSP inhibitor (micellar quercetin, 2mg/ml) to study local HSP70 suppression on hepatic RFA-induced distant tumor growth.

RESULTS

Hepatic RFA at 70°Cx5 and 60°Cx10 had more periablational HSP70 compared to 90°Cx2m (rim: 334.5±79.3µm vs. 230.9±52.6µm, p<0.001), with similar trends for local α -SMA, CD68, and CDC47 (p<0.01 for all). Lower RF heating (70°Cx5 and 60°Cx10) also resulted in larger distant tumors at 7d (19.2±0.8mm for both) compared to sham (13.5±0.5mm, p<0.001 for all). By comparison, higher RF heating (90°Cx2) led to less distant tumor growth at 7d (16.4±0.7mm, p<0.01 for both), though more than sham (13.5±0.5mm, p<0.01). Ki-67 and MVD correlated with tumor growth (p<0.01 for all). Anti-HSP70 MicQ blocked distant tumor growth at both low-RF (60°Cx10: RF/MicQ 14.5±0.6mm vs. RF 19.1±0.6mm, p<0.001) and high-RF (90°Cx2: RFA/MicQ 14.4±0.5mm vs. RFA:16.4±0.7mm, p<0.01) arms.

CONCLUSION

Different hepatic RF heating parameters alter the extent of periablational HSP70 expression, which in turn stimulates variable distant tumor growth in small animals. Modulation of RF heating parameters alone or in combination with adjuvant nanodrug HSP inhibition can reduce these unwanted, off-target systemic tumorigenic effects.

CLINICAL RELEVANCE/APPLICATION

Modulating RFA heating parameters with or without adjuvant anti-HSP70 drugs can mitigate the 'off-target' tumorigenic effects that can substantially effect clinical practice.

VSIO11-19 Adrenal Mass Ablation

Sunday, Nov. 27 5:45PM - 6:00PM Room: S405AB

Participants

Muneeb Ahmed, MD, Wellesley, MA, (mahmed@bidmc.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.

ABSTRACT

RC101

A Practical Guide to Lung Cancer Screening

Sunday, Nov. 27 2:00PM - 3:30PM Room: E450A



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

Participants

Caroline Chiles, MD, Winston-Salem, NC, (cchiles@wakehealth.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Develop the infrastructure for a successful lung cancer screening clinic. 2) Implement the Lung-RADS reporting system. 3) Compare the Lung-RADS reporting system with other currently available nodule risk prediction models. 4) Specify the appropriate management for lung nodules according to nodule size, consistency, and growth patterns. 5) Recognize atypical appearances of screen-detected lung cancers.

ABSTRACT

Lung cancer remains the leading cause of cancer-related death worldwide, but screening with low-dose CT has been shown to reduce lung cancer mortality. This mortality reduction can best be achieved by developing a lung cancer screening clinic that includes shared decision making, smoking cessation programs and CT screens that deliver radiation doses that are ALARA. Nodule management should comply with evidence-driven protocols such as those in the Lung-RADS reporting system developed by the American College of Radiology, with consideration of lung cancer risk for individual nodules. This course will also highlight nodule risk prediction models that include clinical factors as well as nodule features of diameter/volume, location and consistency to guide nodule management. A pictorial review of NLST-detected lung cancers will emphasize typical appearances, as well as atypical appearances of screen-detected lung cancers.

Sub-Events

RC101A Building a Clinical Program

Participants

Jared D. Christensen, MD, Durham, NC (*Presenter*) Advisory Board, Riverain Technologies, LLC

LEARNING OBJECTIVES

View learning objectives under the main course title.

RC101B LungRads

Participants

James G. Ravenel, MD, Charleston, SC (*Presenter*) Consultant, Imbio, LLC

LEARNING OBJECTIVES

View learning objectives under the main course title.

RC101C Lung Nodule Management

Participants

Jane P. Ko, MD, New York, NY, (jane.ko@nyumc.org) (*Presenter*) Speaker, Siemens AG

LEARNING OBJECTIVES

1) To improve understanding of screening detected nodule management using the lung-RADS reporting system. 2) To understand techniques for further nodule characterization.

ABSTRACT

RC101D Typical and Atypical Manifestations of Screen-Detected Lung Cancer

Participants

Caroline Chiles, MD, Winston-Salem, NC, (cchiles@wakehealth.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Contrast the typical CT appearances of screen-detected lung cancers (small solid, part-solid, and non-solid nodules) with less commonly encountered forms, including cancers that are airspace filling, or associated with cystic air spaces or areas of pulmonary fibrosis. 2) Recognize the typical distribution of screen-detected lung cancers as peripheral lesions within the upper lobes, as compared with those encountered centrally or within the lower lobes.

RC102

What's New from the Radiology Residency Review Committee

Sunday, Nov. 27 2:00PM - 3:30PM Room: S504AB

ED

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

Participants

Felicia Davis, Chicago, IL (*Presenter*) Nothing to Disclose

James C. Anderson, MD, Portland, OR (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To provide updates from the Review Committee for Diagnostic Radiology. 2) To provide updates from ACGME. 3) To provide updates on ACGME's Next Accreditation System.

RC103

Imaging of Atherosclerosis

Sunday, Nov. 27 2:00PM - 3:30PM Room: E352



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

FDA Discussions may include off-label uses.

Participants

John J. Carr, MD, MS, Nashville, TN (*Moderator*) Nothing to Disclose

Sub-Events

RC103A The Biology of Atherosclerosis

Participants

Pamela K. Woodard, MD, Saint Louis, MO, (woodardp@mir.wustl.edu) (*Presenter*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research agreement, Siemens AG; ; ; ;

LEARNING OBJECTIVES

1) Discuss the initiation of the atherosclerotic disease process, including chemical, mechanical and immunological factors. 2) Discuss the molecular biology of atherosclerosis and cellular mechanisms involved in plaque remodeling, progression, instability and repair. 3) Discuss potential molecular targets in atherosclerosis imaging.

ABSTRACT

RC103B Molecular Imaging of Atherosclerosis

Participants

Zahi A. Fayad, PhD, New York, NY, (zahi.fayad@mssm.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define Nanomedicine and its opportunity in cardiovascular disease detection and treatment. 2) Demonstrate the methods of plaque molecular imaging with MR Imaging, PET, CT. 3) Discuss the advantages and limitations of plaque molecular imaging using MR Imaging, PET, CT. 4) Discuss the preclinical and clinical relevance of plaque molecular imaging by MR Imaging, PET, CT. 5) Discuss novel methods for atherosclerotic plaque treatment using nanomedicine.

ABSTRACT

Atherosclerosis is a chronic progressive disease, affecting the medium and large arteries, in which lipid-triggered inflammation plays a pivotal role. The major clinical manifestations of atherosclerosis are coronary artery disease (CAD), leading to acute myocardial infarction (MI) and sudden cardiac death; cerebrovascular disease, leading to stroke; and peripheral arterial disease, leading to ischemic limbs and viscera. These complications of atherosclerosis are leading causes of death worldwide. Despite progress in medical and revascularization therapies for atherothrombotic disease, the incidence of MI and stroke remain high under the current standard of care, and the past decade has generated few new medical therapies to prevent atherosclerosis-induced events. Similarly, current diagnostic approaches to atherosclerosis do not accurately identify those individuals who will suffer an ischemic complication. The field of atherosclerosis is therefore ripe for reengineering in both the therapeutic and diagnostic arenas. Research into the process of atheroma lesion development and maturation has implicated many immune cells including lymphocytes, dendritic cells, and neutrophils. The most numerous cells in atherosclerotic plaque are macrophages, which are leukocytes that are central to the innate immunity. Because they play a major role in instigating plaque development and complication—both of which are inflammation-related disease processes—leukocytes are promising targets for more effective atherosclerosis treatments. However, the complexity of the immune system and its role as a defensive force against infection require novel tools to very precisely identify and treat the inflammatory cells that promote atherosclerosis. Biomedical engineering offers unique possibilities for diagnosing and treating atherosclerotic plaque inflammation. Thus, interfacing engineering with immunology will be essential to meaningful advances in disease management. This talk will discuss how recent discoveries in atherosclerosis immunology can provide opportunities for diagnostic imaging of atherosclerotic plaques and cardiovascular complications of atherosclerosis, including translatable molecular imaging techniques. Integrated diagnostic modalities have uncovered new pathways that can serve as potential diagnostic and therapeutic targets, and show that these pathways can be specifically modulated by nanomedicine based interventions.

RC103C MR Imaging of Atherosclerosis

Participants

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

LEARNING OBJECTIVES

1) Identify the clinical goals of MRI of atherosclerosis, describe the critical information needed for different vascular beds. 2) Explain the technical need and challenges in imaging atherosclerosis. 3) Assess current approaches and applications and future directions.

ABSTRACT

RC103D **CT Imaging of Atherosclerosis**

Participants

Pal Maurovich-Horvat, MD, PhD, Pecs, Hungary (*Presenter*) Nothing to Disclose

RC104

Interpretation of Musculoskeletal Radiographs: A Master Class

Sunday, Nov. 27 2:00PM - 3:30PM Room: S406A

MK

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

Participants

Zehava S. Rosenberg, MD, New York, NY (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

Interpretation of Musculoskeletal Radiographs: A Master Class The learning goal of this course is to sharpen skills in interpretation of plain radiographs of the musculoskeletal system and will focus on subtle or difficult radiographic findings which, if missed, may lead to delay in or misleading clinical diagnosis. The course is geared toward both the general radiologist as well as the more experienced musculoskeletal radiologist. Often radiographs are the first line of choice when a clinical dilemma is encountered. As such, correct assessment is crucial to guide further workup and treatment. Yet, radiographic interpretation skills have fallen by the wayside compared to those of more advanced cross sectional imaging. In this course the presenters will alert the participants to easily missed plain radiographic findings which are paramount for correct interpretation. The course will have 5 sections, the first 4 will focus on the following joints in this order: the ankle, the shoulder, the wrist and the knee; the last section will focus on various other joints. At the end of the course the participants should enhance their skills when interpreting plain radiographs of the musculoskeletal system.

Sub-Events

RC104A Ankle

Participants

Zehava S. Rosenberg, MD, New York, NY (*Presenter*) Nothing to Disclose

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/>

Zehava S. Rosenberg, MD - 2014 Honored Educator

RC104B Shoulder

Participants

Robert J. Ward, MD, Boston, MA, (robert.ward@tufts.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

RC104C Wrist

Participants

Catherine N. Petchprapa, MD, New York, NY, (Petchc01@nyumc.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC104D Knee

Participants

Anne Cotten, MD, Lille, France, (anne.cotten@chru-lille.fr) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

With the development of MRI, knee radiographs are less and less frequently performed and taught to residents. Nevertheless, knowledge of subtle radiographic findings may be particularly useful for the management of many disorders. The aim of this lecture

is to raise awareness among radiologists of easily overlooked features by presenting many illustrative cases (subtle avulsion fractures or cortical depressions, subtle signs of trochlear dysplasia, subchondral or marginal changes, ...).

RC104E Other Pearls and Pitfalls

Participants

Mary G. Hochman, MD, Boston, MA, (mhochman@bidmc.harvard.edu) (*Presenter*) Stockholder, General Electric Company; Stock options, Nomir Medical Technologies, Inc; Author, UpToDate, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

RC105

Difficult Diagnoses in Neuroradiology

Sunday, Nov. 27 2:00PM - 3:30PM Room: S406B

NR

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

Participants

Aaron S. Field, MD, PhD, Madison, WI (*Moderator*) Nothing to Disclose

Sub-Events

RC105A Autoimmune Encephalitis

Participants

Walter Kucharczyk, MD, Toronto, ON (*Presenter*) Research Grant, InSightec Ltd

LEARNING OBJECTIVES

1) Identify auto-immune encephalitis on cross-sectional images of the brain. 2) Differentiate auto-immune encephalitis from viral encephalitis. 3) Recommend further actions to be taken when auto-immune encephalitis is suspected on the basis of clinical, lab, or imaging tests.

ABSTRACT

RC105B Is it Vasculitis?

Participants

Daniel M. Mandell, MD, PhD, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Appreciate the spectrum of imaging findings in CNS vasculitis. 2) Appreciate findings that help differentiate among related conditions. 3) Understand the role of imaging relative to other tests (CSF sampling, biopsy etc...).

RC105C The Elusive Dural Fistula

Participants

Michele H. Johnson, MD, New Haven, CT (*Presenter*) Nothing to Disclose

RC106

Contemporary Thyroid and Parathyroid Imaging: The Incidental Thyroid Nodule Through 4DCT

Sunday, Nov. 27 2:00PM - 3:30PM Room: E353B



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

Participants

Sub-Events

RC106A **Managing the Incidental Thyroid Nodule**

Participants

Ilona M. Schmalfluss, MD, Gainesville, FL, (schmai@radiology.ufl.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss ACR guidelines on managing incidental thyroid nodules. 2) Review imaging features distinguishing between benign and malignant thyroid nodules. 3) Apply ACR guidelines on managing incidental thyroid nodules to different case examples.

ABSTRACT

RC106B **Imaging Thyroid Cancer**

Participants

Laurie A. Loevner, MD, Gladwyne, PA (*Presenter*) Nothing to Disclose

RC106C **Parathyroid Imaging**

Participants

Hillary R. Kelly, MD, Boston, MA, (hillary.kelly@mgh.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the relevant anatomy for localization of the parathyroid glands, including in the normal, ectopic and disease states. 2) Describe the current surgical approaches to parathyroid disease and implications for preoperative parathyroid imaging. 3) Compare and contrast the available imaging modalities for preoperative localization of parathyroid lesions, and their advantages and disadvantages.

Active Handout:Hillary Rolls Kelly

[http://abstract.rsna.org/uploads/2016/16001279/ACTIVE RC106C.pdf](http://abstract.rsna.org/uploads/2016/16001279/ACTIVE_RC106C.pdf)

GYN and Pelvic Floor 2016: Latest Imaging Guidelines and Angles Simplified!

Sunday, Nov. 27 2:00PM - 3:30PM Room: E451A

GU

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

Participants

Mark E. Lockhart, MD, Birmingham, AL, (mlockhart@uabmc.edu) (*Coordinator*) Author, Oxford University Press

Maitray D. Patel, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Therese M. Weber, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe current best practice recommendations for management of adnexal asymptomatic, incidental, and/or potentially physiologic findings on pelvic US, CT, and MR based on lesion characteristics and patient clinical factors. 2) Understand the reference lines and angles in pelvic MRI that are used in the evaluation of pelvic floor disorders. 3) Understand the typical imaging characteristics of the endometrium and myometrium according to patient age and stage of the reproductive cycle, and review associated benign pathology.

ABSTRACT

This session will present on topics related to pelvic imaging. At the conclusion of the three presentations, the participants should have an improved understanding of imaging characteristics of the ovaries and uterus, including endometrium. Also, the imaging parameters used in evaluation of pelvic floor abnormalities such as organ prolapse and structural abnormalities related to incontinence will be reviewed. In each lecture, the imaging characteristics of a variety of disease processes will be covered.

RC108

Emergency Neuroradiology (An Interactive Session)

Sunday, Nov. 27 2:00PM - 3:30PM Room: N227B



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

Participants

Sub-Events

RC108A Non-traumatic Subarachnoid Hemorrhage

Participants

Diego B. Nunez JR, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Analyze the various causes, patterns of distribution and imaging features of non-traumatic subarachnoid hemorrhage. 2) Identify the different diagnostic pitfalls encountered in the initial assessment of patients with suspected subarachnoid hemorrhage. 3) Assess the contribution of additional imaging (CTA, MR, DSA) as integral part of the admitting evaluation of patients with subarachnoid hemorrhage.

ABSTRACT

RC108B CT and MRI of Neck Infections

Participants

Wayne S. Kubal, MD, Tucson, AZ (*Presenter*) Stockholder, Stryker Corporation; Stockholder, Sarepta Therapeutics Inc; Stockholder, CVS Health Corporation; Stockholder, Gilead Sciences, Inc; Author, Reed Elsevier; Editor, Reed Elsevier

LEARNING OBJECTIVES

1) To diagnose neck infection on CT and MR. 2) To characterize the nature and the location of the infection. 3) To appreciate the complications that may result from the infection.

ABSTRACT

Active Handout: Wayne Scott Kubal

[http://abstract.rsna.org/uploads/2016/16000635/ACTIVE Handout for Course RC108B.pdf](http://abstract.rsna.org/uploads/2016/16000635/ACTIVE%20Handout%20for%20Course%20RC108B.pdf)

RC108C CT and MRI of Spine Infections

Participants

A. Orlando Ortiz, MD, MBA, Mineola, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the epidemiology and pathophysiology of spine infection. 2) Focus on making the diagnosis of infectious spondylitis utilizing: Clinical findings, Imaging findings, Biopsy. 3) Distinguish infectious spondylitis from other radiographic mimics.

RC109

Biliary - Potpourri

Sunday, Nov. 27 2:00PM - 3:30PM Room: S402AB



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

Participants

Sub-Events

RC109A Imaging of Jaundice

Participants

Silvia D. Chang, MD, Vancouver, BC, (Silvia.Chang@vch.ca) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate the MRI findings in common and uncommon benign biliary disease. 2) Convey available MRI techniques and protocols for evaluation of benign biliary disease. 3) Illustrate common pitfalls that can mimic benign biliary disease.

ABSTRACT

RC109B Biliary Post-op Complications

Participants

Chandana G. Lall, MD, Orange, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand underlying mechanism of iatrogenic biliary injury. 2) Review of biliary anatomy: Anatomic variants which may predispose to injury. 3) MR Imaging features of iatrogenic biliary injury. 4) Classification of biliary injuries. 5) Role of hepatobiliary agents in workup of biliary injury.

ABSTRACT

Surgical procedures and underlying mechanism for iatrogenic biliary injury
Biliary anatomy: Anatomic variants which may predispose to injury
Imaging features of iatrogenic biliary injury on MR Imaging
Classification system in assessing biliary injuries
Role of hepatobiliary agents

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/>

Chandana G. Lall, MD - 2013 Honored Educator

RC109C Cholangiocarcinoma

Participants

Kartik S. Jhaveri, MD, Toronto, ON (Presenter) Speaker, Bayer AG; Speaker, Siemens AG

LEARNING OBJECTIVES

1) Discuss Classification and Imaging Appearances of Cholangiocarcinoma. 2) Discuss Staging Systems and Resectability Evaluation of Cholangiocarcinoma.

ABSTRACT

RC109D Biliary Cases I Missed

Participants

John P. McGahan, MD, Sacramento, CA, (jpmcgahan@ucdavis.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To familiarize the audience with common imaging pitfalls when evaluating the biliary system. 2) To help the audience avoid common mistakes when evaluating the biliary tract with either MRI or CT. 3) To demonstrate to the audience what devastating consequences that may occur when suggesting a specific wrong diagnosis.

ABSTRACT

RC110

Renal Doppler, Contrast and Elastography

Sunday, Nov. 27 2:00PM - 3:30PM Room: S103CD

GU **US**

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

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC110A Renal Doppler: What You Need to Know

Participants

John S. Pellerito, MD, Manhasset, NY, (jpelleri@northwell.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Apply techniques and protocols for the renal Doppler evaluation. 2) Analyze diagnostic criteria for renal artery stenosis and occlusion. 3) Utilize Doppler for the evaluation of renal artery stents. 4) Compare Doppler to other imaging modalities used to evaluate renal vascular disease.

ABSTRACT

RC110B Contrast Evaluation of Renal Masses

Participants

Dirk-Andre Clevert, MD, Muenchen, Germany, (dirk.clevert@med.uni-muenchen.de) (Presenter) Speaker, Siemens AG; Speaker, Koninklijke Philips NV; Speaker, Bracco Group;

LEARNING OBJECTIVES

1) Ultrasound visualization of renal lesions using B-mode sonography, contrast enhanced ultrasound and image fusion is explained. This includes the characterization of renal cysts. 2) The Bosniak classification is explained with the five different categories of characterization of renal cysts. A common finding are non-complicated solitary lesions Bosniak type I. 3) The main differential diagnoses are explained with an emphasis on the renal cell carcinoma.

ABSTRACT

Ultrasound is the most used interdisciplinary non-ionizing imaging technique in clinical routine. Therefore, ultrasound has a special value in the diagnosis and monitoring of cystic renal lesions, which can be classified as non-complicated or complicated and by means of occurrence as solitary or multifocal lesions. The Bosniak classification (I-IV) classifies renal cysts in 5 different categories with the help of ultrasound and computed tomography image criteria and is used for decisions of further clinical treatment. Additionally to normal native B-mode sonography, several new methods are in clinical use to improve diagnostic accuracy of unclear cases. Contrast enhanced ultrasound and MRI/CT are able to find and characterize difficult pathologies. In contrast to multislice-CT (MS-CT), ultrasound image fusion is a real-time imaging technique that can be used in combination with other cross-sectional imaging techniques. This course explains the most important pathologies of cystic lesions of the kidney and stresses the different imaging methods of native B-mode sonography and the new techniques of contrast enhanced ultrasound.

RC110C Renal Elastography: Where Are We?

Participants

Nicolas Grenier, MD, Bordeaux CEDEX, France, (nicolas.grenier@chu-bordeaux.fr) (Presenter) Advisory Board, Supersonic Imagine; Travel support, Guerbet SA

LEARNING OBJECTIVES

1) Explain the principles and limitations of elastographic techniques applied to the kidney. 2) Learn about the impact of the renal structure on elasticity values. 3) Identify the significant structural changes responsible for variations of renal elasticity.

ABSTRACT

Ultrasound elastography is a new imaging technique under development that provides information about renal stiffness. Kidney elasticity quantification with ultrasound should be better performed with a quantitative technique, based on shear wave velocity measurements (ARFI or SSI methods). Kidney stiffness changes can be affected by mechanical factors such as external pressure induced by the probe and intrarenal characteristics such as tissue anisotropy, which is high in renal medulla, vascularization, which is high within the cortex, and hydronephrosis. Chronic kidney disease (CKD) incidence and prevalence are increasing in Western countries, due particularly to diabetes mellitus and hypertension-related nephropathies. During progression of such renal parenchymal diseases, cellular density may increase, mainly during acute inflammatory phases, and the interstitial matrix may be invaded by fibrosis. All components of these tissue changes may induce an increase of renal elasticity which is not specifically related to fibrosis. Tubular, glomerular, interstitial and vascular changes may also be responsible for an increase of stiffness. This is why, further studies are now necessary before to understand the real impact of elastography measurement in clinical nephrology. Considering characterization of renal tumors with elastography, clinical experience is still limited. Preliminary results show that benign tumors seem to have lower values of elasticity than malignant ones, but, here too, more experience is also necessary.

RC111

Improving PET Interpretation (An Interactive Session)

Sunday, Nov. 27 2:00PM - 3:30PM Room: S505AB

CT NM

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

Participants

LEARNING OBJECTIVES

1) Understand the patient preparation issues with performing PET/CT. 2) Review recommendations on patient preparation prior to performing PET/CT. 3) Review the issues in performing PET/CT scans on diabetic patients and learn ways to optimize the glucose level. 4) With the aid of challenging case examples, this activity aims improve PET-CT interpretation through recognition of pitfalls and variants. In addition, it aims to review typical as well as unusual examples of commonly encountered oncologic diagnoses. 5) Learn how to discriminate malignancy from benign FDG-avid changes caused by surgery and procedures, radiation, and chemotherapy.

Sub-Events

RC111A Therapy-induced Complications on PET/CT

Participants

Gary A. Ulaner, MD, PhD, New York, NY, (ulanerg@mskcc.org) (*Presenter*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES

1) Learn how to discriminate malignancy from benign FDG-avid changes caused by surgery and procedures, radiation, and chemotherapy.

ABSTRACT

FDG is not a cancer-specific agent, and FDG-avidity can be seen in many benign processes. It can be particularly challenging to discriminate malignancy from benign FDG-avid changes caused by surgery and procedures, radiation, and chemotherapy. FDG-avid lesions caused by surgery and procedures includes inflammation at sites of incision or dissection, inflammation from vascular compromise or surgical retraction, surgical transposition of structures with physiologic FDG-avidity (such as ovaries or testes), and pleurodesis inflammation. Radiation may induce FDG-avid pneumonitis, esophagitis, or hepatitis, as well as osteoradionecrosis or fractures. FDG-avid chemotherapy complications include pneumonitis, osteonecrosis, enterocolitis, and pancreatitis. Granulocyte Colony Stimulating Factor for treatment of bone marrow suppression after chemotherapy induces temporary increases of FDG-avidity in the bone marrow and spleen. We will illustrate common and unusual iatrogenic causes of FDG-avidity that can confound FDG PET/CT interpretation.

RC111B Impact of Patient Preparation

Participants

Don C. Yoo, MD, E Greenwich, RI (*Presenter*) Consultant, Endocyte, Inc

LEARNING OBJECTIVES

1) Understand the patient preparation issues with performing PET/CT. 2) Review recommendations on patient preparation prior to performing PET/CT. 3) Review the issues in performing PET/CT scans on diabetic patients and learn ways to optimize the glucose level.

ABSTRACT

F18-FDG PET/CT is a valuable tool for a variety of oncologic applications. The purpose of this educational activity is to discuss the importance of appropriate patient preparation prior to performing oncologic F18-FDG PET/CT scans. The recommendations from the American College of Radiology (ACR), the Society of Nuclear Medicine and Molecular Imaging (SNMMI), and the National Cancer Institute (NCI) for patient preparation will be discussed. Issues that will be discussed include fasting, limiting exercise, hydration, sedation, low carbohydrate meals, and diabetic patients.

Patients are typically asked to fast for at least 4 hours before tracer injection for oncologic PET/CT scans. The ACR and SNMMI both recommend checking glucose levels on all patients prior to administration of F18-FDG. SNMMI guidelines recommend that patients with glucose of greater than 150–200 mg/dL should usually be rescheduled. Performing PET/CT scans in poorly controlled diabetic patients can result in a PET/CT scan with an altered biodistribution limiting interpretation of the study. In a poorly controlled diabetic patient with a glucose level of greater than 200 mg/dl, the study should usually be rescheduled if it does not critically affect patient care. Hyperglycemia will dilute the FDG uptake by tumors through competitive inhibition. Subcutaneous insulin should not be administered to a diabetic patient with high glucose within 4 hours of a PET/CT scan as insulin will stimulate FDG uptake by skeletal muscle resulting in an altered biodistribution which can severely limit interpretation.

RC111C Challenging Case Examples

Participants

Esma A. Akin, MD, Washington, DC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) With the aid of challenging case examples, this activity aims improve PET-CT interpretation through recognition of pitfalls and variants. In addition, it aims to review typical as well as unusual examples of commonly encountered oncologic diagnoses.

ABSTRACT

RC112

Transcatheter Aortic Valve Replacement (TAVR)

Sunday, Nov. 27 2:00PM - 3:30PM Room: S404AB

CA

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

RC112A 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.

RC112B 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; Consultant, Edwards Lifesciences Corporation; Consultant, Neovasc Inc; Consultant, Samsung Electronics Co, Ltd; Consultant, Koninklijke Philips NV; Consultant, Arineta Ltd; Consultant, Pi-Cardia Ltd;

LEARNING OBJECTIVES

1) 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

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

RC112C Measurements, Workflow, Training and Q/A

Participants

Shannon Walters, RT, MS, 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.

Pediatric Series: Fetal/Neonatal

Sunday, Nov. 27 2:00PM - 3:30PM Room: S102AB



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

Participants

Beth M. Kline-Fath, MD, Cincinnati, OH, (beth.kline-fath@cchmc.org) (*Moderator*) Nothing to Disclose
Amy R. Mehollin-Ray, MD, Houston, TX, (armeholl@texaschildrens.org) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES**ABSTRACT****Sub-Events****RC113-01 Congenital Diaphragmatic Hernia Imaging**

Sunday, Nov. 27 2:00PM - 2:20PM Room: S102AB

Participants

Amy R. Mehollin-Ray, MD, Houston, TX, (armeholl@texaschildrens.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Distinguish the various subtypes of diaphragmatic hernia on fetal ultrasound and MRI. 2) Learn to measure lung-head ratio, total fetal lung volume and liver herniation and apply the values to define prognosis. 3) Utilize fetal imaging to prepare the multidisciplinary team for potential fetal and post-natal therapies for diaphragmatic hernia.

ABSTRACT**RC113-02 In Vitro and in Vivo MR Measurement of Fetal Blood Oxygen Saturation: Initial Results**

Sunday, Nov. 27 2:20PM - 2:30PM Room: S102AB

Participants

Fabian Kording, Hamburg, Germany (*Presenter*) Nothing to Disclose
Hendrik Kooijmann, PhD, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jin Yamamura, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Manuela Tavares de Sousa, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Mathias Kladeck, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Kurt Hecher, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Bjoern Schoennagel, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Intrauterine growth restriction is associated with an increased perinatal mortality and morbidity and is associated with a decreased oxygen delivery to the fetus. With the relationship between T2 relaxation time and oxygen saturation (sO₂), magnetic resonance oximetry represents a valuable method for a direct noninvasive determination of fetal oxygen saturation. The purpose of this work was to investigate a relationship between fetal sO₂ and T2 relaxation time using in-vitro fetal blood samples. Parameters describing the T2 relaxation of fetal blood were consecutively validated in-vivo in one fetus.

METHOD AND MATERIALS

A balanced steady-state free precession (SSFP) sequence in combination with T2 preparation pulses was applied at 1.5 Tesla (Achieva, Philips Healthcare, Best, The Netherlands) for T2 determination. Fetal blood for in-vitro measurements was derived from the umbilical cord during abdominal delivery from 9 different fetuses. The blood from each fetus was heparinized and divided into 5 samples with different oxygen saturation levels (30 % to 100%). The relationship between T2 and sO₂ was fitted based on the Luz and Meiboom model using measured signal intensities and sO₂ values measured using a blood gas analyzer. Consecutively, the fitted parameters (T₂₀, tex and a) were compared between each fetal blood sample and applied to T2 measurements in the left ventricle in one fetus (34 gestation week) using the same SSFP sequence.

RESULTS

Mean parameters of the blood samples were 160±10 ms (T₂₀), 4.5 ms±1.2 (tex) and 0.032±0.002 103sec⁻¹ (a). The mean parameters were retrospectively used to calculate the sO₂ for each sample for verification ($r = 0.9$). Results of measured signal intensities in the left fetal ventricle using the mean calculated parameters resulted in a sO₂ value of 98 %.

CONCLUSION

In vitro parameters to calculate blood sO₂ were similar for fetal cord blood samples compared to measured sO₂ values and measurements were successfully evaluated in-vivo. In conclusion, MR oximetry is a promising method for a noninvasively determination of fetal oxygen saturation. In future, the calculated parameters have to be validated in a larger fetal population.

CLINICAL RELEVANCE/APPLICATION

In vivo MR oximetry within the fetal heart could help in the diagnosis of fetal hypoxia and associated growth abnormalities.

RC113-03 Utility of Virtual Autopsy (Post-mortem MRI) in the Phenotypic Characterization of Stillbirths

Participants

Shruthi M, NEW DELHI, India (*Abstract Co-Author*) Nothing to Disclose
Madhulika Kabra, MBBS, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Neerja Gupta, MBBS, NEW DELHI, India (*Abstract Co-Author*) Nothing to Disclose
Arun K. Gupta, MBBS, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Raju Sharma, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Manisha Jana, MD, FRCR, New Delhi, India (*Presenter*) Nothing to Disclose
Atin Kumar, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Asit Mridha, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare conventional and virtual autopsy (post- mortem MRI) in the phenotypic characterization of stillbirths

METHOD AND MATERIALS

Initial recruitment in this ethically approved study included 63 stillborn foetuses over two year period, including all still births 20 weeks and above. Consent for both conventional autopsy and MRI was available in 52 (82.5%) cases; out of which 9 cases were excluded from final recruitment because of maternal causes of fetal demise (n=2) and extensive autolysis precluding conventional autopsy (n=7). After detailed history taking, clinical examination, clinical photographs and whole body infantogram; fetus was transported to MRI room (in 10% formalin). Whole body MRI at 1.5T scanner was performed using 3D DRIVE for brain, spine, heart, abdomen, axial T2W TSE for brain, and axial single shot TSE for chest and abdomen. Conventional autopsy was performed as per standard protocol. Both radiologists and pathologists were blinded for each other's findings. Individual malformations detected based on conventional autopsy and postmortem MRI were compared. Diagnosis based on autopsy and MRI findings were made separately and were compared with the clinical diagnosis.

RESULTS

Virtual autopsy had an overall sensitivity and specificity of 77.7% and 99.8% respectively for the detection of malformations. Sensitivity was better for brain and spinal cord (93.1%), renal (96.1%) and pulmonary (91.1%) malformations and relatively poor for cardiovascular (60.9%), musculoskeletal (66.8%) and gastrointestinal (80.6%) malformations. Post-mortem MRI provided additional information over a conventional autopsy in brain and spinal cord malformations in 5 cases. Clinical diagnosis was revised after virtual autopsy in 14 cases (32.5%) and after conventional autopsy in 18 cases (41.8%). In 35 (81.4%) out of 43 cases, final diagnosis based on virtual autopsy was concordant with that of conventional autopsy.

CONCLUSION

Virtual autopsy using post-mortem MRI can be an acceptable alternative to conventional autopsy when refused. Post-mortem MRI allows in situ evaluation of brain and may even give additive value over a conventional autopsy.

CLINICAL RELEVANCE/APPLICATION

Post mortem MRI of still born fetus should be done for genetic counselling and prognostication, when conventional autopsy is refused for any reasons in the evaluation of stillbirths, especially if brain and spinal cord malformations are found on antenatal ultrasonogram.

RC113-04 Cardiovascular Magnetic Resonance of Fetal Persistent Left Superior Vena Cava in Chinese

Participants

Su-Zhen Dong, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Ming Zhu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To show the diagnostic accuracy of fetal cardiovascular magnetic resonance (CMR) for prenatal persistent left superior vena cava (LSVC) in Chinese.

METHOD AND MATERIALS

The prenatal echocardiography (and/or ultrasound) and CMR data of 44 fetuses with persistent LSVC, which confirmed by postnatal diagnoses between January 2010 and June 2015 were reviewed retrospectively. All prenatal CMR was performed at 1.5 T. Imaging sequences included steady-state free-precession (SSFP) sequences, real-time SSFP, single-shot turbo spin echo (SSTSE) and T1-weighted turbo field echo (T1W_TFE) sequences. The images were mostly acquired along the transverse view of the fetal thorax, the four-chamber, short-axis, coronal and oblique sagittal planes of the fetal heart.

RESULTS

All the 44 cases of fetal persistent (LSVC) were correctly diagnosed by fetal CMR, but only 32 cases (72.7%) were correctly diagnosed by first fetal US and/or echocardiography before fetal CMR. 32 cases were associated with other cardiovascular abnormalities and 6 cases with extracardiac abnormalities, 6 cases had no associated condition. Among the 32 fetuses, the congenital cardiovascular abnormalities included heterotaxy syndromes (n = 8) (7 cases of asplenia and 1 case of polysplenia) , tricuspid atresia (n = 1), ventricular septal defects (VSD, n = 5), double outlet right ventricle (DORV, n = 2), complete transposition of great arteries (TGA, n = 2), coarctation of the aorta (CoA, n = 5) , double aortic arch (n=1), right aortic arch (RAoA) with vascular ring (n = 3) , pulmonary atresia with ventricular septal defect (PA/VSD) (n = 1) , tetralogy of Fallot (TOF, n = 2) , hypoplastic left heart syndrome (HLHS, n=2). 39 (88.6%) cases the innominate vein were absent, 5 (11.4%) cases had the innominate vein. Approximately 15.9% of patients (7 cases) the fetal persistent LSVC drains directly into the atrium, 37 (84.1%) cases drains into the coronary sinus.

CONCLUSION

Fetal CMR can accurately diagnose persistent LSVC, especially in situations that limit echocardiography.

CLINICAL RELEVANCE/APPLICATION

Fetal CMR can accurately diagnose persistent LSVC, especially in situations that limit echocardiography. Fetal CMR can also display the innominate vein between the bilateral superior vena cava.

RC113-05 Cardiac MR Imaging of Fetal Congenital Non-Obstructive Aortic Arch Anomalies

Sunday, Nov. 27 2:50PM - 3:00PM Room: S102AB

Participants

Su-Zhen Dong, MD, Shanghai, China (*Presenter*) Nothing to Disclose

Ming Zhu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To illustrate the appearance of fetal non-obstructive aortic arch anomalies at prenatal cardiac magnetic resonance imaging

METHOD AND MATERIALS

Between June 2005 and October 2015, 92 fetuses with congenital non-obstructive aortic arch anomalies which confirmed by postnatal imaging were evaluated using fetal echocardiography and cardiac MRI in our hospital. Cardiac MRI was performed using 1.5T unit. Among the 92 cases, fetal cardiac MRI was performed at 20 to 33 weeks' gestation (mean 24.5 weeks). Imaging sequences included steady-state free-precession (SSFP), real-time SSFP and single-shot turbo spin echo (SSTSE) sequences. The images were mostly acquired along the transverse view of the fetal thorax, the four-chamber, short-axis, coronal and oblique sagittal planes of the fetal heart.

RESULTS

The 92 cases of fetal congenital non-obstructive aortic arch anomalies included double aortic arch (n=26), right aortic arch with aberrant left subclavian artery (n=31), right aortic arch with mirror image branching (n=25), right aortic arch with right ductus arteriosus (n=2), right aortic arch with mirror image branching with retroesophageal ductus (n=3), left aortic arch with aberrant right subclavian artery (n=2) and cervical aortic arch (n=3). The fetal congenital non-obstructive aortic arch anomalies formed vascular ring can be correctly diagnosed using fetal cardiac MRI by experienced doctors; Only 69 cases (75%) were correctly diagnosed as congenital non-obstructive aortic arch anomalies by fetal echocardiography.

CONCLUSION

Fetal cardiac MRI can provide diagnostic information for fetal congenital non-obstructive aortic arch anomalies. Fetal congenital non-obstructive aortic arch anomalies can easily get important clues at the transverse view of aortic arch.

CLINICAL RELEVANCE/APPLICATION

Fetal cardiac MRI can provide accurate diagnostic information for fetal congenital non-obstructive aortic arch anomalies and is recommended as an adjunct to fetal echocardiography.

RC113-06 Maternal-Fetal Attachment in Blind Women Using Physical Model from Three-dimensional Ultrasound and Magnetic Resonance Scan Data: Six Serious Cases

Sunday, Nov. 27 3:00PM - 3:10PM Room: S102AB

Participants

Heron Werner, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose

Bianca Guedes Ribeiro, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

Pedro Daltro, MD, Rio De Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

Tatiana M. Fazecas, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

Renata A. Nogueira, MD, Rio De Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

Jorge Lopes, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

Gerson Ribeiro, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

Leise Rodrigues, Rio De Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The objective of this study is to assess the maternal-fetal attachment (MFA) in six blind pregnant women by means three-dimensional (3D) physical models from 3D ultrasound and magnetic resonance imaging (MRI) scan data.

METHOD AND MATERIALS

We performed a prospective observational cross-sectional study with six blind pregnant women who performed 3D ultrasound and MRI exams to build 3D physical models for their fetuses. The MFA was assessed quantitatively by means a questionnaire of three questions, each one with a score ranging from 0 to 3. We considered MFA values > 7 to each pregnant woman. The descriptive data were expressed by mean \pm standard deviation (SD). The pregnant women were included to this study after providing informed consent.

RESULTS

The mean (\pm SD) maternal age was 32 ± 2.7 years. The mean gestational age at 3DUS and MRI exams were 23.1 ± 3.7 and 21.3 ± 0.9 weeks, respectively. The mean of gestational age at delivery was 36.5 ± 4.7 weeks and all of them were cesarean sections. The mean newborn weight was 2615.8 ± 871.9 g and the gender was 50% both female and male. The MFA was quantitatively observed in all pregnant women, with maximum value (9) in all of them.

CONCLUSION

The MFA was quantitatively observed in all blind pregnant women using 3D physical models.

CLINICAL RELEVANCE/APPLICATION

The three-dimensional (3D) physical models from 3D ultrasound and magnetic resonance imaging (MRI) scan data were designed to

improve the maternal-fetal attachment (MFA) in blind pregnant women. The techniques described in this study can be applied at different stages of pregnancy and constitute an innovative contribution to research on fetal abnormalities. We believe that physical models will help in the tactile and interactive study of complex abnormalities in multiple disciplines. They may also be useful for prospective parents because a 3D physical model with the characteristics of the fetus should allow a more direct emotional connection to their unborn child.

RC113-07 Perinatal Imaging of the Airway: Prenatal Imaging, with Postnatal Correlation, Including a Discussion of the EXIT (Ex-Utero-Intrapartum-Treatment) Procedure

Sunday, Nov. 27 3:10PM - 3:30PM Room: S102AB

Participants

Carol E. Barnewolt, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how to approach imaging of the fetal airway, using both sonography and MRI when pathology such as cervical teratomas, mediastinal masses, and tracheal atresia are expected to adversely effect airway development and function. 2) Learn how the imager can provide critical imaging support before, during, and after specialized deliveries, particularly the so-called EXIT (ex-utero-intra-partum treatment) delivery.

ABSTRACT

RC114

Morbidity and Mortality

Sunday, Nov. 27 2:00PM - 3:30PM Room: S502AB

IR

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

Participants

Michael D. Darcy, MD, Saint Louis, MO (*Moderator*) Research funded, Cook Group Incorporated
Michael J. Lee, MD, Dublin, Ireland, (mlee@rcsi.ie) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

I am a moderator

ABSTRACT

Moderator

Sub-Events

RC114A Oncologic M & M

Participants

Afshin Gangi, MD, PhD, Strasbourg, France, (gangi@unistra.fr) (*Presenter*) Proctor, Galil Medical Ltd

RC114B Most Memorable M & M

Participants

Michael D. Darcy, MD, Saint Louis, MO (*Presenter*) Research funded, Cook Group Incorporated

RC114C Vascular M & M

Participants

William Lea, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose

RC114D Nononcologic Liver M & M

Participants

Michael J. Lee, MD, Dublin, Ireland (*Presenter*) Nothing to Disclose

RC115

The Biology of Breast Cancer

Sunday, Nov. 27 2:00PM - 3:30PM Room: N228



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

Participants

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

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC115A Breast Cancer Genomics

Participants

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

LEARNING OBJECTIVES

1) Understand the molecular classification of breast cancer and comparison with clinical definitions. 2) Learn some of the main genomic features and clinical and treatment outcomes that stratify with the molecular subtypes.

ABSTRACT

RC115B Breast Imaging for Improved Understanding of Genetic Risk & Cancer Biology

Participants

Elizabeth S. Burnside, MD, MPH, Madison, WI, (eburnside@uwhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the different types of genetic information that are being measured and used for the clinical care of breast cancer. 2) Convey that cancer development and evolution depends on both genetics and environment influences. 3) Demonstrate that imaging has the potential to better understand biology, capturing the complex combined influence of genetics and environment. 4) Illustrate the move toward personalized medicine in breast cancer and the role of imaging.

ABSTRACT

RC115C Imaging Appearance of Breast Cancer Subtypes

Participants

Karen S. Johnson, MD, Durham, NC, (karen.johnson2@dm.duke.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify known mammographic, sonographic, and MRI features of different immunohistochemical and molecular subtypes of breast cancer.

The Newly Hired Radiologist: Lessons for Aspiring, New and Experienced Radiologists

Sunday, Nov. 27 2:00PM - 3:30PM Room: E450B

PR

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

Participants

Brandon P. Brown, MD, MA, Indianapolis, IN, (brpbrown@iupui.edu) (*Moderator*) Nothing to Disclose
Anastasia L. Hryhorczuk, MD, Brookline, MA, (ahryhorczuk@tuftsmedicalcenter.org) (*Presenter*) Nothing to Disclose
Kate Hanneman, MD, FRCPC, Toronto, ON, (kate.hanneman@uhn.ca) (*Presenter*) Nothing to Disclose
Brent J. Wagner, MD, Reading, PA, (Brent.Wagner@readinghealth.org) (*Presenter*) Nothing to Disclose
Michael C. Veronesi, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the needs and challenges faced by the beginning radiologist, including how to find an expertise “niche” and how to divide time between clinical work, committee volunteerism, and leadership roles. 2) Examine the impact of social media and patient portals on the physician-patient interaction and identify the risks and benefits of these new opportunities for communication. 3) Identify the issues facing a private practice group when incorporating a new partner including questions of fairness/transparency, patience with colleagues, formal and informal mentorship, and communicating expectations. 4) Discuss the ways in which a radiology group can assist a new radiologist transitioning out of training, in order to bring out the best in their new colleague and help them to live up to and exceed their highest potential.

ABSTRACT

While residency/fellowship training, board certification, and the job search are familiar topics among the radiology community, an equally important yet oft-neglected topic is that of the newly hired radiologist. Although formal training is focused on clinical and diagnostic skills, navigating professional practice requires building relationships, identifying areas of focus, and learning how best to collaborate with partners and other clinical colleagues. For the beginning faculty member, the demands of teaching and research create additional dilemmas in how best to prioritize time. In addition, new technologies and communication norms now face the practicing radiologist. Social media and patient portals provide radiologists with new forums for interacting with the public and patients. In theory, social media can be leveraged for professional outreach, to improve public understanding of radiologists' roles and to increase departmental profiles. However, it is imperative that radiologists balance this potential with the ethical and professional considerations surrounding patient privacy and autonomy. Finally, in both academic and private practice settings, unique challenges face the new partner, challenges not previously faced and for which training might not have fully prepared them. Although the new hire is full of promise, the impact of their colleagues in helping them rise to the challenge and fulfill expectations can be essential.

RC117

Emerging Technologies: Imaging and Management of Pain

Sunday, Nov. 27 2:00PM - 3:30PM Room: S504CD

MR NM

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

FDA Discussions may include off-label uses.

Participants

Sandip Biswal, MD, Stanford, CA (*Moderator*) Stockholder, SiteOne Therapeutics Inc; Scientific Advisory Board, SiteOne Therapeutics Inc; Research Grant, General Electric Company;

Sub-Events

RC117A Challenges in Pain Diagnosis: A Pain Specialist's Perspective on the Potential of Imaging

Participants

Vivianne Tawfik, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the current challenges of pain diagnosis. 2) Identify patients suffering from chronic pain in whom specialized imaging studies add diagnostic value. 3) Develop a multidisciplinary team to better evaluate and treat complex pain conditions.

ABSTRACT

RC117B MR Imaging of Peripheral Nerves in Patients with Pain

Participants

Cynthia T. Chin, MD, San Francisco, CA, (cynthia.t.chin@ucsf.edu) (*Presenter*) Nothing to Disclose

Active Handout: Cynthia T. Chin

http://abstract.rsna.org/uploads/2016/16001538/ACTIVE_RC117B.pdf

RC117C PET/MRI of Inflammation and Pain Generators

Participants

Sandip Biswal, MD, Stanford, CA, (biswal@stanford.edu) (*Presenter*) Stockholder, SiteOne Therapeutics Inc; Scientific Advisory Board, SiteOne Therapeutics Inc; Research Grant, General Electric Company;

LEARNING OBJECTIVES

1) Understand the challenges of current conventional imaging approaches in diagnosing peripheral pain generators. 2) Understand the basis for identifying specific molecular and cellular biomarkers of pain and how these biomarkers can be exploited with molecular and cellular imaging techniques. 3) Demonstrate clinical PET/MR or advanced MRI approaches in identifying pain generators.

ABSTRACT

Chronic pain is now the most prevalent disease in the world. The chronic pain sufferer is currently faced with a lack of objective tools to identify the source of their pain. The goal of this session is to describe new clinical molecular imaging and emerging molecular/cellular imaging methods to more accurately localize chronic pain generators/drivers so that we may objectively identify and more intelligently act upon the cause in a pain sufferer. Successful imaging of pain is relying heavily upon a multidisciplinary effort that include expertise from of a number of scientists and clinicians in the fields of synthetic chemistry, radiochemistry, magnetic resonance physics/engineering, molecular pain neurobiology, clinical pain, radiology and others. A number of clinical and emerging pre-clinical approaches in positron emission tomography (PET) and magnetic resonance imaging (MRI) will be described. These imaging methods will demonstrate how the site of increased physiologic or inflammatory activity can potentially be used to more accurately identify and localize pain generators.

RC118

Multidisciplinary Communication in Cancer Care: Talking the Same Language

Sunday, Nov. 27 2:00PM - 3:30PM Room: E353A



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

Participants

Sub-Events

RC118A Structured Reporting in Oncology: Pearls and Pitfalls

Participants

Hebert Alberto Vargas, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with the definition of “structured reporting” and the differences between structure and accuracy of reports’ content. 2) Discuss the advantages of structured reporting emphasizing its impact of clear and effective communication of imaging findings. 3) Emphasize the importance of standardizing terminology and the expression of diagnostic certainty in structured reports.

ABSTRACT

RC118B The Impact of Subspecialty Reading on Patient Management

Participants

Fergus V. Coakley, MD, Portland, OR, (coakleyf@ohsu.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the importance and context of radiology interpretation to patient management. 2) Describe the available data on the incremental benefit of subspecialist interpretation.

ABSTRACT

RC118C Proliferation of Tumor Boards: Should Radiology Departments Support Them All?

Participants

Giles W. Boland, MD, Boston, MA (*Presenter*) Principal, Radiology Consulting Group; Royalties, Reed Elsevier

RC120

Fundamentals of Imaging for the Radiation Oncologist

Sunday, Nov. 27 2:00PM - 3:30PM Room: S404CD

RO

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

Participants

Eric Leung, MD, FRCPC, Toronto, ON (*Moderator*) Nothing to Disclose

Sub-Events

RC120A Fundamentals in Radiation Oncology Imaging of Sarcoma

Participants

David B. Mansur, MD, Cleveland, OH, (david.mansur@UHhospitals.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify optimal diagnostic imaging to characterize adult extremity soft tissue sarcomas.2) Describe how proper diagnostic imaging aids in target delineation, staging, and treatment planning in adult extremity soft tissue sarcoma.3) Understand the overall indications, target volumes, and dose for radiation therapy for adult extremity soft tissue sarcoma.

RC120B Fundamentals in Radiation Oncology Imaging of Breast Cancer

Participants

William Small JR, MD, Maywood, IL, (wsmall@lumc.edu) (*Presenter*) Speakers Bureau, Carl Zeiss AG; Advisory Board, Varian Medical Systems, Inc

LEARNING OBJECTIVES

1) To enable attendees to understand the contribution of various imaging modalities in the initial evaluation of breast cancer.2) To review imaging modalities role in radiation treatment planning for breast cancer.3) To review the use of imaging modalities in the follow-up of breast cancer.

RC120C Fundamentals in Radiation Oncology Imaging of Prostate Cancer

Participants

Stanley L. Liauw, MD, Chicago, IL, (sliauw@radonc.uchicago.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The primary objective of this session is to enable attendees to understand the contribution of various imaging modalities (including CT, MRI, bone scan, and novel imaging) in the management of prostate cancer by the practicing radiation oncologist.

ABSTRACT

RC120D Fundamentals in Radiation Oncology Imaging of Pancreatic Cancer

Participants

Suzanne M. Russo, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1. To identify different imaging techniques used for staging and therapy recommendations2. To understand appropriate incorporation of imaging into radiation treatment planning for pancreatic cancer3. To explore the potential of imaging for 'adaptive therapy' in pancreatic cancer

RC121

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

Sunday, Nov. 27 2:00PM - 3:30PM Room: N230B

CT **PH**

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

FDA Discussions may include off-label uses.

Participants

Ehsan Samei, PhD, Durham, NC (*Coordinator*) Research Grant, General Electric Company; Research Grant, Siemens AG
Norbert J. Pelc, ScD, Stanford, CA (*Coordinator*) Research support, General Electric Company; Research support, Koninklijke Philips NV; Consultant, Varian Medical Systems, Inc; Consultant, NanoX; Scientific Advisory Board, RefleXion Medical Inc; Scientific Advisory Board, Prismatic Sensors AB; Medical Advisory Board, OurCrowd, LP ;

LEARNING OBJECTIVES

1) Recognize the various forms of open gantry systems for volumetric CT, including C-arms and similar systems for interventional and diagnostic imaging. 2) Understand the image quality characteristics of such systems, including advantages and challenges associated with volumetric (cone-beam) CT. 3) Understand the clinical applications of such systems in interventional and diagnostic imaging. 4) Describe some of the latest CT acquisition techniques, including high pitch, gating, dynamic (shuttle), and automatic kV selection. 5) Explain the clinical applications of these novel acquisition techniques.

Sub-Events

RC121A Closed Gantry Systems Advances in X-ray Sources and Detectors

Participants

Norbert J. Pelc, ScD, Stanford, CA (*Presenter*) Research support, General Electric Company; Research support, Koninklijke Philips NV; Consultant, Varian Medical Systems, Inc; Consultant, NanoX; Scientific Advisory Board, RefleXion Medical Inc; Scientific Advisory Board, Prismatic Sensors AB; Medical Advisory Board, OurCrowd, LP ;

LEARNING OBJECTIVES

RC121B Open Gantry Systems: Advances, Challenges, and New Applications

Participants

Jeffrey H. Siewerdsen, PhD, Baltimore, MD, (jeff.siewerdsen@jhu.edu) (*Presenter*) Research Grant, Siemens AG; Research Grant, Carestream Health, Inc; Advisory Board, Siemens AG; Advisory Board, Carestream Health, Inc; License agreement, Carestream Health, Inc; License agreement, Elekta AB; ; ;

LEARNING OBJECTIVES

1) Recognize the various forms of open gantry systems for volumetric CT, including C-arms and similar systems for interventional and diagnostic imaging. 2) Understand the image quality characteristics of such systems, including advantages and challenges associated with volumetric (cone-beam) CT. 3) Understand the clinical applications of such systems in interventional and diagnostic imaging.

RC121C Novel CT Acquisition Techniques

Participants

Lifeng Yu, PhD, Chicago, IL, (yu.lifeng@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe some of the latest CT acquisition techniques, including high pitch, gating, dynamic (shuttle), and automatic kV selection. 2) Explain the clinical applications of these novel acquisition techniques.

RC122

Imaging for Proton Treatment Planning

Sunday, Nov. 27 2:00PM - 3:30PM Room: S403A

RO PH

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

Participants

Jon J. Kruse, PhD, Rochester, MN (*Moderator*) Research Grant, Varian Medical Systems, Inc

ABSTRACT

Proton therapy has the potential to deliver very conformal dose distributions which may lead to higher cure rates or lower treatment toxicities than conventional or intensity modulated x-ray therapy. Like modern photon modalities, proton therapy relies heavily on advanced imaging techniques for treatment planning and dose calculation. This course will describe imaging requirements which are unique to proton therapy treatment planning. Much of the advantage of proton therapy is derived from the particle beam's finite range, and calculation of proton range within a patient requires a conversion between CT Hounsfield Units (HU) and proton stopping power. This calibration process is significantly different from the HU to electron density conversion which is performed for x-ray dose calculation. Uncertainties in the stopping power conversion are currently managed by expanding normal tissue margins around the clinical target volume and through appropriate beam selection. Improved CT techniques and alternative imaging modalities promise to deliver a more reliable image of stopping power within the patient, allowing for reduced treatment volumes. Tumor motion also presents a unique challenge in proton therapy, as a moving target exhibits not only variable position within a beam's eye view, but varying range as well. Modern proton therapy facilities which deliver treatments via a scanning beam are additionally susceptible to the interplay effect, in which the time dependent dose delivery is altered by motion of the target and surrounding anatomy. Four-dimensional imaging and dose calculation are then critically important in proton therapy to ensure that the treatment plan is robust against tumor motion.

Sub-Events

RC122A Uncertainties in Imaging for Dose Calculations

Participants

Andrew Wroe, PhD, Loma Linda, CA, (awroe@llu.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

Describe the Bragg peak and the impact this has on treatment delivery Understand proton therapy clinical workflow Discuss imaging modalities used for proton therapy treatment planning Describe the CT number to proton stopping power calibration Understand sources of range uncertainty in proton therapy Discuss alternate imaging modalities that may impact proton range uncertainty

RC122B Uncertainties in Motion for Treatment Planning

Participants

Heng Li, Houston, TX, (hengli@mdanderso.org) (*Presenter*) Research funded, Varian Medical Systems, Inc

LEARNING OBJECTIVES

1) Describe the impact of tumor motion on a proton dose distribution. 2) Compare the relative value of various four-dimensional imaging modalities in the evaluation of a proton plan for a mobile target. 3) Explain the process for incorporating four-dimensional imaging into dose calculation.

ABSTRACT

RC123

Digital Information Security and Medical Imaging Equipment: Threats, Vulnerabilities and Best Practices

Sunday, Nov. 27 2:00PM - 3:30PM Room: E350



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

Participants

LEARNING OBJECTIVES

1) Understand the changing environment of network and internet connected devices and software. 2) Be aware of the motivations and tactics of current threat actors. 3) Understand common security issues found in medical devices. 4) Know simple actions that can decrease risk. 5) Understand the vulnerabilities of imaging system modalities to security and privacy breaches. 6) Determine ways to protect and secure imaging systems from internal and external threats. 7) Describe institutional best-practices to maintain protection yet provide necessary accessibility for imaging modalities. 8) Do medical devices contain cybersecurity vulnerabilities, and do they affect patient safety? 9) Are medical devices subject to ransomware threats? 10) What is the role and capabilities of the DHS ICS-CERT (Industrial Control Systems Cyber Emergency Response Team) in medical device security? 11) What are some steps that can be taken to protect medical devices?

Sub-Events

RC123A Medical Device Security in a Connected World

Participants

LEARNING OBJECTIVES

1) Understand the changing environment of network and internet connected devices and software. 2) Be aware of the motivations and tactics of current threat actors. 3) Understand common security issues found in medical devices. 4) Know simple actions that can decrease risk.

ABSTRACT

Medical devices are increasingly becoming dependent on technology and network connectivity, at a time that the electronic environment is becoming more dangerous. Because of this medical devices and systems can become easy targets for attackers attempting to access PHI, disrupt patient care or even harm a patient. When tested, these devices have been shown to have multiple vulnerabilities. These vulnerabilities range from hardcoded passwords, publically available service passwords and no encryption of patient data. Because of this institutions using these devices need to work with their vendors to improve the security of medical devices and take actions themselves to help protect their environment and patients.

RC123B Knowing if Your Imaging Systems are Secure and Keeping Them That Way

Participants

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

LEARNING OBJECTIVES

1) Understand the vulnerabilities of imaging system modalities to security and privacy breaches. 2) Determine ways to protect and secure imaging systems from internal and external threats. 3) Describe institutional best-practices to maintain protection yet provide necessary accessibility for imaging modalities.

ABSTRACT

Handout: J. Anthony Seibert

http://abstract.rsna.org/uploads/2016/15002845/Making sure your systems are safe_Seibert2016_final.pdf

RC123C The US Government and Medical Device Security

Participants

Kevin Hemsley, Idaho Falls, ID (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Do medical devices contain cybersecurity vulnerabilities, and do they affect patient safety? 2) Are medical devices subject to ransomware threats? 3) What is the role and capabilities of the DHS ICS-CERT (Industrial Control Systems Cyber Emergency Response Team) in medical device security? 4) What are some steps that can be taken to protect medical devices?

ABSTRACT

This session will discuss the current and emerging cyber threat landscape from the perspective NCCIC/ICS-CERT, including current and anticipated impact on healthcare; the ICS-CERT's role in coordinating vulnerabilities in medical devices and hospital equipment and providing incident response to US critical infrastructure. The role of the Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) and how healthcare constituents can connect with ICS-CERT for assistance as well as informational and educational resources.

RC124

Histiocytosis from Head to Toe (In Conjunction with the American Institute for Radiologic Pathology)

Sunday, Nov. 27 2:00PM - 3:30PM Room: N229

OT

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

Participants

Mark D. Murphey, MD, Silver Spring, MD, (mmurphey@acr.org) (*Moderator*) Nothing to Disclose
Mark D. Murphey, MD, Silver Spring, MD, (mmurphey@acr.org) (*Presenter*) Nothing to Disclose
Jeffrey R. Galvin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Kelly K. Koeller, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Darcy J. Wolfman, MD, Bethesda, MD (*Presenter*) Nothing to Disclose
Ellen M. Chung, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the typical clinical and pathological features of Langerhans cell histiocytosis. 2) Define the characteristic imaging patterns of Langerhans cell histiocytosis. 3) Understand the pathological basis for the imaging patterns of Langerhans cell histiocytosis.

ABSTRACT

The histiocytoses are a diverse group of diseases that can affect multiple organ systems. These entities included in our discussion are Langerhans cell histiocytosis, Erdheim-Chester disease, juvenile xanthogranuloma and Rosai-Dorfman disease. These diseases often reveal a characteristic appearance on imaging, reflecting their pathology is emphasized in a multiorgan and multimodality approach.

Active Handout: Jeffrey R. Galvin

<http://abstract.rsna.org/uploads/2016/15003287/RC124.pdf>

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/>

Mark D. Murphey, MD - 2015 Honored Educator

RC125

Perspectives on Exposure and Risk-Visions of Radiation Safety: What We Know and What is Coming

Sunday, Nov. 27 2:00PM - 3:30PM Room: N226

PH SQ

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

Participants

Madan M. Rehani, PhD, Boston, MA, (mrehani@mgh.harvard.edu) (*Moderator*) Nothing to Disclose

Martha S. Linet, MD, Rockville, MD (*Presenter*) Nothing to Disclose

Sub-Events

RC125A Radiation Doses and Safety Levels Today and Likely in 2020

Participants

Madan M. Rehani, PhD, Boston, MA, (madan.rehani@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Comprehend radiation dose in imaging in current practice to individual patient, cumulative and collective doses. 2) Explain radiation safety levels of patients in different imaging modalities. 3) Identify technological advances in pipeline with their implications on radiation safety.

RC125B What Can We Say About Risks with an Acceptable Level of Uncertainty

Participants

Martha S. Linet, MD, Rockville, MD, (linetm@exchange.nih.gov) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Have an evidence-based perspective on human low-dose radiation exposure and cancer risks. 2) Compare the relative size of adult and child radiation cancer risks.

ABSTRACT

Active Handout: Martha S. Linet

http://abstract.rsna.org/uploads/2016/16001105/Active_RC125.pdf

RC125C Radiation Risk Scenario from CT Scans: Today and Likely in 2020

Participants

Donald P. Frush, MD, Durham, NC, (donald.frush@duke.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn current status of pediatric CT radiation risk communication. 2) Be able to discuss needs for improved communication/education over next 5 years. 3) Understand evolving and potential strategies for understanding this risk.

RC125D Discussion

Participants

ABSTRACT

RC127

Imaging Challenges and Change: A Global Perspective

Sunday, Nov. 27 2:00PM - 3:30PM Room: S403B

HP

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

Participants

Frank J. Lexa, MD, Philadelphia, PA (*Moderator*) Nothing to Disclose

Frank J. Lexa, MD, Philadelphia, PA (*Coordinator*) Nothing to Disclose

Shigeru Ehara, MD, Morioka, Japan, (ehara@iwate-med.ac.jp) (*Presenter*) Nothing to Disclose

Geraldine B. McGinty, MD, MBA, New York, NY, (gbm9002@med.cornell.edu) (*Presenter*) Nothing to Disclose

Bruce B. Forster, MD, Vancouver, BC, (bruce.forster@vch.ca) (*Presenter*) Nothing to Disclose

Luis Marti-Bonmati, MD, PhD, Godella, Spain, (Luis.Marti@uv.es) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Examine the drivers of change in radiology in four nations: Canada, Japan, Spain and the US. 2) Compare and contrast the challenges that radiology faces globally. 3) Understand how organized radiology is adapting to a rapidly changing societal landscape for its services. 4) Analyze best practices for handling the challenges that we all face.

ABSTRACT

Radiologists in many parts of the globe are experiencing rapid changes in the way that they practice their specialty. The drivers of change and the challenges that they create are legion. In this session, we will have distinguished speakers from four nations discuss the challenges that organized radiology faces in their home countries and how they have tried to adapt in these circumstances. The topics will include a wide ranging array of strategic considerations including but not limited to: aging patient populations, rising demand for healthcare, changing government regulation, methods of payment in the public (and where appropriate the private) sector, regulatory issues, radiologist workforce issues and the training of the next generation of radiologists. The session will encompass both presentations and a panel discussion which will be informative and provocative

Handout:Luis Marti-Bonmati

http://abstract.rsna.org/uploads/2016/15002660/Handouts_Challenges_in_Radiology_in_Spain.docx

RC129

MR Imaging of the Female Pelvis (An Interactive Session)

Sunday, Nov. 27 2:00PM - 3:30PM Room: E451B

GU **OB** **MR**

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

Participants

Sub-Events

RC129A **Role of MRI in Staging Endometrial and Cervical Cancer**

Participants

Andrea G. Rockall, MRCP, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

To know the current indications for MRI in patients with cervix or endometrial cancer. To be familiar with the MRI protocol requirements for staging cervix or endometrial cancer. To recognise the stages of cervix and endometrial cancer on MRI. To be familiar with some common pitfalls when using MRI to stage uterine cancer.

ABSTRACT

RC129B **Clinical Indications and MR Imaging of Complex and Sonographically Indeterminate Adnexal Masses**

Participants

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

RC129C **Interactive Cases**

Participants

Isabelle Thomassin-Naggara, MD, Paris, France (*Presenter*) Speakers Bureau, General Electric Company;

LEARNING OBJECTIVES

1) To explain how to analyze an MR imaging for staging uterin cancer. 2) To develop how to use ADNEX MR SCORING system to classify adnexal masses. 3) To identify pitfalls in MR interpretation and avoid the false negative or false positive of the score. 4) To list the different step to make a good MR report. .

ABSTRACT

RC131

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

Sunday, Nov. 27 2:00PM - 3:30PM Room: S103AB



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

Participants

Joshua A. Hirsch, MD, Boston, MA (*Moderator*) Consultant, Medtronic plc; Data Safety Monitoring Board, Johnson & Johnson;

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

RC131A Devices and Data that Support IA Treatment as the Standard of Care for Ischemic Stroke

Participants

Allan L. Brook, MD, Bronx, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC131B 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.

RC131C Minimally Invasive Surgery for ICH - The Next Frontier

Participants

David J. Fiorella, MD, PhD, Stony Brook, NY (*Presenter*) Institutional research support, Siemens, AG; Institutional research support, Terumo Corporation; Institutional research support, Sequent Medical, Inc; Consultant, Medtronic plc; Consultant, Penumbra, Inc; Consultant, Sequent Medical, Inc; Consultant, Johnson & Johnson; Stockholder, Vascular Simulations LLC; Consultant, Vascular Simulations LLC; Owner, TDC Technologies; Owner, CVSL; Royalties, Johnson & Johnson; ; ;

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 $\sim \pm 50$ 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 $\sim 50\%$ reduction in mortality and a ~ 3 -fold increase in good outcomes, despite a $\sim 50\%$ 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 AIS 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.

RC132

How to Avoid Failure: Qualities of a Successful Leader

Sunday, Nov. 27 2:00PM - 3:30PM Room: E353C

LM

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

Participants

LEARNING OBJECTIVES

1) Develop an understanding of the essential traits and skills required for a leader to be successful, ie traits and states. 2) Develop an understanding of the common errors made by leaders in academic and private practices enabling the attendee to obtain the 'learnings' without the 'lumps'. 3) Acquire the skills of succession planning needed to ensure that the success of your organization is sustainable over time and leadership transitions. (This course is part of the Leadership Track)

Sub-Events

RC132A Life Lessons for Successful Leadership

Participants

James A. Brink, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the importance of emotional intelligence in for successful leadership. 2) To explore the relationship between communication style and the effectiveness of leadership. 3) To consider techniques that elevate the level of respect and trust in an organization.

RC132B Keys to Avoid Failure: Key Qualities of a Successful Leader

Participants

Jonathan S. Lewin, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title. (This course is part of the Leadership Track)

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/>

Jonathan S. Lewin, MD - 2012 Honored Educator

RC132C Leadership

Participants

N. Reed Dunnick, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize historical examples of leaders, in addition to how you can recognize and emulate their favorable characteristics that draw you to their leadership attributes. 2) Understand an overview of leadership references, where and how to access the same, how the related body of knowledge has evolved, and current perspectives concerning leaders and leadership. (This course is part of the Leadership Track)

MR Imaging-guided Breast Biopsy (Hands-on)

Sunday, Nov. 27 2:00PM - 3:30PM Room: E260



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

Participants

Roberta M. Strigel, MD, MS, Madison, WI, (rstrigel@uwhealth.org) (*Presenter*) Research support, General Electric Company
 Peter R. Eby, MD, Seattle, WA (*Presenter*) Consultant, Devicor Medical Products, Inc
 Beatriz E. Adrada, MD, Houston, TX (*Presenter*) Nothing to Disclose
 Lizza Lebron, MD, New York, NY (*Presenter*) Nothing to Disclose
 Selin Carkaci, MD, Miami, FL, (selincarkaci@msn.com) (*Presenter*) Author with royalties, Reed Elsevier
 Chloe M. Chhor, MD, Brooklyn, NY (*Presenter*) Consultant, Siemens AG
 Mark J. Dryden, MD, Houston, TX (*Presenter*) Nothing to Disclose
 Sarah M. Friedewald, MD, Chicago, IL, (sarah.friedewald@nm.org) (*Presenter*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc; Consultant, C. R. Bard, Inc
 Sujata V. Ghatge, MD, Durham, NC (*Presenter*) Nothing to Disclose
 Vilett A. Loving, MD, Gilbert, AZ, (vloving@mdanderson.org) (*Presenter*) Nothing to Disclose
 Santo Maimone IV, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose
 Bethany L. Niell, MD, Tampa, FL (*Presenter*) Nothing to Disclose
 Elissa R. Price, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
 John R. Scheel, MD, PhD, Seattle, WA (*Presenter*) Research support, General Electric Company
 Jean M. Seely, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
 Stephen J. Seiler, MD, Dallas, TX (*Presenter*) Nothing to Disclose
 Laura B. Shepardson, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
 Toma Omofoye, Houston, TX, (tsoomofoye@mdanderson.org) (*Presenter*) Nothing to Disclose
 Lilian Wang, MD, Chicago, IL (*Presenter*) Nothing to Disclose
 Jocelyn A. Rapelyea, MD, Washington, DC (*Presenter*) Speakers Bureau, General Electric Healthcare Company; Research consultant, Q-view LLC.; Research consultant, QTUS
 Ryan W. Woods, MD, MPH, Baltimore, MD, (rwoods12@jhmi.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Explain why MR-guided breast biopsy is needed for patient care. 2) Identify relative and absolute contraindications to MR-guided breast biopsy. 3) Describe criteria for MR-guided breast biopsy patient selection. 4) Debate risks and benefits of pre-biopsy targeted ultrasound for suspicious MRI findings. 5) Understand the basic MR-guided biopsy procedure, protocol and requirements for appropriate coil, needle and approach selection. 6) Manage patients before, during and after MR-guided breast biopsy. 7) Define the benefits and limitations of MR-guided vacuum assisted breast biopsy. 8) Apply positioning and other techniques to challenging combinations of lesion location and patient anatomy for successful MR-guided biopsy.

ABSTRACT

This course is intended to provide basic didactic instruction and hands-on experience for MR-guided breast biopsy. Because of the established role of breast MRI in the evaluation of breast cancer through screening and staging, there is a proven need for MR-guided biopsy of the abnormalities that can only be identified at MRI. This course will be devoted to the understanding and identification of: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy technologies and techniques 5) potential problems and pitfalls and 6) practice audits. Participants will spend 30 minutes in didactic instruction followed by 60 minutes practicing MR-guided biopsy using provided phantoms. Various combinations of full size state-of-the-art breast MRI coils, biopsy localization equipment and needles from multiple different vendors will be available for hands-on practice. Some stations will have monitors loaded with targeting software. Expert breast imagers from around the world will be at each of 10 stations to provide live coaching, tips, techniques and advice.

Active Handout: Roberta Marie Strigel

[http://abstract.rsna.org/uploads/2016/6005779/ACTIVE RC150.pdf](http://abstract.rsna.org/uploads/2016/6005779/ACTIVE_RC150.pdf)

Techniques for Interventional Sonography and Thermal Ablation (Hands-on)

Sunday, Nov. 27 2:00PM - 3:30PM Room: E264

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

Discussions may include off-label uses.

Participants

Stephen C. O'Connor, MD, Boston, MA, (stephen.o'connor@bhs.org) (*Presenter*) Nothing to Disclose
Veronica J. Rooks, MD, Honolulu, HI (*Presenter*) Nothing to Disclose
Kristin M. Dittmar, MD, Columbus, OH (*Presenter*) Nothing to Disclose
Carmen Gallego, MD, Madrid, Spain, (cgallego@salud.madrid.org) (*Presenter*) Nothing to Disclose
Mabel Garcia-Hidalgo Alonso, MD, Majadahonda , Spain (*Presenter*) Nothing to Disclose
James W. Murakami, MD, Columbus, OH (*Presenter*) Nothing to Disclose
Sara E. Smolinski, MD, Springfield, MA (*Presenter*) Nothing to Disclose
Humberto G. Rosas, MD, Madison, WI (*Presenter*) Nothing to Disclose
William W. Mayo-Smith, MD, Boston, MA (*Presenter*) Author with royalties, Reed Elsevier; Author with royalties, Cambridge University Press
John D. Lane, MD, Bayside, WI (*Presenter*) Nothing to Disclose
Neil T. Specht, MD, Trumbull, CT, (saint2@optonline.net) (*Presenter*) Nothing to Disclose
Manish N. Patel, DO, Cincinnati, OH, (manish.patel@cchmc.org) (*Presenter*) Nothing to Disclose
Njogu Njuguna, MD, Springfield, MA (*Presenter*) Nothing to Disclose
Hollins P. Clark, MD, Winston Salem, NC (*Presenter*) Research Consultant, Galil Medical Ltd
Yassine Kanaan, MD, Dallas, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography. 2) Discuss and perform basic skills involved in thermal tumor ablation in a live learning model. 3) Perform specific US-guided procedures to include core biopsy, abscess drainage, vascular access, cyst aspiration, soft tissue foreign body removal, and radiofrequency tumor ablation. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning opportunities.

ABSTRACT

Next Generation Infrastructure for Medical Imaging (In Association with the Society for Imaging Informatics in Medicine)

Sunday, Nov. 27 2:00PM - 3:30PM Room: S105AB



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) (*Moderator*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Advisory Board, Bayer AG

LEARNING OBJECTIVES

1) The participant will be introduced to the importance of information system integration and interoperability to support modern imaging informatics workflow. 2) Examples of practical integration strategies that have been used successfully (e.g. web viewer EHR integration, single sign-on, RIS vs PACS driven workflow) will be discussed. 3) Advanced integration strategies, including using vendor APIs, state aggregation, SOA, and IHE, will be presented.

ABSTRACT

Modern imaging informatics workflow requires consumption, choreography, and orchestration of content from multiple disparate information systems that do not natively "talk to each other." Without optimal integration and interoperability amongst these systems, humans are required to serve as "integrating agents:" this frequently results in inefficiency and error. This session will provide an introduction to the importance of system integration and will provide a practical introduction to commonly used integration strategies. In addition, more advanced integration approaches, including leveraging vendor APIs (application programming interfaces), IHE, and SOA (service oriented architecture) will be discussed.

Sub-Events

RC153A Interoperability and Integration-from HL7, DICOM, IHE, to SOA

Participants

Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Advisory Board, Bayer AG

LEARNING OBJECTIVES

1) The participant will be introduced to the importance of information system integration and interoperability to support modern radiology workflow. 2) Examples of practical integration strategies that have been used successfully (e.g. web viewer EHR integration, single sign-on, RIS vs PACS driven workflow) will be discussed. 3) Advanced integration strategies, including using vendor APIs, state aggregation, SOA, and IHE, will be presented.

ABSTRACT

Modern radiology workflow requires consumption, choreography, and orchestration of content from multiple disparate information systems that do not natively "talk to each other." Without optimal integration and interoperability amongst these systems, humans are required to serve as "integrating agents:" this frequently results in inefficiency and error. This session will provide an introduction to the importance of system integration and will provide a practical introduction to commonly used integration strategies. In addition, more advanced integration approaches, including leveraging vendor APIs (application programming interfaces), IHE, and SOA (service oriented architecture) will be discussed.

RC153B Image Sharing-A Fond Farewell to CDs

Participants

David S. Mendelson, MD, Larchmont, NY (*Presenter*) Spouse, Employee, Novartis AG; Advisory Board, Nuance Communications, Inc; Advisory Board, General Electric Company; Advisory Board, Toshiba Medical Systems Corporation; Advisory Board, Bayer AG

LEARNING OBJECTIVES

1) Understand the importance of Image Sharing / Exchange with regard to the quality of care a radiologist delivers as well as to efforts to control costs. 2) Understand the benefits and pitfalls of CDs and the transition to internet based sharing. 3) Understand the different internet (Cloud) based solutions that are available and what distinguishes them. 4) Learn that the cloud can be employed not only for archival but for a variety of radiology services. 5) Learn about the IHE XDS-I and related profiles and their role in internet based image exchange. 6) Understand what solutions a radiologist might implement at this time. 7) Understand how image exchange fits into the broader efforts directed at healthcare information exchange and interoperability through EHRs. Specific projects including The RSNA Image Share Validation program will be discussed.

ABSTRACT

The safe and secure exchange of healthcare information is of paramount importance in delivering the highest quality of care to our patients. The realm of Health Information Exchange while nascent is undergoing explosive growth. The exchange of radiologic exams and reports must be tightly integrated into this process. Radiological images have historically presented some unique challenges. This session will focus on existing solutions for image exchange/interoperability and discuss how it is expected to evolve over the next few years through the use of internet based technologies. The RSNA Image Share Validation program is a new effort to ensure vendors deliver products that comply with accepted standards.

RC153C Vendor Neutral Archives vs Archive Neutral Vendors: Towards the Next Generation Archive

Participants

Richard L. Kennedy, MSc, Sacramento, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the differences between vendor neutral archives, archive neutral vendors, and cloud archives. 2) Identify key strategic advantages and disadvantages of these three respective models of archival. 3) Observe some potential obstacles to implementation of these three respective models of archival.

RC154

Optimizing PowerPoint Slides

Sunday, Nov. 27 2:00PM - 3:30PM Room: E351



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

Participants

William J. Weadock, MD, Ann Arbor, MI (*Presenter*) Owner, Weadock Software, LLC

Sarah C. Abate, BS, Ann Arbor, MI, (sabate@med.umich.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the components of an optimal slide presentation. 2) Learn about common errors made in slide preparation and how they can be avoided. 3) Learn about how to improve the quality of a presentation by using optimal different slide backgrounds, font size and color, and image sizes. 4) Learn tips to ensure a smooth presentation.

ABSTRACT

Electronic presentations are very common in radiology practice. This hands-on demonstration and questions and answer session will show attendees how to optimize their presentations. The focus will be on the use of slide templates, color selection (font and background), font and image size, and animations. Additional review of image and video display and management will be covered. Demonstrations will include tips to decrease time creating and modifying presentations. Bring your questions!

Data Collection, Organization and Analysis with Excel - A Hands-On Tutorial (Hands-on)

Sunday, Nov. 27 2:00PM - 3:30PM Room: S401AB



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

Participants

Jaydev K. Dave, PhD, MS, Philadelphia, PA, (jaydev.dave@jefferson.edu) (*Presenter*) Nothing to Disclose
Raja Gali, MS, Philadelphia, PA, (raja.gali@jefferson.edu) (*Presenter*) Nothing to Disclose
Manish Dhyani, MBBS, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe techniques for creating a spreadsheet to allow trouble-free data analysis. 2) Demonstrate key data management skills. 3) Describe tools for performing basic descriptive statistics. 4) Identify how to perform simple statistical tests and perform these tests with a sample dataset. 5) Understand how bad data (or bad data acquisition techniques) may corrupt subsequent data analyses. 6) Practice data plotting/representation techniques. 7) Identify differences between a spreadsheet and a database. 8) Identify statistical tasks that require more sophisticated software. **Pre-requisites:** Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed

ABSTRACT

A spreadsheet program is commonly employed to collect and organize data for practicing quality improvement, for research, and for other purposes. In this refresher course, we will demonstrate to a user, familiar with Microsoft Excel environment, how this spreadsheet program may be used for such purposes. The course will begin with describing efficient approach for data acquisition and highlight key data management skills; and with reviewing common errors that may be avoided during data logging. Then we will provide a brief introduction on basic descriptive tests before proceeding with a hands-on tutorial using a sample dataset to calculate basic descriptive statistics, and to perform basic statistical tests like t-test, chi-square test, correlation analysis, etc. Effect of corrupted data on such analysis will also be demonstrated. The final hands-on component for this course will include data plotting and representation including the use of pivot tables. The course will conclude with a discussion on identifying differences between a spreadsheet and a database, limitations of a spreadsheet program and avenues where a dedicated statistical software program would be more beneficial. A list of some of these dedicated statistical software programs for analyses will also be provided. **Pre-requisites:** Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed

RCB12

Making the Most of Google Docs: Docs, Slides, Forms, and Sheets (Hands-on)

Sunday, Nov. 27 2:00PM - 3:30PM Room: S401CD

IN

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

Participants

Ross W. Filice, MD, Washington, DC (*Presenter*) Nothing to Disclose
Aaron P. Kamer, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose
Andrew B. Lemmon, MD, Atlanta, GA, (alemmon@emory.edu) (*Presenter*) Nothing to Disclose
Thomas W. Loehfelm, MD, PhD, Palo Alto, CA (*Presenter*) Nothing to Disclose
Marc D. Kohli, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the benefits and drawbacks of using Google tools for collaborative editing. 2) Explain issues related to storing protected health information in Google Drive. 3) Demonstrate the ability to use the Google productivity applications for collaboration on document, spreadsheet, online form and presentation creation.

ABSTRACT

Note: Attendees should have or create a Google account prior to coming to the session. In today's busy environment, we need tools to work smarter, not harder. Google's suite of productivity applications provides a platform for collaboration that can be used across and within institutions to produce documents and presentations and to obtain and work-up data with ease. However, with increased sharing, security concerns need to be addressed. At the end of the session, learners should be able to demonstrate creating, sharing, and editing a document as a group.

RCC12

Imaging 3.0: Informatics Tools to Improve Radiologists' Productivity, Quality and Value

Sunday, Nov. 27 2:00PM - 3:30PM Room: S501ABC



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

Participants

J. Raymond Geis, MD, Fort Collins, CO (*Moderator*) Shareholder, Montage Healthcare Solutions, Inc; Advisor, Nuance Communications, Inc;

LEARNING OBJECTIVES

1) Understand how an IT-savvy radiology practice will gain a competitive advantage. 2) See how to use IT solutions to demonstrate radiologists' value. 3) Learn of Imaging Informatics tools that improve radiologists' productivity and efficiency.

ABSTRACT

Imaging 3.0 imaging informatics tools and processes help radiologists to be faster and better, and then help them demonstrate, with hard data, how valuable they are. This session will demonstrate IT tools to help radiologists be more productive; deliver a higher quality product; and better measure and demonstrate their value to payers, healthcare enterprises and patients. We also will discuss how to implement IT to get the most value from it.

Sub-Events

RCC12A ACRSelect - Using Informatics to Complying with PAMA: CDS Image Ordering Legislation

Participants

Keith J. Dreyer, DO, PhD, Boston, MA (*Presenter*) Medical Advisory Board, IBM Corporation

LEARNING OBJECTIVES

1) Be informed of the new federal legislation requiring the use of Clinical Decision Support (CDS) for the ordering of medical imaging required by CMS in 2017. 2) Understand the challenges of implementing CDS in the hospital and imaging center environments. 3) Learn the value of embedding CDS into the EHR and CPOE ordering process. 4) Learn methods to use CDS to manage the utilization of medical image appropriateness. 5) Become familiar with methods to implement CDS in an ACO environment.

RCC12B Radiology Assist: Informatics Tools to Produce a More Valuable Report and Still Report Fast

Participants

Tarik K. Alkasab, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the motivations for integrating clinical decision support (CDS) into the clinical practice of radiologists. 2) Understand how CDS modules can be defined for use in radiologist reporting. 3) Understand what it looks like for a CDS system to be integrated with radiologist reporting. 4) Understand the challenges associated with deploying CDS for radiologists.

ABSTRACT

RCC12C Use Your Data to Reduce Costs and Demonstrate Your Value to the Hospital

Participants

Woojin Kim, MD, Philadelphia, PA (*Presenter*) Officer, Nuance Communications, Inc

LEARNING OBJECTIVES

1) Understand the role of business intelligence (BI) tools in providing value-based care. 2) Understand how BI can provide effective monitoring of various components of the imaging value chain, including imaging appropriateness, modality operations, image interpretation and reporting, and report communication. 3) Learn how data mining can improve report quality by ensuring proper documentation and reducing errors. 4) Learn how one should implement a BI system and learn about potential problems to consider.

ABSTRACT

The goals of improving population health at a lower cost and higher quality are placing increased emphasis on value-based care over volume-based approach. Imaging 3.0™ is ACR's call to action for radiologists to take a leadership role in shaping America's future healthcare system through 5 key pillars, which are imaging appropriateness, quality, safety, efficiency, and satisfaction. With the aims of delivering better value to patients, Imaging 3.0 has outlined what it calls "imaging value chain" where each link of this chain represents a discrete number of unique value opportunity activities. The imaging value chain includes following components: imaging appropriateness and patient scheduling, imaging protocols, modality operations, image interpretation and reporting, and report communication and referring physician interaction. In the center of the imaging value chain, inter-connected with every link, lie data mining and business intelligence (BI). Timely analysis and appropriate modification using data mining and BI tools are critical to the effective monitoring of all components of the imaging value chain. As a result, it is a critical component of your Imaging 3.0 informatics toolkit. Effective use of BI will allow access to right information at the right time for right decision. This presentation will discuss the basics of BI and its benefits. Specifically, attendees will learn how data mining and BI can monitor adherence to imaging appropriateness guidelines, modality capacity, patient throughput, radiation dose exposure, and report standardization and quality including detection of errors and compliance with various reporting requirements including documentation of proper report communication. In addition, attendees will learn how one should implement a BI system, what are some potential problems to

consider, and various tips for getting BI right.

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/>

Woojin Kim, MD - 2012 Honored Educator

RCC12D Using Workflow Software to Improve Efficiency and Profitability

Participants

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

LEARNING OBJECTIVES

1) Become familiar with workflow technologies that are available and being used in other industries. 2) See how workflow terminologies can be applied in practice. 3) See how workflow engines have been applied in radiology.

ABSTRACT

Workflow is a critical element of safe and efficient practices. Workflow is usually supported by using relational databases, which tends to force a linear workflow into practice. SQL queries are also not optimal for detecting and handling error conditions. Workflow engines are used in other industries for exactly those reasons--they help enforce an agreed upon optimal pathway of events, and make it easy and clear how to deal with error and exception conditions. While they have been applied in healthcare, those experiments have usually failed because the implementation did not handle error conditions well, and did not completely model the richness and complexity of healthcare. Radiology tends to be more straightforward, and may be a good area to use workflow engines. In this session, we will describe one implementation in a clinical practice, as well as use in research and clinical trials. As we have begun to use workflow engines, it became apparent that agreeing on the names for key steps in the workflow would be helpful. Such a common lexicon would help us to assure that workflow was done in the same way in different locations. It could also allow us to measure the efficiency of workflows. This latter aspect was perceived to be of great value to practices across the world, and led to the creation of the SIIM Workflow Initiative in Medicine (SWIM) lexicon, which is now a part of RadLEX. The basic concepts of SWIM and its connection to IHE and the practice will be described.

PS12

Sunday Afternoon Plenary Session

Sunday, Nov. 27 4:00PM - 5:45PM Room: Arie Crown Theater



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

Participants

Richard L. Baron, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Sub-Events

PS12A Report of the RSNA Research and Education Foundation

Participants

Burton P. Drayer, MD, New York, NY (*Presenter*) Advisor, Hologic, Inc

Abstract

The R&E Foundation exemplifies the 2016 Annual Meeting theme "Beyond the Image" as each and every year, R&E grant recipients pursue projects that go beyond radiologic sciences and touch every area of healthcare delivery and discovery. In the annual address of the R&E Foundation, Board of Trustees Chairman Burton P. Drayer, MD will report on this year's record funding of 101 research and education awards totaling over \$4 million, and why the need to support the Foundation is greater than ever. With a 30% funding rate of its applicants, the RSNA R&E Foundation provides a critical source of early support for so many young investigators and educators. It is through their awards that these individuals become engaged in research and excited about the prospect of pursuing a career in academic radiology. R&E grant recipients are poised to lead research efforts in the future that will extend beyond radiology into every area of patient care. To support these efforts and continue forth on this path, the Foundation launched Inspire – Innovate – Invest: The Campaign for Funding Radiology's Future at RSNA 2014. The Campaign is moving steadily toward the Campaign goal of \$17.5 million with the support of individuals, private practice groups and our corporate colleagues. For the future of radiologic research to belong to the next generation of radiologists, the specialty must put its financial support squarely behind its Foundation—our Foundation. During the meeting week, please take time to visit the R&E Foundation Booth, located on Level 3 of Lakeside Center to learn more about the 2016 grant recipients, their innovative projects and the many available opportunities to support the Foundation through our Campaign.

PS12B Image Interpretation Session

Participants

Ronald J. Zagoria, MD, San Francisco, CA, (ron.zagoria@ucsf.edu) (*Presenter*) Nothing to Disclose

John Eng, MD, Cockeysville, MD (*Presenter*) Nothing to Disclose

Ellen M. Chung, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

Nancy J. Fischbein, MD, Stanford, CA, (fischbein@stanford.edu) (*Presenter*) Nothing to Disclose

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

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

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

Honored Educators

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

Gautham P. Reddy, MD - 2014 Honored Educator

Man vs Machines: How to Use Machine Learning and Medical Images (Hands on)

Sunday, Nov. 27 4:00PM - 5:30PM Room: S401AB

INAMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**Participants**

Bradley J. Erickson, MD, PhD, Rochester, MN, (bje@mayo.edu) (*Presenter*) Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC; Stockholder, FlowSigma
Timothy L. Kline, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Panagiotis Korfiatis, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Zeynettin Akkus, PhD, Rochester, MN, (akkus.zeynettin@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with commonly used machine learning algorithms, including Perceptrons, neural nets, support vector machines, and Naive Bayes. 2) Become familiar with how to use IPython and scikit-learn to implement some of the common machine learning algorithms. 3) Learn how to read image data into python to use iwth machine learning.

ABSTRACT

In this course, we will review som eof the commonly used machine learning algorithms, describing the strengths and weaknesses of each. We will the demonstrate how to access these algorithms using IPython and scikit-learn. IPython is an interactive development environment for Python programming. The Scikit-learn library is a comprehensive machine learning library for the python programming language. We will also show how to read DICOM images into your program, extract features from those images, and then input those features into the machine learning algorithm.

RCB13

Intro to Statistics with R (Hands-on)

Sunday, Nov. 27 4:00PM - 5:30PM Room: S401CD



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

Participants

Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Joe C. Wildenberg, MD, PhD, Philadelphia, PA, (joe.wildenberg@gmail.com) (*Presenter*) Nothing to Disclose

James E. Schmitt, MD, PhD, Philadelphia, PA, (james.schmitt@uphs.upenn.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Install and launch the R software package. Understand how to search for and download external packages to extend R's functionality. 2) Load data from external files such as txt, csv, and xls. 3) Perform basic mathematical operations and utilize data structures to manipulate data. 4) Use loops to perform more complex operations over the data, including true/false logic. 5) Understand the basics of creating plots and histograms. 6) Perform common statistical tests including correlation, Chi-square, and ANOVA.

ABSTRACT

RCC13

Creation of Radiology Reports

Sunday, Nov. 27 4:00PM - 5:30PM Room: S501ABC



AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.00

Participants

Curtis P. Langlotz, MD, PhD, Menlo Park, CA, (langlotz@stanford.edu) (*Presenter*) Shareholder, Montage Healthcare Solutions, Inc; Spouse, Consultant, Novartis AG;
William J. Weadock, MD, Ann Arbor, MI (*Presenter*) Owner, Weadock Software, LLC
David B. Larson, MD, MBA, Los Altos, CA (*Presenter*) License agreement, Bayer AG; Potential royalties, Bayer AG

LEARNING OBJECTIVES

1) Learn about the history of radiology reporting. 2) Review the attributes of a high-quality radiology report. 3) Understand key shortcomings of radiology report style and how to address them. 4) Learn what you can do today to improve your radiology reports.

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